# INSTITUTE OF AERONAUTICAL ENGINEERING

**Autonomous**

Dundigal, Hyderabad - 500 043

## COMPUTER SCIENCE AND ENGINEERING

## COURSE DESCRIPTION FORM

| | | | | |
|---|---|---|---|---|
| **Course Title** | **COMPUTER NETWORKS** | | | |
| **Course Code** | **A50515** | | | |
| **Regulation** | **R15 - JNTUH** | | | |
| **Course Structure** | Lectures | Tutorials | Practicals | Credits |
| | 4 | - | - | 4 |
| **Course Coordinator** | Mr. P. Ravinder, Assistant Professor, CSE | | | |
| **Team of Instructors** | Mr. P.V Narasimha Rao, Assistant professor, CSE<br>Ms. B. Geetha Vani Assistant Professor,CSE | | | |

## I. COURSE OVERVIEW:

The growing importance of Internetworking in recent years and their use in every field has made Computer Networks a central issue for modern systems. The main objective of the course is to know the functions of various layers of a network model. Topics to be covered include: data communication concepts and techniques in a layered network architecture, communications switching and routing, types of communication, network congestion, network topologies, network configuration and management, network model components, layered network models (OSI reference model, TCP/IP networking architecture) and their protocols, various types of networks (LAN, MAN, WAN and Wireless networks) and their protocols.

## II. PREREQUISITE(S):

| Level | Credits | Periods/ Week | Prerequisites |
|---|---|---|---|
| UG | 4 | 4 | Data Structures, Data Communications, Computer Organization, Linux Operating Systems |

## III. MARKS DISTRIBUTION:

| Sessional Marks | University End Exam marks | Total marks |
|---|---|---|
| **Midterm Test**<br>There shall be two midterm examinations. Each midterm examination consists of essay paper, objective paper and assignment.<br>The essay paper is for 10 marks of 60 minutes duration and shall contain 4 questions. The student has to answer 2 questions, each carrying 5 marks.<br>The objective paper is for 10 marks of 20 minutes duration. It consists of 10 multiple choice and 10 fill-in-the blank questions, the student has to answer all the questions and each carries half mark.<br>First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion.<br>Five marks are earmarked for assignments. There shall be two assignments in | 75 | 100 |

| Sessional Marks | University End Exam marks | Total marks |
|---|---|---|
| every theory course. Assignments are usually issued at the time of commencement of the semester. These are of problem solving in nature with critical thinking.<br>Marks shall be awarded considering the average of two midterm tests in each course. | | |

## IV. EVALUATION SCHEME:

| S. No | Component | Duration | Marks |
|---|---|---|---|
| 1. | I Mid Examination | 80 minutes | 20 |
| 2. | I Assignment | - | 5 |
| 3. | II Mid Examination | 80 minutes | 20 |
| 4. | II Assignment | - | 5 |
| 5. | External Examination | 3 hours | 75 |

## V. COURSE OBJECTIVES:

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

I. Build an understanding of the fundamental concepts of computer networking.

II. Familiarize with the basic taxonomy and terminology of the computer networking area.

III. Introduced to advanced networking concepts, preparing for entry to advanced courses in computer networking.

IV. Allow to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

## VI. COURSE OUTCOMES:

**After completing this course the student must demonstrate the knowledge and ability to:**

1. **Understand** basic computer network technology.
2. **Understand** and explain Data Communications System and its components.
3. **Enumerate** the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
4. **Identify** the different types of network topologies and protocols.
5. **Identify** the shortest path in a given network.
6. **Model** mathematically various error control schemes.
7. **Analyze** different LLC multiplexing mechanisms, node-to-node flow and error control.
8. **Analyze** different MAC mechanisms (Aloha, Slotted Aloha, TDMA, FDMA) and understand their pros and cons.
9. **Identify** the different types of network devices and their functions within a network.
10. **Enable** to interconnect various heterogeneous networks.
11. **Understand** and building the skills of subnetting and routing mechanisms.
12. **Design** and implement a peer to peer file sharing application utilizing application layer protocols such as HTTP, DNS, and SMTP and transportation layer protocol.
13. **Predict** ethical, legal, security and social issues related to computer networks.

## VII. HOW PROGRAM OUTCOMES ARE ASSESSED:

| Program Outcomes | | Level | Proficiency assessed by |
|---|---|---|---|
| PO1 | **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. | H | Lectures |
| PO2 | **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. | H | Lectures, Assignments, Exams |
| PO3 | **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. | H | Problem Solving Seminars, Exercises |
| PO4 | **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. | H | Lectures, Assignments, Exams |
| PO5 | **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. | H | Lectures, Assignments, Workshops |
| PO6 | **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 practice. | S | -- |
| PO7 | **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. | N | -- |
| PO8 | **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. | S | -- |
| PO9 | **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. | H | Assessments Discussions, |
| PO10 | **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. | N | -- |
| PO11 | **Project management and finance**: Demonstrate knowledge and understanding of the engineering 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. | S | -- |
| PO12 | **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. | S | -- |

**N - None** **S - Supportive** **H - Highly Related**

## VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

| Program Specific Outcomes | | Level | Proficiency assessed by |
|---|---|---|---|
| PSO1 | **Professional Skills:** The ability to research, understand and implement computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient analysis and design of computer-based systems of varying complexity. | H | Lectures, Assignments |
| PSO2 | **Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success. | H | Projects |
| PSO3 | **Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths, to be an entrepreneur, and a zest for higher studies. | S | Guest Lectures |

**N - None** **S - Supportive** **H - Highly Related**

## IX. SYLLABUS:

**UNIT-I**

**Overview of the Internet:** Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Internet history standards and administration. Comparison of the OSI and TCP/IP reference model.

**Physical Layer:** Guided transmission media, wireless transmission media.

**Data Link Layer**-design issues, CRC Codes, Elementary Data link Layer protocols, sliding window protocol.

**UNIT-II**

**Multiple Access Protocols-** ALOHA, CSMA, Collision free protocols, Ethernet-Physical Layer, Ethernet Mac Sub layer, data link layer switching & use of bridges, learning bridges, spanning tree bridges, repeaters, hubs, bridges, switches, routers and gateways.

**UNIT-III**

**Network Layer:** Network Layer Design issues, store and forward packet switching connection less and connection oriented networks-routing algorithms-optimality principle, shortest path, flooding, Distance Vector Routing, Count to Infinity Problem, Hierarchical Routing, Congestion control algorithms, admission control.

**UNIT-IV**

**Internetworking:** Tunneling, Internetwork Routing, Packet fragmentation, IPv4, IPv6 Protocol, IP addresses CIDR, IMCP, ARP, RARP, DHCP.

**Transport Layer:** Services provided to the upper layers elements of transport protocol-addressing connection establishment, connection release, Crash Recovery.

**UNIT-V**

**The Internet Transport Protocols** UDP-RPC, Real Time Transport Protocols,

**The Internet Transport Protocols-**Introduction to TCP, The TCP Service Model, The TCP Segment Header, The Connection Establishment, The TCP Connection Release, The Connection Management Modeling, The TCP Sliding Window, The TCP Congestion Control, The future of TCP.

**Application Layer-**Introduction, providing services, Application layer paradigms, Client server model, Standard client-server application-HTTP, FTP, electronic mail, TELNET, DNS,SSH.

**Text Books:**

1. Behrouz A. Forouzan, "Data Communications and Networking", 5e TMH, 2013.
2. Andrew S Tanenbaum, "Computer Networks", 4e, Pearson Education.

**Reference Books:**

1. S. Keshav, "An Engineering Approach to Computer Networks", 2e, Pearson Education.
2. W. A. Shay, "Understanding communications and Networks", 3e, Cengage Learning.
3. Chwan-Hwa(John)Wu, J.David Irwin, "Introduction to Computer Networks and Cyber Security", CRC Press.
4. L. L. Peterson and B. S. Davie, "Computer Networks", 4e, Elsevier.
5. James F. Kurose, K. W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 3e, Pearson Education.

## X. COURSE PLAN:

**At the end of the course, the students are able to achieve the following course learning outcomes:**

| Lecture No. | Topics to be covered | Course Learning Outcomes | Reference |
|---|---|---|---|
| 1 | Protocols and layering scenario | **Understand** and explore the basics of computer networks and various network protocols. | T1:2.1 |
| 2 | OSI model | **Demonstrate** guidelines for the development of universally compatible networking protocols using OSI model. | T1:2.3 |
| 3 | Internet history standards and administration and comparison of the OSI and TCP/IP reference model | **Recognize** knowledge on previous versions of internet and demonstrates that TCP/IP protocol is not replacement for OSI model. | T1:2.3.1 |
| 4-8 | Guided and wireless transmission media | **Illustrate** guided and unguided medium. | T1:7.2,7.3 |
| 9 | Design issues of CRC codes | **Illustrate** the purpose of error detection and correction techniques. | T1:10.3.1 |
| 10-19 | Elementary data link layer protocol: sliding window protocol ALOHA, CSMA and collision free protocols | **Design** and implement data link layer protocol with in a simulated networking environment. | T1:11.2, 12.1.1,12.1.2, |
| 20-21 | Ethernet-physical layer and MAC sub layer | **Describe** how networked devices can format data for transmission to other network devices on the same network segment using Ethernet. | T1:13.3.2,13.4.1 |
| 22-24 | Data link layer switching & use of bridges, learning bridges, spanning tree bridges, repeaters, hubs, switches, routers and gateways | **Understand** the working concepts of the switching devices. | T1:17.1.1,17.1.3 |
| 25 - 27 | Network layer design issues, store and forward packet switching, connection-less and connection-oriented networks | **Identify** global addressing system and routing procedures | T1:18.1, 18.2.1 |
| 28-30 | Routing algorithms | **Understand** various routing algorithms and analyze the shortest path between any two stations. | T1:20.2 |

| | | | |
|---|---|---|---|
| 31-34 | Congestion control algorithms and admission control | **Understand** the mechanisms to handle congestion scenarios on networks. | T1:18.3.4,18.3.4.1 |
| 35-36 | Tunneling, internetworking and packet fragmentation | **Illustrate** the pros and cons of tunneling. | T1:22.12,19.1.2 |
| 37-40 | IPv4, IPv6 Protocol and IP addresses CIDR | **Compare** popular internet protocols IPV4 and IPV6. | T1:18.4,18.4.3 |
| 41-43 | ICMP, ARP, RARP and DHCP | **Understand** various address related protocols. | T1:19.2,18.4.4 |
| 44-46 | Services provided to the upper layers elements of transport protocol and addressing connection establishment, connection release, crash recovery | **Describe** how transport Layer protocol provides process-process delivery and evaluate the recovery of crashed data packets. | T1:23.1.1,23.1.3 |
| 47-49 | UDP-RPC and Real Time Transport Protocols(RTP) | **Describe** the practical use of UDP and RTP protocols. | T1:24.2,28.4 |
| 50-54 | Introduction to TCP, TCP service model, segment header, connection establishment, release and management modeling | **Explain** three way handshaking procedure of TCP. | T1:24.3.1, 24.3.3,24.3.4 |
| 55-58 | The TCP sliding window, congestion control and future of TCP | **Understand** the packet transmission mechanism of TCP. | T1:24.3.6, 24.3.9 |
| 59-60 | Introduction, providing services, application layer paradigms and client server model, standard client-server application | **Apply** latest client –server technologies to configure and manage web servers. | T1:25.1,25.1.2 |
| 61-64 | HTTP, FTP, electronic mail TELNET and SSH | **Explain** purpose of FTP for file transfer and access remote system through remote login. | T1:26.1.2,26.2, 26.3, 26.4,26.5 |
| 65-67 | DNS | **Define** name space, Domain Name Space and explain how to assign the domain for different organization. | T1:26.6 |

## XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

| Course Objectives | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| I | H | | | | | | | | S | | S | | H | | H |
| II | H | | | S | H | | | | | | | | | H | |
| III | H | | | S | H | | | | | | | | | H | S |
| IV | S | S | | | H | | | | | | | | S | S | |
| V | | S | S | | | | S | | | | | | | S | H |

**S – Supportive** **H - Highly Related**

## XII. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| **1** | H | | | S | S | | | | | | | | H | | S |
| **2** | S | H | | S | S | | | | | | | | | H | S |
| **3** | S | | | | | | S | | | | | | | H | S |
| **4** | S | H | | S | | | H | | | | | | | | |
| **5** | S | S | | H | | | | | | | | | S | H | |
| **6** | S | | | S | H | | | | | | | | S | | H |
| **7** | S | S | | H | S | | | | | | | | | H | |
| **8** | H | | S | | | | S | | | | | | H | | S |
| **9** | S | | H | | | | S | | | | | | H | | S |
| **10** | | S | | | | | H | | | | | | H | | S |
| **11** | H | | | S | S | | | | | | | | H | | S |
| **12** | S | H | | S | S | | | | | | | | | H | S |

**S – Supportive** **H - Highly Related**

**Prepared by:** Mr. P. Ravinder, Assistant Professor, CSE

**Date** **:** 10 July, 2017

**HOD, CSE**