Course Code	CSE565
Course Name	Software Defined Networking
Credits	4
Course Offered to	UG/PG
Course Description	Traditionally, networking equipments consists of proprietary switching hardware with embedded software. This not only made manageability of networks complex but also stymied innovation. SDN paradigm proposed to change this, primarily by separating networking software into data and control planes. The data plane's goal is to do switching in distributed hardware equipments. The control plane centrally governs what will be the switching rules at the data plane. As the control plane is separated from the switching hardware, it is easier to change its software, thereby speeding up software development cycle and in turn lowering the barrier for innovation. The separation of planes and centralization of control plane simplifies manageability of networks. In addition to these two benefits, SDN also facilitates network virtualization, which is a key enabler Cloud Computing. In this course, we will begin by getting familiarized to the aforementioned functions in the traditional networks. We will then learn how SDN changes the way networks will function now. We will look at open source technologies that enable deployment of SDN on real hardware and in simulation. We will see how all of networking functions, e.g. switching, routing, firewall, load balancers, and VPN, are instrumented in the new paradigm. We will explore SDN via lectures from the instructor, assignments, presentations of research papers by students, and a course project.

Pre-requisites

Pre-requisite (Mandatory)	Pre-requisite (Desirable)	Pre-requisite(other)
CSE232 Computer Networks		

*Please insert more rows if required

Post Conditions*(For suggestions on verbs please refer the second sheet)

CO1	CO2	CO3	CO4	CO5
Use Mininet to simulate network	Use controller-switch architecture	Execute routing algorithm for SDN	Create a firewall in SDN	Design a data center in virtualized environment

Weekly Lecture Plan

Week Number	Lecture Topic	COs Met	Assignment/Labs/Tutorial
1	L2 switching, L3 routing, Firewall, Load balancer, and VPN		
2	L2 switching, L3 routing, Firewall, Load balancer, and VPN		Non-programming assignment on L2, L3, and Firewall (2 hours)
3	Data and control together, Active networks, Attempts towards virtualization: VLAN, Tempest, VINI, Click, SDN as separation of control and data plane, Role of OpenFlow, Details of OpenFlow		
4	Data and control together, Active networks, Attempts towards virtualization: VLAN, Tempest, VINI, Click, SDN as separation of control and data plane, Role of OpenFlow, Details of OpenFlow		Non-programming assignment on OpenFlow (4 hours)
5	Control Plane, Controller, Flow matching, Mininet, Open source controllers: NOX/POX, OVN, Ryu, Floodlight, OpenDaylight,,Making Hub and Learning Switch, Making Firewall	CO1	Mininet programming (8 hours)
6	Control Plane, Controller, Flow matching, Mininet, Open source controllers: NOX/POX, OVN, Ryu, Floodlight, OpenDaylight,,Making Hub and Learning Switch, Making Firewall		Project proposal (4 hours)
7	Virtualization: ESXi, KVM, Tunneling, Open vSwitch, FlowVisor, Data centers: Multi-tenancy and need for network virtualization and centralization	CO2	Non-programming assignment on controller (4 hours)
8	Virtualization: ESXi, KVM, Tunneling, Open vSwitch, FlowVisor, Data centers: Multi-tenancy and need for network virtualization and centralization	CO3	Implement routing (10 hours)
9	Programmable data plane, Software-based routers can be fast, OpenFlow Chip, RISC Architecture, Tables, Processor, Switch Blade, Configurable packet parser, Flow of control from table to table, Network assembly language		Midsem project demo
10	Programmable data plane, Software-based routers can be fast, OpenFlow Chip, RISC Architecture, Tables, Processor, Switch Blade, Configurable packet parser, Flow of control from table to table, Network assembly language	CO4	Implement firewall (10 hours)
11	Northbound APIs and Southbound APIs, Dynamically adding rules, Policies: Frenetic, Pyretic, Resonance, Event-based network control		Paper critique (10 hours)
12	Northbound APIs and Southbound APIs, Dynamically adding rules, Policies: Frenetic, Pyretic, Resonance, Event-based network control	CO5	Implement policies at the controller (10 hours)
13	OpenStack, Containers, Data center		

*Please insert more rows if required

Weekly Lab Plan

Week Number	Laboratory Exercise	COs Met	Platform (Hardware/Software)

*Please insert more rows if required

Assessment Plan

Type of Evaluation	% Contribution in Grade
Assignment	20
Paper presentation	15
Mid-sem	20
End-sem	25
Project	20

*Please insert more row for other type of Evaluation

Resource Material

Type	Title
Reference	SDN : software defined networks by Nadeau, Thomas D.
Reference	Network innovation through openflow and SDN : principles and design by Hu, Fei
Reference	Software defined networks : a comprehensive approach by Goransson, Paul and Black, Chuck