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**Format No. QSP/7.1/01.F01 (B) Issue No.05 Rev. No 5 Dated: Jan 1, 2017**

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**UNIVERSITY OF PETROLEUM & ENERGY STUDIES**

**College of Engineering Studies**

**Dehradun**

**COURSE PLAN**

Programme : B.Tech (CS+ All IBM Branches)

Course : Data Communication and Computer Networks

Subject Code : CSEG 2009

No. of credits : 3

Semester : IV

Session : Jan 2019 – May 19

Batch : 2017-21

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**Approved By**

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**COURSE PLAN**

1. **PREREQUISITE:**
   1. Basic Knowledge Mathematics.
   2. Basic Knowledge of Data structure
   3. Basic Knowledge of Algorithms

1. **PROGRAM OUTCOMES (POs) for DCN:**

**Program Outcomes for B. Tech. CSE After completion of the program the students will be able to:**

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **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.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **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.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **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.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**PROGRAM SPECIFIC OUTCOMES**

1. Perform system and application programming using computer system concepts, concepts of Data Structures, algorithm development, problem solving and optimizing techniques,
2. Apply software development and project management methodologies using concepts of front-end and back-end development and emerging technologies and platforms.
3. Ability to understand and apply Cloud Computing architecture for scalable, secure and dynamically provisioned business oriented environment with optimized performance tuning and data reliability.

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1. **OBJECTIVES OF COURSE:-**

The objectives of this course are to:

1. Students should be able to classify the functions of layers in a network with fine- grained knowledge about classification of functionalities among network layers.
2. Student should be able to classify the network devices on the basis of their functionalities.
3. Student should be able to understand the real time networks including wired and wireless.
4. Students should be able to assess the pros of cons while selecting network devices in any network.
5. **COURSE OUTCOMES FOR Data Communication and Computer Networks: At the end of this course student should be able to**

CO1: Understand Theoretical Concepts of Network and Transmission Fundamentals.

CO2. Understand Evolution and Layered Architecture of Networks with detail information about the rationale behind each layer.

CO3. Understand the concept of Errors control and Multiplexing in the transmission Medium. Flow control and LAN protocols and LAN Standards.

CO4: Understanding the IP based networking and the concepts of Routing concepts and relation with Algorithm and Data Structures.

CO5: Understanding the Transport Layer and associated concepts of connection oriented and connection less behavior.

CO6: Understand the concepts of Application Layer concepts and protocols.

**Table: Correlation of POs v/s COs**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO1 |  |  |  |  |  |  | 1 | 1 |  |  |  |
| CO2 |  |  |  |  |  |  |  |  | 2 | 2 |  |
| CO3 | 2 |  |  |  |  |  |  |  |  |  |  |
| CO4 |  |  |  |  |  |  | 2 |  |  |  |  |
| CO5 |  |  |  |  |  |  |  | 3 |  |  |  |
| CO6 |  |  |  |  |  |  |  | 1 |  |  |  |

1. WEAK 2. MODERATE 3. STRONG
2. **COURSE OUTLINE**

|  |  |  |
| --- | --- | --- |
| **Sl. No** | **Module** | **Contents** |
| 1. | Module 1 | Data Communication |
| 2 | Module 2 | Physical Layer |
| 3 | Module 3 | Data Link Layer |
| 4 | Module 4 | Network Layer |
| 5 | Module 5 | Routing Strategies |
| 6 | Module 6 | Transport Network and Application Layer |

1. **PEDAGOGY**
2. **Class Test**
3. **Quiz**
4. **Assignments/ Tutorials**
5. **Digital and analog Presentations**
6. **Concept diary (needs to be maintained by students-short and concise notes which include course concepts that he/she has understood.)**
7. **COURSE COMPLETION PLAN**

|  |  |
| --- | --- |
| **Total Class room sessions** | 24 |
| **Online Sessions** | 12 |
| **Total Test** | 01 |
| **Total Assignment** | 02 |
| **Total Reflections** | 02 |

One Session =60 minutes

1. **EVALUATION & GRADING**

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No.** | **Assessment** | **Weightage** | **Schedule** |
| 1 | Internal Assessment (IA) | 30% | Detailed Below |
| 2 | Mid-semester Examination (MS) | 20% | Academic Calendar |
| 3 | End-semester Examination (ES) | 50% | Academic Calendar |

**I1. INTERNAL ASSESSMENT: WEIGHTAGE – 30%**

Internal Assessment shall be done based on the following:

|  |  |
| --- | --- |
| **Assessment** | **Percentage** |
| Tests – 1 | **30%** |
| Reflections – 02 (Quiz) | **20%** |
| Assignments - 2 | **40%** |
| Attendance & Performance | **10%** |
| Total | **100%** |

**I2*. Internal Assessment Record Sheet (including Mid Term Examination marks)*** *will be displayed online at the end of semester i.e. last week of regular classroom teaching.*

**I3. CLASS TESTS/QUIZZES:** One Class Tests based on descriptive type theoretical & numerical questions will be held after mid semester examination. Those who do not appear in Viva-Voce and quiz examinations shall lose their marks.

*The marks obtained by the students will be displayed on Blackboard a week before the start of Mid Term and End Term Examinations respectively.*

**I4. ASSIGNMENTS:** After completion of two units there will be home assignments based on theory, numerical problems and case studies. One assignment based before the mid semester exam and one after mid semester. Those who fail to submit the assignments by the due date shall lose their marks.

**I5. GENERAL DISCIPLINE:** Based on student’s regularity, punctuality, sincerity and behavior in the class.

*The marks obtained by the students will be displayed on LMS at the end of semester.*

**I6. MID TERM EXAMINATION: WEIGHTAGE – 20%**

**Mode of Mid Term Examination - Offline**

Mid Term examination shall be Two Hours duration and shall be a combination ofShort and Long theory Questions.

***Date of showing Mid Term Examination Answer Sheets: Within a week after completion of mid Sem examination.***

**I7. END SEM EXAMINATION: WEIGHTAGE – 50%**

End Sem Examination shall be Three Hours duration and shall be a combination of Short and Long theory/numerical Questions.

**I8. GRADING:**

The overall marks obtained at the end of the semester comprising all the above three mentioned shall be converted to a grade. Each faculty member will prepare individual award sheet for their respective classes. Common grading will be there.

1. **DETAILED SESSION PLAN**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Module/** | **TOPICS** | **Course Outcomes Addressed** | **Required Learning Resources** | | **Pedagogy/** | |  |
| **Session** | **(including media)** | | **Discussion(s)/ Postings** | | **Assessment** |
| **Module 1 data communication \*** | | | | | | | |
| **1** | Introduction to networks, Theoretical Model for Communication | **CO1** |  | | **F2F Lecture** | |  |
| **2** | Analog and digital signal, Bandwidth, Noise, Channel Capacity, Data Rate, | **CO1** |  | | **F2F Lecture** | |  |
| **3** | Transmission Impairments, Guided Transmission Media, Wireless Transmission Media, Line of Sight Transmission | **CO1** | **Online** | | **Readings/ brief video/ presentation** | |  |
| **4** | Concept of circuit, Message, Packet Switching with their timing diagram, Comparison of Switching Techniques | **CO2** |  | | **F2F Lecture** | |  |
| **Module 2 PHYSICAL LAYER** | | | | | | | |
| **5** | Evolution of computer network, layered network architecture, OSI Model, | **CO2** |  | | **F2F Lecture** | |  |
| **6** | ATM, Three Tier Architecture, System Network Architecture, Topology, Line Discipline, | **CO2** | **Online** | | **Readings/ brief video/ presentations** | |  |
| **7** | ISDN, Frame Relay | **CO2** |  | | **F2F Lecture** | |  |
| **8** | Fast Ethernet | **CO2** |  | | **F2F Lecture** | |  |
| **9** | Gigabit Ethernet, FDDI, TCP/IP Model | **CO2** | **Online** | | **Readings/ brief video/ presentations** | | **Assignment 1** |
| **Module 3 Data Link Layer\*** | | | | | | | |
| **10** | Error Detection & Correction Techniques, Hamming Code, | **CO3** |  | **F2F Lecture** | | **Discussion-1 Release** | |
| **11** | CRC, Parity Check | **CO3** |  | **Readings/ brief video/ presentations** | | **Reflection - 1** | |
| **12** | ARQ Techniques (Stop and wait Protocol), Go Back N Protocol, Selective Repeat Request, HDLC | **CO3** | **Offline/Online** | **F2F Lecture** | |  | |
| **13** | TDM, FDM, CDMA, | **CO3** | **Online** | **Readings/ brief video/ presentations** | |  | |
| **14** | ALOHA: Pure, Slotted ALOHA, CSMA, CSMA/CD | **CO3** |  | **F2F Lecture** | |  | |
| **15** | IEEE 802 standards for LAN & WAN: 802.3, 802.4, 802.5, 802.6, 802.2 and Their Comparison | **CO3** | **Online** | **Readings/ brief video/ presentations** | |  | |
| **Module 4 Network Layer\*** | | | | | | | |
| **16** | Network Layer Service, Datagram and VC services, | **CO4** |  | | **F2F Lecture** | |  |
| **17** | IP Datagram format and Types of Services, | **CO4** |  | | **F2F Lecture** | |  |
| **18** | Datagram Encapsulation and Fragmentation, IP Addressing: Subnetting and Supernetting | **CO4** | **Online** | | **Readings/ brief video/ presentations** | |  |
| **Module 5 Routing Strategies** | | | | | | | |
| **19** | Routing: Link State Routing, Distance Vector Routing, | **CO4** |  | | **F2F Lecture** | |  |
| **20** | Hierarchical Routing, Multicast Routing, | **CO4** |  | | **F2F Lecture** | |  |
| **21** | RIP,OSPF, BGP | **CO4** | **Online** | | **Readings/ brief video/ presentations** | |  |
| **22** | IPv4: Frame Formats, | **CO4** |  | | **F2F Lecture** | |  |
| **23** | Introduction to ICMP, | **CO4** |  | | **F2F Lecture** | |  |
| **24** | DHCP, and NAT, IPv6: Frame Formats, | **CO4** | **Online** | | **Readings/ brief video/ presentations** | | **Assignment 2** |
| **25** | Network Management: SNMP and RMON models | **CO4** |  | | **F2F Lecture** | |  |
| **Module 6 Transport Layer and Application Layer\*** | | | | | | | |
| **26** | Transport Layer Services, Relationship with network and application layer | **CO5** |  | | **F2F Lecture** | |  |
| **27** | Multiplexing and De multiplexing, UDP | **CO5** | **Online** | | **Readings/ brief video/ presentations** | |  |
| **28** | TCP: Header, Segment Structure, Services, | **CO5** |  | | **F2F Lecture** | |  |
| **29** | Connection Establishment and Termination, Flow Control and Window Size Advertising, | **CO5** |  | | **F2F Lecture** | |  |
| **30** | TCP timeout and re-transmission, Congestion control, | **CO5** | **Online** | | **Readings/ brief video/ presentations/Web Search** | | **Class Test-1,** |
| **31** | TCP Fairness, Delay Modelling, | **CO5** |  | | **F2F Lecture** | |  |
| **32** | Application Layer Protocols: HTTP | **CO6** |  | | **F2F Lecture** | |  |
| **33** | FTP | **CO6** | **Online** | | **Readings/ brief video/ presentations/Web Search** | |  |
| **34** | SNMP | **CO6** |  | | **F2F Lecture** | |  |
| **35** | DNS | **CO6** |  | | **F2F Lecture** | |  |
| **36** | (**Based on complete syllabus)** |  | **Online** | | **Readings/ brief video/ presentations/Web Search** | | **Reflection -2** |

**Suggested Readings:**

**Text Book**

**T1:** **Data Communications and Networks, Behrouz A. Forouzan**

**Reference Books**

**R1: Computer Networks 3/e , Andrew S. Tanenbaum**

**GUIDELINES**

***Cell Phones and other Electronic Communication Devices*:** Cell phones and other electronic communication devices (such as Blackberries/Laptops) are not permitted in classes during Tests or the Mid/Final Examination. Such devices MUST be turned off in the class room.

***E-Mail and online learning tool:*** Each student in the class should have an e-mail id and a pass word to access the LMS system regularly. Regularly, important information – Date of conducting class tests, guest lectures, via online learning tool. The best way to arrange meetings with us or ask specific questions is by email and prior appointment. All the assignments preferably should be uploaded on online learning tool. Various research papers/reference material will be mailed/uploaded on online learning platform time to time.

***Attendance:*** Students are required to have **minimum attendance of 75%** in each subject. Students with less than said percentage shall **NOT** be allowed to appear in the end semester examination.

**Course outcome assessment:** To assess the fulfilment of course outcomes two different approaches have been decided. Degree of fulfillment of course outcomes will be assessed in different ways through direct assessment and indirect assessment. In Direct Assessment, it is measured through quizzes, tests, assignment, Mid-term and/or End-term examinations. It is suggested that each examination is designed in such a way that it can address one or two outcomes (depending upon the course completion). Indirect assessment is done through the student survey which needs to be designed by the faculty (sample format is given below) and it shall be conducted towards the end of course completion. The evaluation of the achievement of the Course Outcomes shall be done by analyzing the inputs received through Direct and Indirect Assessments and then corrective actions suggested for further improvement.

***Passing criterion:*** Student has to secure minimum 35% marks individually in both the ‘End-Semester examination’ and ‘Total Marks’ in order to pass in the paper.

**Sample format for Indirect Assessment of Course outcomes**

|  |
| --- |
| NAME: |
| ENROLLMENT NO: |
| SAP ID: |
| COURSE: |
| PROGRAM: |

Please rate the following aspects of course outcomes of Data Communication and Computer Networks.

Use the scale 1-4\*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sl. No. |  | 1 | 2 | 3 | 4 |
| 1 | CO1: Understand Theoretical Concepts of Network and relate with Telephone Network. |  |  |  |  |
| 2 | CO2. Understand Evolution and Layered Architecture of Networks with detail information about the rationale behind each layer. |  |  |  |  |
| 3 | CO3. Understanding of TCP/IP layered stack and correlation with OSI. |  |  |  |  |
| 4 | CO4: Understand the concept of Errors, Error Correction and Error Detection and Multiplexing of the transmission Medium. |  |  |  |  |
| 5 | CO5: Understand the function of Data Link Layer and Flow control in Layer 3. |  |  |  |  |
| 6 | CO6: Understand the working and Evolution of MAC Layer historic and evolved LAN Standards. |  |  |  |  |
| 7 | CO7. Understanding the IP based networking. |  |  |  |  |
| 8 | CO8: Understand the concept of Routing concepts and relation with Algorithm and Data Structures. |  |  |  |  |
| 9 | CO9: Understanding the Transport and Application Layer concepts and protocols. |  |  |  |  |

3

Below Average

Good

1

**\***

Very Good

Average

4

2