**FR. Conceicao Rodrigues College Of Engineering**

Father Agnel Ashram, Bandstand, Bandra-west, Mumbai-50

**Department of Information Technology**

**B.E. (IT) (semester VII)  (2019-2020)**

**Lesson Plan:**

**Subject: Enterprise Network Design (ITC701)                                        Credits-4**

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

1. To be familiarized with the methodologies and approaches of the network design for an enterprise network.
2. To understand the network hierarchy and use modular approach to network design for an enterprise network.
3. To understand the campus design and data center design considerations for designing an enterprise campus.
4. To study Enterprise Edge WAN Technologies and design a WAN using them
5. Designing an IP addressing plan and selecting a Route protocol for an enterprise network.
6. To design enterprise network for given user requirements in an application.

**Course Outcomes: At the end of this course a student will be able to:**

1. Understand the customer requirements and Apply a Methodology to Network Design
2. Structure and Modularize the Network
3. Design Basic Campus and Data Center Network.
4. Design Remote Connectivity
5. Design IP Addressing and Select suitable Routing Protocols for the Network
6. Compare Openflow controllers and switches with other enterprise networks.



**DETAILED SYLLABUS:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sr | Module | Detailed Content | Books | Hours |
| 0 | Prerequisite  | 1. OSI Reference Model andTCP/IP Protocol Suite2. Routing IP Addresses3. Internetworking Devices | Syllabus books | 02 |
| 1 | Applying aMethodology to Network Design: | The Cisco Service Oriented Network Architecture, Network Design Methodology, Identifying Customer Requirements, Characterizing the Existing Network and Sites, Using the Top- Down Approach to Network Design, The DesignImplementation Process. | Syllabus books | 08 |
| 2 | Structuring andModularizing theNetwork: | Network Hierarchy, Using a Modular Approach to Network Design, *Services Within Modular Networks, Network Management Protocols and Features* | Syllabus books | 09 |
| 3 | Designing BasicCampus and DataCenter Networks | Campus Design Considerations, Enterprise Campus Design, Enterprise Data Center Design Considerations | Syllabus books | 09 |
| 4 | Designing RemoteConnectivity | Enterprise Edge WAN Technologies, WAN Design, Using WAN Technologies, Enterprise Edge WAN and MAN Architecture, Selecting Enterprise Edge Components, Enterprise Branch and Teleworker Design. | Syllabus books | 09 |
| 5 | Designing IPAddressing in theNetwork &Selecting RoutingProtocols | Designing an IP Addressing Plan, Introduction to IPv6, Routing Protocol Features, Routing Protocols for the Enterprise, Routing Protocol Deployment, Route Redistribution, Route Filtering, Redistributing and Filtering with BGP, Route Summarization | Syllabus books | 10 |
| 6 | Software Defined Networks | Understanding SDN and Open Flow : SDN – SDN Building Blocks, OpenFlow messages – Controller to Switch, Symmetric and Asynchronous messages, Implementing OpenFlow Switch, OpenFlow controllers , POX and NOX, Open Flow in Cloud Computing, Case study: how SDN changed Traditional Enterprise network Design | Syllabus books | 05 |

**Text Books:**

1. Authorized Self-Study Guide, Designing for Cisco Internetwork Solutions (DESGN), Second Edition, Cisco Press-Diane Teare.
2. Network Analysis, Architecture, and Design 3rd Edition, Morgan Kaufman, James D.
3. CCDA Cisco official Guide
4. Software Defined Networking with Open Flow : PACKT Publishing SiamakAzodolmol

**References:**

1. Top-Down Network Design (Networking Technology) 3rd Edition, Priscilla Oppenheimer ,Cisco Press Book
2. Network Planning and Design Guide Paperback – 2000, Shaun Humme

Term Work shall consist of full Mini Project on above syllabus. Also Term work Journal

must include at least 2 assignments.

**Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Mini Project) + 5 Marks (Assignments) + 5

Marks (Attendance)

**Oral Exam:** An Oral exam will be held based on the Mini Project and Presentation.



1. **Course Outcome Statement**

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| Sr.No. | Course Outcome Statement |
| ITC 701.1 | Understand the customer requirements and Apply a Methodology to Network Design |
| ITC 701.2 | Structure and Modularize the Network |
| ITC 701.3 | Design Basic Campus and Data Center Network. |
| ITC 701.4 | Design Remote Connectivity |
| ITC 701.5 | Design IP Addressing and Select suitable Routing Protocols for the Network |
| ITC 701.6 | Compare Openflow controllers and switches with other enterprise networks. |

1. **CO-PO and CO-PSO Mapping**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Name** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| CO1 | 3 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |
| CO2 | **1** | 3 |  |  |  |  |  |  |  |  |  |  |  |  |
| CO3 |  | 2 | 3 | 2 | 3 |  |  |  |  |  |  |  |  |  |
| CO4 |  |  |  | 2 |  |  |  | 3 |  |  |  |  |  |  |
| CO5 |  |  | 3 |  | 2 |  |  |  |  |  |  |  |  |  |
| CO6 |  |  |  |  | 3 |  |  |  |  |  |  |  |  |  |

1. **CO Assessment Tools**

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| --- | --- | --- |
|  | **Direct Methods** | **Indirect Methods** |
|  |  |  |  |  |  |  | Course Exit Survey |
| ITC701.1 | UT1(20%) | P1-P5 (20%) | A1(30%) | Oral(10%) | UE(20%) |  | 100% |
| ITC701.2 | UT1(30%) | A1(40%) | Oral(10%) | UE(20%) |  |  | 100% |
| ITC701.3 | UT1(20%) | Mini-Project(50%) | A1(10%) | Oral(10%) | UE(20%) |  | 100% |
| ITC701.4 | UT2(20%) | Mini-Project(50%) | A1(10%) | Oral(10%) | UE(20%) |  | 100% |
| ITC701.5 | UT2(20%) | Mini-Project(20%) | P6(30%) | A2(10%) | Oral (10%) | UE(10%) | 100% |
| ITC701.6 | UT2(30%) | A2 (40%) | Oral (10%) | UE (20%) |  |  |  |

1. **Course Outcomes Target:**

**Upon Completion of this course, students will be able to :**

ITC701.1Understand the customer requirements and Apply a Methodology to Network Design

**Target level: 2.0**

ITC701.2: Structure and Modularize the Network

**Target level: 2.0**

ITC701.3: Design Basic Campus and Data Center Network

**Target level: 2.0**

ITC701.4: Design Remote Connectivity

**Target level: 2.0**

ITC701.5: Design IP Addressing and Select suitable Routing Protocols for the Network

**Target level: 2.0**

ITC701.6: Compare Openflow controllers and switches with other enterprise networks

**Target level: 2**

1. **Lesson Plan**

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| --- | --- | --- | --- |
| No of classes available: | 47 | 1. No of Classes taken:2.Total Remedial Lectures |  |
|  |  |  |  |
| Sr. No. | Topic Planned with CO  | Planned Date  | Actual Date | Delivery Mechanisms |
| 0. | Prerequisite  | 03/07/19 | 03/07/19 | Blackboard, notes |
| 1. | Applying aMethodology to Network Design: | 05/07/19 | 05/07/19 | Blackboard, |
| 2. | Structuring andModularizing theNetwork: | 16/07/19 | 16/07/19 | Blackboard |
| 3. | Designing BasicCampus and DataCenter Networks | 18/07/19 | 18/07/19 | Blackboard |
| 4. | Designing RemoteConnectivity | 31/07/19 | 31/07/19 | Blackboard, notes |
| 5. | Designing IPAddressing in theNetwork &Selecting RoutingProtocols | 21/08/19 | 21/08/19 | Blackboard,notes,  |
| 6. | Software Defined Networks | 20/09/19 | 20/09/19 |  |

**Date wise lecture plan**

|  |  |  |  |
| --- | --- | --- | --- |
| **Date** | **Topic Taught** | **Date** | **Topic Taught** |
| 03/07/19 | OSI Reference Model | 29/08/19 | Routing Protocol Deployment |
| 04/07/19 | Routing IP Addresses | 30/08/19 | Routing Protocol Deployment |
| 05/07/19 | The Cisco Service OrientedNetwork Architecture, Network Design Methodology | 11/09/19 | *Route* Redistribution, RouteFiltering |
| 09/07/19 | Existing Network and Sites, Using the Top-Down Approach to Network Design, | 13/09/19 | *Route* Redistribution, RouteFiltering |
| 10/07/19 | The DesignImplementation Process. | 17/09/19 | Redistributing andFiltering with BGP |
| 16/07/19 | Network Hierarchy, Modular Approach to NetworkDesign | 18/09/19 | RouteSummarization |
| 17/07/19 | *Network Management**Protocols and Features* | 20/09/19 | Introduction to SDN, SDN architecture |
| 18/07/19 | Campus Design Considerations | 24/09/19 | Features and advantages of SDN |
| 23/07/19 | Campus Design Considerations | 25/09/19 | Introduction to OpenFlow |
| 24/07/19 | Campus Design | 26/09/19 | OpenFlow messages –Controller to Switch |
| 25/07/19 | Enterprise Data Center DesignConsiderations | 27/09/19 | OpenFlow messages –Controller to Switch |
| 30/07/19 | Data Center DesignConsiderations | 01/10/19 | Symmetricand Asynchronous messages |
| 31/07/19 | Enterprise Edge WANTechnologies, | 03/10/19 | Implementing OpenFlow Switch |
| 01/08/19 | WAN Design, UsingWAN Technologies | 04/10/19 | OpenFlow controllers, POX |
| 06/08/2019 | EnterpriseEdge WAN and MAN Architecture | 05/10/19 | OpenFlow controllers, NOX |
| 07/08/19 | Enterprise EdgeComponents, | 09/10/19 | Open Flow in CloudComputing, |
| 08/08/19 | Enterprise EdgeComponents | 10/10/19 | Open Flow in CloudComputing, |
| 09/08/19 | Enterprise Branchand Teleworker Design. | 11/10/19 | Case study: how SDNchanged Traditional Enterprisenetwork Design |
| 20/08/19 | Enterprise Branchand Teleworker Design. |  |  |
| 21/08/19 | Designing an IP Addressing Plan |  |  |
| 22/08/19 | Introduction to IPv6 |  |  |
| 23/08/19 | Introduction to IPv6 |  |  |
| 27/08/19 | RoutingProtocols for the Enterprise |  |  |
| 28/08/19 | RoutingProtocols for the Enterprise |  |  |

1. **Lab Plan**

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| --- | --- | --- | --- | --- | --- |
| No. | Title of the Experiment | Batch | Planned Dates | Actual Dates | Relevant CO |
| 1 | DHCP Server configuration on Cisco router using GNS3 | A | 17/07/19 | 17/07/19 | CO1 |
| B | 19/07/19 | 19/07/19 | CO1 |
| C | 18/07/19 | 18/07/19 | CO1 |
| D | 16/07/19 | 16/07/19 | CO1 |
| 2 | Static Routing configuration on Cisco using GNS3 | A | 24/07/19 | 24/07/19 | CO1 |
| B | 26/07/19 | 26/07/19 | CO1 |
| C | 25/07/19 | 25/07/19 | CO1 |
| D | 23/07/19 | 23/07/19 | CO1 |
| 3 | Dynamic Routing based on RIP using GNS3 | A | 31/07/19 | 31/07/19 | CO1 |
| B | 02/08/19 | 02/08/19 | CO1 |
| C | 01/08/19 | 01/08/19 | CO1 |
| D | 30/07/19 | 30/07/19 | CO1 |
| 4 | EIGRP simulation using GNS3 | A | 07/08/19 | 07/08/19 | CO1 |
| B | 09/08/19 | 09/08/19 | CO1 |
| C | 08/08/19 | 08/08/19 | CO1 |
| D | 06/08/19 | 06/08/19 | CO1 |
| 5 | OSPF simulation using GNS3 | A | 21/08/19 | 21/08/19 | CO1 |
| B | 23/08/19 | 23/08/19 | CO1 |
| C | 22/08/19 | 22/08/19 | CO1 |
| D | 20/08/19 | 20/08/19 | CO1 |
| 6 | IPV6 configuration on Cisco Router using GNS3 | A | 28/08/19 | 28/08/19 | CO5 |
| B | 30/08/19 | 30/08/19 | CO5 |
| C | 29/08/19 | 29/08/19 | CO5 |
| D | 27/08/19 | 27/08/19 | CO5 |
| 7 | Mini-Project | A | 11/09/19, 11/9/19, 18/09/19 | 11/09/19, 11/9/19, 18/09/19 | CO3, CO4, CO5 |
| B | 13/09/19, 20/09/19, 27/09/19 | 13/09/19, 20/09/19, 27/09/19 | CO3, CO4, CO5 |
| C | 12/09/19, 19/09/19, 26/09/19 | 12/09/19, 19/09/19, 26/09/19 | CO3, CO4, CO5 |
| D | 10/09/19, 17/09/19, 24/09/19 | 10/09/19, 17/09/19, 24/09/19 | CO3, CO4, CO5 |

1. **Assignment Plan**

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| Assignment No. | Date | Topics with CO |
| 1 | 10/09/2019 | Design Methodology for networking,Structuring and Modernizingthe network (ITC701.1, ITC701.2, ITC701.3, ITC701.4) |
| 2.  |  | IP addressing and SDN (ITC701.5, ITC701.6) |