# COURSE STRUCTURE

## *For*

# B.TECH. DEGREE

## *in*

# COMPUTER SCIENCE & ENGINEERING

*(Applicable from the academic session 2024-2025)*

**Dr. B. C. Roy Engineering College**

***An Autonomous Institution***

***Approved by: All India Council for Technical Education (AICTE)***
***Affiliated to: Maulana Abul Kalam Azad University of Technology, West Bengal***
***(Formerly Known as -WBUT)***

**Jemua Road, Durgapur, West Bengal, India, 713206**

• The first year course structure (Page 3 and Page 4) is unanimously accepted and approved in the first BoS meeting held in the Department of a) Physics, b) Chemistry, c) Mathematics, d) English, e) Electrical Engineering, f) Electronics and Communication Engineering, g) Computer Science and Engineering, h) Mechanical Engineering.

• The BoS of CSE (Computer Science and Engineering) in its first meeting (held in the Department of CSE (Computer Science and Engineering) on 6th November 2024 has unanimously accepted and approved the four year course structure of CSE (Computer Science and Engineering).

Head
Dept. Computer Science & Eng
Dr. B. C. Roy Engineering College
Durgapur

| Semester 7 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sl No** | **Course Type** | **Paper Code** | **Paper Name** | **Marks** | **L** | **T** | **P** | **Credit** |
| ***Theory*** | | | | | | | | |
| 1 | HM | CS-701 | Human Resource Development & Organizational Behavior | 100 | 3 | 0 | 0 | 3 |
| 2 | PE | CS702-711 | Core Elective IV: Cloud Computing / Neural Network & Deep Learning / Natural Language Processing / Mobile Computing | 100 | 3 | 0 | 0 | 3 |
| 3 | PE | CS712-721 | Core Elective V: Data Analytics / Cyber Security / Quantum Computing / High Performance Computing | 100 | 3 | 0 | 0 | 3 |
| 4 | OE | CS722-731 | Open Elective III: E-Commerce & ERP / Industrial Management / Game Theory & Applications / Bio-Informatics / Social Network Analysis | 100 | 3 | 0 | 0 | 3 |
| | | | Total Theory | 400 | 12 | 0 | 0 | 12 |
| 5 | PROJ | CS781 | Project II | 100 | 0 | 0 | 12 (S*) | 6 |
| 6 | | CS782 | Industrial Training & Seminar | 100 | 0 | 0 | 2 (S*) | 1 |
| **Total Credits** | | | | | | | | **19** |

**Course Name:** Human Resource Development & Organizational Behavior

**Course Code: CS701**

**(Semester-VII)**

**Category: Major**

**Course Broad Category: Engineering Science Course**

**[For Computer Science and Engineering]**

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**Course Name: Cloud Computing**
**Code: CS702**
**(Semester –VII)**
**Category: Major**
**Course Broad Category: Engineering Science Course**
**[For Computer Science and Engineering]**

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- **Course Prerequisite: Operating System**
  **Basic Computer Fundamentals**
  **Computer Networking Concepts- PCC-CS602**
  **Operating Systems pcc-cs502**

- **Course Learning Objectives:**
- Understand the **concept, characteristics, and benefits** of cloud computing.
- Differentiate between **IaaS, PaaS, and SaaS** service models.
- Compare **deployment models**: Public, Private, Hybrid, and Multi-cloud.
- Recognize the **economic benefits** of cloud: CAPEX vs OPEX.

- **Teaching methodology and evaluation system for the course:**
  **Teaching methodology –**Lectures and Presentations, Interactive Discussions and Case Studies.
  **Evaluation System –**
  A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
  B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
  C. End-Semester Exam (60 Marks)- Summative Assessment.
- **Course Content:**
  **Course Name: Cloud Computing**
  **Course Code: CS702**
  **Hours per Week:** 3L:0T:0P
  **Credits:** 3

| Module | Topics | Lectures |
|---|---|---|

| | | |
|---|---|---|
| **Unit 1: Definition of Cloud Computing and its Basics (Lectures** ). | Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public , Private, Hybrid and Community Clouds), Service Platform as a Service, Software as a Service with examples of services/ service providers, models – Infrastructure as a Service, Cloud Reference model, Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing, A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients, IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS) | 9L |

| | | |
|---|---|---|
| **Unit 2: Use of Platforms in Cloud Computing** | Concepts of Abstraction and Virtualization Virtualization technologies : Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced load balancing (including ApplicationDelivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging (including mention of Open Virtualization Format – OVF) Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance, Concepts of Platform as a Service, Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development Use of PaaS Application frameworks, Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service., Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service, Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure | 12L |
| **Unit 3: Cloud Infrastructure :** | Cloud Management: An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle). Concepts of Cloud Security: Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards) | 7L |

| | | |
|---|---|---|
| **Unit 4: Concepts of Services and Applications :** | Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs, Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs Cloud-based Storage: Cloud storage definition – Manned and Unmanned Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services | 8L |

6. **References:**

**Text & References Books:**


7. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013 2. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Private Limited, 2013 3. Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill 4. Cloud Computing, Miller, Pearson 5. Building applications in cloud:Concept, Patterns and Projects, Moyer, Pearson 6. Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India


8. **Course Outcomes:**

**After going through this course the Students will be able to:**

| Course Outcomes | Details/Statement | Action Verb | Knowledge Level |
|---|---|---|---|
| CS702.1 | Understand the **concept, characteristics, and benefits** of cloud computing. | Remembering | L-1 |
| CS702.2 | Differentiate between **IaaS, PaaS, and SaaS** service models. | Understanding | L-2 |
| CS702.3 | Private ,Public and Hybrid clouds | Understanding | L-2 |
| CS702.4 | Recognize the **economic benefits** of cloud: CAPEX vs OPEX. | Analyzing | L-3 |
| CS702.5 | Practical implementation on clouds | Apply | L-4 |

9. **Mapping of course outcomes to module / course content**

| Module | CO1 | CO2 | CO3 | CO4 | CO5 | |
|---|---|---|---|---|---|---|
| 1 | 1 | - | - | - | - | |
| 2 | - | 1 | - | - | - | |
| 3 | - | 1 | 1 | - | - | |
| 4 | | | | 1 | - | - |
| 5 | - | - | - | - | 1 | - |
| 6 | - | - | - | - | - | - |
| 7 | - | - | - | - | - | - |

## 10. Mapping of the Course outcomes to Program Outcomes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 1 | | - | 1 | 1 | - | - | - | 1 | - | - |
| **CO2** | 1 | 1 | 1 | 1 | - | - | - | - | - | - | - | - |
| **CO3** | - | 1 | 1 | 1 | - | - | - | - | - | 1 | - | - |
| **CO4** | - | - | 1 | 1 | 1 | - | - | - | - | 1 | - | - |
| **CO5** | - | - | - | 1 | - | - | - | - | - | - | - | - |
| **CO6** | - | - | - | | 1 | - | - | - | - | 1` | - | - |
| **AVG.** | | | | | | | | | | | | |

## 11. Mapping to PSO

| | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|
| **CO1** | - | - | - | - |
| **CO2** | - | - | - | - |
| **CO3** | - | - | - | - |
| **CO4** | - | - | - | - |
| **CO5** | - | - | - | - |
| **CO6** | - | - | - | - |

***** End of Syllabus*****

**Course Name: Neural Networks and Deep Learning**
**Code: CS703**
**(Semester –VII)**
**Category: Major**
**Course Broad Category: Engineering Science Course**
**[For Computer Science and Engineering]**

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1. **Course Prerequisite:**
   - ➔ Linear Algebra,Probability and Statistics,Calculus,
   - ➔ Machine Learning Basics,
   - ➔ Programming (Python and Libraries like NumPy, TensorFlow, PyTorch)

2. **Course Learning Objectives:**

   **By the end of this course, students will be able to:**

   1. Explain learning paradigms, deep learning frameworks, and fundamental techniques.
   2. Design and implement artificial neural networks with activation functions and multi-layer structures.
   3. Train and optimize neural networks using loss functions, backpropagation, and regularization.
   4. Apply probabilistic models such as CRFs, Markov Networks, and HMMs in deep learning.
   5. Develop and deploy deep learning models for computer vision, NLP, and object recognition.

3. **Teaching methodology and evaluation system for the course:**
   **Teaching methodology –**Lectures and Presentations, Interactive Discussions and Case Studies.
   **Evaluation System –**
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

4. **Course Content:**
   **Course Name : Neural Networks and Deep Learning**
   **Course Code: CS703**
   **Hours per Week:** 3L:0T:0P
   **Credits:** 3

| Module | Topics | Lectures |
|---|---|---|
| **Unit 1: Introduction:** | Various paradigms of earning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques.. | 3L |
| **Unit 2: Feed forward neural network:** | Artificial Neural Network, activation function, multi-layer neural network.cardinality, operations, and properties of fuzzy relations. | 6L |
| **Unit 3 Training Neural Network:** | Risk minimization, loss function, backpropagation, regularization, model selection, and optimization. | 6L |
| **Unit 4: Conditional Random Fields:** | Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy. | 9L |
| **Unit 5: Deep Learning:** | Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network. | 6L |
| **Unit 6: Deep Learning research: Programming** | Object recognition, sparse coding, computer vision, natural language | 6L |

## 6. References:

### Text & References Books:


- Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
- Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
- Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
- Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
- Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.
- Dr. Rajiv Chopra, Deep Learning, Khanna Publishing House, New Delhi (AICTE Recommended Textbook – 2018)


## 7. Course Outcomes:

**After going through this course the Students will be able to:**

| Course Outcomes | Course Outcome Statement | Action Verb | Bloom's Taxonomy Level |
|---|---|---|---|
| CS703.1 | **Describe** various learning paradigms, deep learning frameworks, and fundamental techniques. | ***Describe*** | *Remember (L1)* |
| CS703.2 | **Explain** the structure of artificial neural networks, activation functions, and fuzzy relations. | ***Explain*** | *Understand (L2)* |
| CS703.3 | **Apply** training techniques such as backpropagation, risk minimization, and optimization in neural networks. | ***Apply*** | *Apply (L3)* |
| CS703.4 | **Analyze** probabilistic models like Conditional Random Fields (CRFs), Markov Networks, and Hidden Markov Models (HMMs). | ***Analyze*** | *Analyze (L4)* |
| CS703.5 | **Evaluate** deep learning architectures including CNNs, RNNs, and Deep Belief Networks for various applications. | ***Evaluate*** | *Evaluate (L5)* |
| CS703.6 | **Design** and **implement** deep learning models for real-world applications in vision, NLP, and object recognition. | ***Design*** | *Create (L6)* |

## 8. Mapping of course outcomes to module / course content

| Module | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
|---|---|---|---|---|---|---|
| 1 | Yes | Yes | - | - | - | - |
| 2 | - | Yes | Yes | - | - | - |
| 3 | - | - | Yes | - | Yes | - |
| 4 | - | - | - | Yes | Yes | - |
| 5 | - | - | - | - | Yes | Yes |
| 6 | - | - | - | - | - | Yes |

## 9. Mapping of the Course outcomes to Program Outcomes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | 1 | 2 | - | - | 1 | 1 | 2 | 1 | 3 |
| **CO2** | 3 | 2 | 1 | 1 | 2 | - | - | 1 | 1 | 2 | 1 | 3 |
| **CO3** | 3 | 3 | 2 | 2 | 3 | - | - | 1 | 2 | 2 | 2 | 3 |
| **CO4** | 3 | 3 | 2 | 3 | 3 | 1 | - | 1 | 2 | 2 | 2 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 3 | 2 | 3 |
| **CO6** | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 3 | 3 | 3 |
| **AVG.** | **3** | **2.67** | **2** | **2.17** | **2.27** | **0.5** | **.33** | **1** | **1.67** | **2.33** | **1.83** | **3** |

## 10. Mapping to PSO

| | PSO1 | PSO 2 | PSO 3 | PSO 4 |
|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 1 |
| **CO2** | 3 | 2 | 2 | 1 |
| **CO3** | 3 | 3 | 2 | 1 |
| **CO4** | 3 | 2 | 3 | 1 |
| **CO5** | 3 | 3 | 3 | 1 |
| **CO6** | 3 | 3 | 3 | 2 |
| **AVG** | **3** | **2.5** | **2.5** | **1.17** |

***** End of Syllabus*****

**Course Name: Natural Language Processing**
**Code: CS704**
**(Semester –VII)**
**Category: Core Elective IV**
**Course Broad Category: Professional Elective Course**
**[For Computer Science and Engineering]**

1. **Course Prerequisite:**
   Data structures, finite automata and probability theory

2. **Course Learning Objectives:**
   1. Be able to construct regular expressions, finite-state automata, and tokenization techniques for text processing.
   2. Be able to explore statistical and probabilistic language models, including N-grams and Hidden Markov Models.
   3. Be able to work on information retrieval techniques, including indexing, ranking algorithms, and search engine evaluation.
   4. Be able to work with computational lexical semantics, including WordNet, thesaurus-based approaches, and distributional word similarity.
   5. Be able to implement and evaluate NLP models using machine learning and deep learning approaches.

3. **Teaching methodology and evaluation system for the course:**
   **Teaching methodology –** Lectures and Presentations, Interactive Discussions, and Case Studies.
   **Evaluation System –**
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.
4. **Course Content:**
   **Course Name: Natural Language Processing**
   **Course Code: CS704**
   **Hours per Week:** 3L:0T:0P
   **Credits:** 3

| Module | Topics | Lectures |
|---|---|---|
| **Unit 1: Regular Expressions and Automata Recap** | Introduction to NLP, Regular Expression, Finite State Automata[2L]<br>**Tokenization** - Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition, Multi Word Extraction, Spell Checking – Bayesian Approach, MinimumEdit Distance [5L]<br>**Morphology** - Morphology – Inflectional and Derivational Morphology, Finite State Morphological Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite State Transducers, Orthographic Rules and Finite State Transducers, Porter Stemmer [4L] | 11L |
| **Unit 2: Language Modeling** | Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-Bell Discounting; Backoff, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models. [4L]<br>**HiddenMarkovModelsandPOSTagging** - Markov Chain, Hidden Markov Models, Forward Algorithm, Viterbi Algorithm, Part of Speech Tagging – Rule based and Machine Learning based approaches, Evaluation. [4L] | 8L |
| **Unit 3: Text Classification** | Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis – Opinion Mining and Emotion Analysis, Resources and Techniques. [4L]<br>**Context Free Grammar -** Context Free Grammar and Constituency, Some common CFG phenomena for 9English, Top-Down and Bottom-up parsing, Probabilistic Context Free Grammar, Dependency Parsing [4L] | 9L |
| **Unit 4: Computational Lexical Semantics** | Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus – WordNet, Computational Lexical Semantics – Thesaurus based and Distributional Word Similarity [4L]<br>**Information Retrieval -** Boolean Retrieval, Term- document incidence, The Inverted Index, Query Optimization, Phrase Queries, Ranked Retrieval – Term Frequency – Inverse Document Frequency based ranking, Zone Indexing, Query term proximity, Cosine ranking, Combining different features for ranking, Search Engine Evaluation, Relevance Feedback [5L] | 9L |

## 6. References:

**Text & References Books:**


- Speech and Language Processing, Jurafsky and Martin, Pearson Education
- Foundation of Statistical Natural Language Processing, Manning and Schutze, MIT Press.
- Multilingual Natural Language Processing Applications from Theory to Practice: Bikel, Pearson.

## 7. Course Outcomes:

This course aims to provide a comprehensive background in Natural Language Processing.

**After going through this course the Students will be able to:**

| Course Outcomes | Details/Statement | Action Verb | Knowledge Level |
|---|---|---|---|
| CS704.1 | Understand the basics of NLP, including regular expressions and automata for text processing. | Understand | K2 |
| CS704.2 | Apply and evaluate different language modeling techniques and their applications. | Apply, Evaluate | K3, K5 |
| CS704.3 | Implement and analyze text classification techniques, including parsing and sentiment analysis. | Apply, Analyze | K3, K4 |
| CS704.4 | Develop computational lexical semantics and information retrieval methods for NLP applications. | Apply, Develop | K3, K6 |

## 8. Mapping of course outcomes to module / course content

| Module | CO1 | CO2 | CO3 | CO4 |
|---|---|---|---|---|
| 1 | 3 | - | - | - |
| 2 | - | 3 | - | - |
| 3 | - | - | 3 | - |
| 4 | - | - | - | 3 |

## 9. Mapping of the Course outcomes to Program Outcomes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - |
| **CO2** | 3 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - |
| **CO3** | 2 | 3 | 3 | 3 | 3 | 2 | 1 | - | - | - | - | - |
| **CO4** | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | - | - | - |
| **AVG.** | **2.25** | **2.5** | **2.5** | **2.66** | **2.66** | **2** | **2** | **1** | **1** | | | |

## 10. Mapping to PSO

| | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | 0 |
| **CO2** | 3 | 3 | 2 | 1 |
| **CO3** | 3 | 3 | 3 | 2 |
| **CO4** | 2 | 3 | 3 | 3 |

***** End of Syllabus*****

**Course Name: Mobile Computing**
**Code: CS705**
**(Semester –VII)**
**Category: Major**
**Course Broad Category: Engineering Science Course**
**[For Computer Science and Engineering]**

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1. **Course Prerequisite:**

   The study of the basic principles of analog and digital communication, including modulation, transmission, and reception, is referred to as "basic communication systems." Computer networks: the basics of networking, such as network protocols, routing, switching, and the OSI and TCP/IP models. Basics of Wireless Communication: Introduction to frequency spectrum, signal propagation, and wireless communication. Principles of Mobile Computing: A review of wireless technology, mobility management, and mobile devices. The basics of signal processing techniques applied in wireless communication are discussed in Digital Signal Processing (DSP). Web programming and technologies: Understanding web technologies like HTML, basic scripting, and network protocols is required in order to understand mobile web applications.

2. **Course Learning Objectives:**

   i. Understand mobile communications systems by explaining the network signalling, mobility control, and topology of GSM, GPRS, and PCS networks.

   ii. Discuss wireless networking technologies incorporating mobile IP, WLAN (IEEE 802.11), wireless protocols employed during mobile data transportation.

   iii. Discuss wireless protocols and the standards of the mobile internet. Describe wireless mark-up languages, WAP, WAP Gateway, and what role they play in mobile web applications.

   iv. Identify 3G networks and wireless local loops (WLL) With focus on Quality of Service (QoS), discuss the WLL architecture, technologies, and key features of IMT-2000, W-CDMA, and CDMA 2000.

   v. Evaluate Satellite-Based Mobile Communication Systems: To understand satellite-based communication networks, study case studies of IRIDIUM and GLOBALSTAR systems.

   vi. Study Pervasive Computing and Wireless Enterprise Networks. Learn about Bluetooth protocols, virtual networks, and ubiquitous web application development using device-independent applications.

3. **Teaching methodology and evaluation system for the course:**

   **Teaching methodology –**Lectures and Presentations, Interactive Discussions and Case Studies.

   **Evaluation System –**

   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.

4. **Course Content:**
   **Course Name: Introduction to Computer Hardware and Software Course**
   **Course Code: CS705**
   **Hours per Week:** 3L:0T:0P
   **Credits:** 3

| Module | Topics | Lectures |
|---|---|---|
| **Unit 1: Introduction to Personal Communications Services (PCS)** | PCS Architecture, Mobility management, Networks signalling. Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signalling. | 5L |
| **Unit 2: General Packet Radio Services (GPRS)** | GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP. | 5L |
| **Unit 3:Wireless Application Protocol (WAP)** | The Mobile Internet standard, WAP Gateway and Protocols, wireless markup Languages (WML). Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies. | 7L |
| **Unit 4: Third Generation (3G) Mobile Services** | Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G | L |
| **Unit 5: Global Mobile Satellite Systems** | case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, Bluetooth technology, Bluetooth Protocols. | 7L |
| **Unit 6: Server-side programming in Java** | Pervasive web application architecture, Device independent example application. | 8L |

6. **References:**

**Text & References Books:**


- "Pervasive Computing", Burkhardt, Pearson
- "Mobile Communication", J. Schiller, Pearson
- "Wireless and Mobile Networks Architectures", Yi-Bing Lin &ImrichChlamtac, John Wiley & Sons, 2001
- "Mobile and Personal Communication systems and services", Raj Pandya, Prentice Hall of India, 2001.
- "Guide to Designing and Implementing wireless LANs", Mark Ciampa, Thomson learning, Vikas Publishing House, 2001.
- "Wireless Web Development", Ray Rischpater, Springer Publishing,
- "The Wireless Application Protocol", Sandeep Singhal, Pearson .
- "Third Generation Mobile Telecommunication systems", by P.Stavronlakis, Springer Publishers
- Brijesh Gupta “Mobile Computing”, Khanna Publishing House, New Delhi

## 7. Course Outcomes:

**After going through this course the Students will be able to:**

| Course Outcomes | Details/Statement | Action Verb | Knowledge Level |
|---|---|---|---|
| CS705.1 | Explain the architecture, mobility management, and network signaling of Global System for Mobile Communication's (GSM) and Personal Communication Systems' (PCS). | Explain | L2 |
| CS705.2 | Define the General Packet Radio Service (GPRS) network nodes and architecture. Evaluate mobile data transmission technologies suchas Mobile IP and WLAN (IEEE 802.11). | Define | L2 |
| CS705.3 | Describe the Wireless Markup Language (WML), WAP Gateway, WAP protocols, and Mobile Internet standard for mobile web applications. | Describe | L2 |
| CS705.4 | Discuss Wireless Local Loops (WLLs) architectureandtechnology,and a summary of IMT-2000, W-CDMA, and CDMA 2000, with anemphasis on Quality of Service (QoS) in 3G networks. | Discuss | L2 |
| CS705.5 | Discuss case studies of satellite communication systems, suchas GLOBALSTAR and IRIDIUM, to understand their applications and architecture. | Discuss | L2 |
| CS705.6 | Discuss Bluetooth technologies and protocols, virtual networks, and web application architecture through examples of device-independent applications. | Discuss | L2 |

## 8. Mapping of course outcomes to module / course content

| Module | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
|---|---|---|---|---|---|---|
| 1 | PCS Architecture, Mobility management, Networks signalling. Global System for Mobile Communication (GSM) system overview: GSM | GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP. | The Mobile Internet standard, WAP Gateway and Protocols, wireless markup Languages (WML). Wireless Local Loop(WLL): Introduction to WLL | Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA | Case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, Bluetooth technology, | Pervasive web application architecture, Device independent example application. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Architecture, Mobility management, Network signalling. | | Architecture, wireless Local Loop Technologies. | 2000, Quality of services in 3G | Bluetooth Protocols. | |

## 9. Mapping of the Course outcomes to Program Outcomes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 2 | 2 | | | | | 2 | | 1 |
| **CO2** | 3 | 3 | 3 | 2 | 3 | | | | | 2 | 2 | 2 |
| **CO3** | 3 | 2 | 2 | 3 | 3 | | | | | 2 | 1 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 2 | | | | 3 | 2 | 2 |
| **CO5** | 3 | 3 | 2 | 3 | 2 | 2 | | | | 2 | 1 | 1 |
| **CO6** | 3 | 3 | 2 | 3 | 3 | 2 | | | | 3 | 2 | 2 |
| **AVG.** | **3** | **2.83** | **2.33** | **2.67** | **2.67** | **1** | **0** | **0** | **0** | **2.33** | **1.33** | **1.67** |

## 10. Mapping to PSO

| | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 1 |
| **CO2** | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 2 | 3 | |
| **CO4** | 3 | 3 | 2 | 1 |
| **CO5** | 3 | 3 | 2 | 1 |
| **CO6** | 3 | 3 | 3 | 2 |

***** End of Syllabus*****

**Course Name: Cyber Security**

**Code: CS713**

**(Semester –VII)**

**Category: Major**

**Course Broad Category: Engineering Science Course**

**[For Computer Science and Engineering]**

……

1. **Course Prerequisite:**

   ….

2. **Course Learning Objectives:**

   i. …

3. **Teaching methodology and evaluation system for the course:**

   **Teaching methodology –**Lectures and Presentations, Interactive Discussions and Case Studies.

   **Evaluation System –**

   i. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   ii. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   iii. End-Semester Exam (60 Marks)- Summative Assessment.

4. **Course Content:**

   **Course Name: Introduction to Computer Hardware and Software Course**

   **Course Code: CS713**

   **Hours per Week:** 3L:0T:0P

   **Credits:** 3

| Module | Topics | Lectures |
|---|---|---|
| **Unit 1: Introduction** | Introduction to Cyber Security, Importance and challenges in Cyber Security, Cyberspace, Cyber threats, Cyber warfare, CIA Triad, Cyber Terrorism, Cyber Security of Critical Infrastructure, Cyber security - Organizational Implications.. | 6L |
| **Unit 2:Hackers and Cyber Crimes** | Types of Hackers, Hackers and Crackers, Cyber-Attacks and Vulnerabilities, Malware threats, Sniffing, Gaining Access, Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks, Worms, Trojans, Viruses, Backdoors. | 7L |
| **Unit 3: Ethical Hacking and Social Engineering** | Ethical Hacking Concepts and Scopes, Threats and Attack Vectors, Information Assurance, Threat Modelling , Enterprise Information Security Architecture, Vulnerability Assessment and Penetration Testing, Types of Social Engineering, Insider Attack, Preventing Insider Threats, Social Engineering Targets and Defence Strategies. | 8L |
| **Unit 4: Cyber Forensics and Auditing** | Introduction to Cyber Forensics, Computer Equipment and associated storage media, Role of forensics Investigator, Forensics Investigation Process, Collecting Network based Evidence, Writing Computer Forensics Reports, Auditing, Plan an audit against a set of audit criteria, Information Security | 10L |

| | | |
|---|---|---|
| | Management System Management. Introduction to ISO 27001:2013 | |
| **Unit 5: Cyber Ethics and Laws** | Introduction to Cyber Laws, E-Commerce and E-Governance, Certifying Authority and Controller, Offences under IT Act, Computer Offences and its penalty under IT Act 2000, Intellectual Property Rights in Cyberspace. at Network Layer-IPSec.. | 5L |

## 6. References:

**Text & References Books:**


- Cyber security , Nina Gobole & Sunit Belapune; Pub: Wiley India.
- Information Security and Cyber Laws, Pankaj Agarwal
- Donaldson, S., Siegel, S., Williams, C.K., Aslam, A., Enterprise Cybersecurity -How to Build a Successful Cybe rdefense Program Against Advanced Threats, A-press
- Nina Godbole , SumitBelapure, Cyber Security, Willey
- Hacking the Hacker, Roger Grimes, Wiley
- Cyber Law By Bare Act, Govt Of india, It Act 2000.
- Information Security & Cyber Laws, Gupta & Gupta, Khanna Publishing House, (AICTE Recommended Textbook- 2018)


## 7. Course Outcomes:

**After going through this course the Students will be able to:**

| Course Outcomes | Details/Statement | Action Verb | Knowledge Level |
|---|---|---|---|
| CS713.1 | | | |
| CS713.2 | | | |
| CS713.3 | | | |
| CS713.4 | | | |
| CS713.5 | | | |
| CS713.6 | | | |

## 8. Mapping of course outcomes to module / course content

| Module | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
|---|---|---|---|---|---|---|
| 1 | - | - | - | - | - | - |
| 2 | - | - | - | - | - | - |
| 3 | - | - | - | - | - | - |
| 4 | - | - | - | - | - | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| 5 | - | - | - | - | - | - |
| 6 | - | - | - | - | - | - |
| 7 | - | - | - | - | - | - |

## 9. Mapping of the Course outcomes to Program Outcomes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO3** | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO4** | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO5** | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO6** | - | - | - | - | - | - | - | - | - | - | - | - |
| **AVG.** | | | | | | | | | | | | |

## 10. Mapping to PSO

| | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|
| **CO1** | - | - | - | - |
| **CO2** | - | - | - | - |
| **CO3** | - | - | - | - |
| **CO4** | - | - | - | - |
| **CO5** | - | - | - | - |
| **CO6** | - | - | - | - |

***** End of Syllabus*****

**Course Name: Quantum Computing**
**Code: CS714**
**(Semester –VII)**
**Category: Major**
**Course Broad Category: Engineering Science Course**
**[For Computer Science and Engineering]**

……

5. **Course Prerequisite:**
   ….

6. **Course Learning Objectives:**
   ii. …

7. **Teaching methodology and evaluation system for the course:**
   **Teaching methodology –**Lectures and Presentations, Interactive Discussions and Case Studies.
   **Evaluation System –**
   iv. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   v. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   vi. End-Semester Exam (60 Marks)- Summative Assessment.
8. **Course Content:**
   **Course Name: Introduction to Computer Hardware and Software Course**
   **Course Code: CS714**
   **Hours per Week:** 3L:0T:0P
   **Credits:** 3

| Module | Topics | Lectures |
|---|---|---|
| **Unit 1:** | Qubit & Quantum States: The Qubit, Vector Spaces. Linear Combination Of Vectors, Uniqueness of a spanning set, basis & dimensions, inner Products, orthonormality, gram-schmidt orthogonalization, bra-ket formalism, the Cauchyschwarez and triangle Inequalities.. | 3L |
| **Unit 2:** | Matrices & Operators: Observables, The Pauli Operators, Outer Products, The Closure Relation, Representation of operators using matrices, outer products & matrix representation, matrix representation of operators in two dimensional spaces, Pauli Matrix, Hermitian unitary and normal operator, Eigen values & Eigen Vectors, Spectral Decomposition, Trace of an operator, important properties of Trace, Expectation Value of Operator, Projection Operator, Positive Operators | 10L |
| **Unit 3:** | Commutator Algebra, Heisenberg uncertainty principle, polar decomposition &singular values, Postulates of Quantum Mechanics. | 5L |
| **Unit 4:** | Tensor Products: Representing Composite States in Quantum Mechanics, Computing inner products, Tensor products of 5 column vectors, operators and tensor products of Matrices. Density Operator: Density Operator of Pure & Mix state, Key Properties, Characterizing Mixed State, Practical Trace & Reduce Density Operator, Density Operator & Bloch Vector. | 5L |
| **Unit 5:** | Quantum Measurement Theory: Distinguishing Quantum states & Measures, Projective Measurements, Measurement on Composite | 8L |

| | | |
|---|---|---|
| | systems, Generalized Measurements, Positive Operator- Valued Measures | |
| **Unit 6:** | Recent trends in Quantum Computing Research, Quantum Computing Applications of Genetic Programming.. | 6L |

**11. References:**

**Text & References Books:**

- Quantum Computing without Magic by Zdzislaw Meglicki
- Quantum Computing Explained By DAVID Mc MAHON
- Quantum Computer Science By Marco Lanzagorta, Jeffrey Uhlmann
- An Introduction to Quantum Computing Phillip Kaye, Raymond Laflamme, Michele Mosca.

**12. Course Outcomes:**

**After going through this course the Students will be able to:**

| Course Outcomes | Details/Statement | Action Verb | Knowledge Level |
|---|---|---|---|
| CS714.1 | | | |
| CS714.2 | | | |
| CS714.3 | | | |
| CS714.4 | | | |
| CS714.5 | | | |
| CS714.6 | | | |

**13. Mapping of course outcomes to module / course content**

| Module | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
|---|---|---|---|---|---|---|
| 1 | - | - | - | - | - | - |
| 2 | - | - | - | - | - | - |
| 3 | - | - | - | - | - | - |
| 4 | - | - | - | - | - | - |
| 5 | - | - | - | - | - | - |
| 6 | - | - | - | - | - | - |
| 7 | - | - | - | - | - | - |

**14. Mapping of the Course outcomes to Program Outcomes**

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

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2** | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO3** | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO4** | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO5** | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO6** | - | - | - | - | - | - | - | - | - | - | - | - |
| **AVG.** | | | | | | | | | | | | |

**15. Mapping to PSO**

| | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|
| **CO1** | - | - | - | - |
| **CO2** | - | - | - | - |
| **CO3** | - | - | - | - |
| **CO4** | - | - | - | - |
| **CO5** | - | - | - | - |
| **CO6** | - | - | - | - |

***** End of Syllabus*****

**Course Name: E-Commerce & ERP**

**Code: CS722**

**(Semester – VII)**

**Category: Major**

**Course Broad Category: Engineering Science Course**

**[For Computer Science and Engineering]**

……

**9. Course Prerequisite:**

….

**10. Course Learning Objectives:**

iii. …

**11. Teaching methodology and evaluation system for the course:**

**Teaching methodology –**Lectures and Presentations, Interactive Discussions and Case Studies.

**Evaluation System –**

vii. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)

viii. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]

ix. End-Semester Exam (60 Marks)- Summative Assessment.

**12. Course Content:**

**Course Name: Introduction to Computer Hardware and Software Course**

**Course Code: CS722**

**Hours per Week:** 3L:0T:0P

**Credits:** 3

| Module | Topics | Lectures |
|---|---|---|
| **Unit 1: Overview** | Definitions, Advantages & Disadvantages of E – Commerce, Threats of E – Commerce, Managerial Prospective, Rules & Regulations For Controlling E – Commerce, Cyber Laws. | 3L |
| **Unit 2: Technologies** | Relationship Between E – Commerce & Networking, Different Types of Networking Commerce, Internet, Intranet & Extranet, EDI Systems Wireless Application Protocol : Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce . | 5L |
| **Unit 3: Business Models of e – commerce** | Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance. | 2L |
| **Unit 4: E – strategy** | Overview, Strategic Methods for developing E – commerce. | 2L |
| **Unit 5: Four C's** | ( Convergence, Collaborative Computing, Content Management & Call Center ). Convergence : Technological Advances in Convergence – Types, Convergence and its implications, Convergence & Electronic Commerce. Collaborative Computing : Collaborative product development, | 6L |

| | | |
|---|---|---|
| | contract as per CAD, Simultaneous Collaboration, Security. Content Management : Definition of content, Authoring Tools & Content Management, Content – partnership, repositories, convergence, providers, Web Traffic & Traffic Management ; Content Marketing. Call Center : Definition, Need, Tasks Handled, Mode of Operation, Equipment , Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE). | |
| **Unit 6: Supply Chain Management** | E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, Internet's effect on Supply Chain Power. | 3L |
| **Unit 7: E – Payment Mechanism** | Payment through card system, E – Cheque, E – Cash, E – Payment Threats & Protections. | 1L |
| **Unit 8: E – Marketing** | Home –shopping, E-Marketing, Tele-marketing | 1L |
| **Unit 9: Electronic Data Interchange (EDI)** | Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA). | 2L |
| **Unit 10: Risk of E – Commerce** | Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures. | 4L |
| **Unit 11: Enterprise Resource Planning (ERP)** | Features, capabilities and Overview of Commercial Software, re-engineering work processes for IT applications, Business Process Redesign, Knowledge engineering and data warehouse . Business Modules: Finance, Manufacturing (Production), Human Resources, Plant Maintenance, Materials Management, Quality Management, Sales &Distribution ERP Package, ERP Market: ERP Market Place, SAP AG, PeopleSoft, BAAN, JD Edwards, Oracle Corporation ERP-Present and Future: Enterprise Application Integration (EAI), ERP and E-Commerce, ERP and Internet, Future Directions in ERP | 10L |

## 16. References:

### Text & References Books:


- E-Commerce ,M.M. Oka, EPH
- Kalakotia , Whinston : Frontiers of Electronic Commerce , Pearson Education.
- Bhaskar Bharat : Electronic Commerce - Technologies & Applications.TMH
- Loshin Pete, Murphy P.A. : Electronic Commerce , Jaico Publishing Housing.
- Murthy : E – Commerce , Himalaya Publishing.
- E – Commerce : Strategy Technologies & Applications, Tata McGraw Hill.
- Global E-Commerce, J. Christopher & T.H.K. Clerk, University Press
- Beginning E-Commerce, Reynolds, SPD

- Krishnamurthy, E-Commerce Mgmt, Vikas

**17. Course Outcomes:**

**After going through this course the Students will be able to:**

| Course Outcomes | Details/Statement | Action Verb | Knowledge Level |
|---|---|---|---|
| CS722.1 | | | |
| CS722.2 | | | |
| CS722.3 | | | |
| CS722.4 | | | |
| CS722.5 | | | |
| CS722.6 | | | |

**18. Mapping of course outcomes to module / course content**

| Module | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
|---|---|---|---|---|---|---|
| 1 | - | - | - | - | - | - |
| 2 | - | - | - | - | - | - |
| 3 | - | - | - | - | - | - |
| 4 | - | - | - | - | - | - |
| 5 | - | - | - | - | - | - |
| 6 | - | - | - | - | - | - |
| 7 | - | - | - | - | - | - |

**19. Mapping of the Course outcomes to Program Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO3** | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO4** | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO5** | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO6** | - | - | - | - | - | - | - | - | - | - | - | - |
| **AVG.** | | | | | | | | | | | | |

**20. Mapping to PSO**

| | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|
| **CO1** | - | - | - | - |
| **CO2** | - | - | - | - |
| **CO3** | - | - | - | - |
| **CO4** | - | - | - | - |
| **CO5** | - | - | - | - |
| **CO6** | - | - | - | - |

***** End of Syllabus*****

**Course Name: Project II**
**Code: CS781**
**(Semester – VII)**
**Category: Major**
**Course Broad Category: Engineering Science Course**
**[For Computer Science and Engineering]**

……

1. **Course Prerequisite:**
   i. Fundamental knowledge on technical report writing
   ii. Understanding the basic components of research methodologies

2. **Course Learning Objectives:**
   i. Identify the gap in the present scenario on a research topic and create the scope to work
   ii. Students will come out with a working model and a detailed report. .

3. **Teaching methodology and evaluation system for the course:**
   **Teaching methodology –**Presentations, Interactive Discussions and Case Studies.
   **Evaluation System –**
   A. Mid-Term Exam (20 Marks)- Summative Assessment (CIA-1)
   B. Internal Assessment (20 Marks)- Formative Continuous Assessment [Continuous Assessment 1 (CIA-2)]
   C. End-Semester Exam (60 Marks)- Summative Assessment.
4. **Course Content:**
   **Course Name: Introduction to Computer Hardware and Software Course**
   **Course Code: CS781**
   **Hours per Week:** 0L:0T:1P
   **Credits:** 6

| Module | Topics | Lectures |
|---|---|---|
| 1 | Project Work I: The object of Project Work I is to enable the student to take up investigative study in the broad field of Computer Science and Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) in R&D work | |
| 2 | Project Work II & Dissertation The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&Dwork and technical leadership. The assignment to normally include: 1. In depth study of the topicassigned in the light of the Report prepared under EC P1; 2. Review and finalization of the Approach tothe Problem relating to the assigned topic; 3. Preparing an Action Plan for conducting the investigation,including team work; 4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed; 5. Final development of product/process, testing, results, conclusions and future directions; 6. Preparing a paper for Conference presentation/Publication in Journals, if possible; 7. Preparing a Dissertation in the standard format for being evaluated by the Department. 8. Final Seminar Presentation before a Departmental Committee. | |
| | | |

## 6. References:

**Text & References Books:**

## 7. Course Outcomes:

**After going through this course the Students will be able to:**

| Course Outcomes | Details/Statement | Action Verb | Knowledge Level |
|---|---|---|---|
| CS781-1 | Conduct a survey on the work done in the chosen domain. | Evalute | L5 |
| CS781-2 | Formulate the problem out of the survey. | Create | L6 |
| CS781-3 | Design some technique towards the solution of the problem defined. | Create | L6 |
| CS781-4 | Develop leadership capability and teamwork in collaborative environments. | Create | L6 |
| CS781-5 | Apply knowledge of the 'real world' situations that a professional engineer can encounter | Apply | L3 |

## 8. Mapping of course outcomes to module / course content

| Module | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
|---|---|---|---|---|---|---|
| 1 | - | - | - | - | - | - |
| 2 | - | - | - | - | - | - |
| 3 | - | - | - | - | - | - |
| 4 | - | - | - | - | - | - |
| 5 | - | - | - | - | - | - |
| 6 | - | - | - | - | - | - |
| 7 | - | - | - | - | - | - |

## 9. Mapping of the Course outcomes to Program Outcomes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | - | 3 | - | 2 | 3 | 3 | 2 | 2 | 1 | 3 |
| **CO2** | 2 | 3 | - | 3 | - | 2 | 3 | 3 | 3 | 2 | 2 | 3 |
| **CO3** | 2 | - | 3 | 3 | 1 | 2 | 3 | 2 | 3 | 2 | 3 | 3 |
| **CO4** | 2 | - | 3 | 3 | 1 | 2 | 3 | 2 | 3 | 2 | 3 | 3 |
| **CO5** | 2 | - | 3 | 3 | 1 | 2 | 3 | 2 | 3 | 2 | 3 | 3 |
| **AVG.** | **2** | **3** | **3** | **3** | **1** | **2** | **3** | **2.4** | **3** | **2** | **2.4** | **3** |

## 10. Mapping to PSO

| | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 |
| **CO6** | - | - | - | - |

***** End of Syllabus*****