GUJARAT TECHNOLOGICAL UNIVERSITY
BRANCH: CYBER SECURITY (59)
SUBJECT NAME: INTERNETWORKING AND SECURITY
SUBJECT CODE: 2725902
SEMESTER: II

Type of course: Master of Engineering (Cyber Security)

Prerequisite: Computer Networks

Rationale: This course aims to provide guidance on network programming, development of new network-aware applications as well as those maintaining existing code, understanding the networking components with their system function. This course also covers to write programs that communicate with each other using an application program interface (API) known as sockets. Sockets become synonymous with network programming. Virtually every operating system (OS) provides numerous network-aware applications such as web browsers, email clients, and file-sharing servers. This course covers the usual partitioning of these applications into client and server.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks		Practical Marks				
L	T	P	C	ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
4	0	2	5	70	30	20	10	10	10	150

Content:

Sr. No.	Content	Total Hours	%Weightage
1.	Introduction, a simple daytime client, protocol independence, error handling: wrapper functions, a simple daytime server, Unix standards, 64-bit architectures	1	5%
2.	Socket introduction, socket address structures, value-result arguments, byte ordering functions, elementary TCP sockets, socket function, connect function, bind function, listen function, accept function, fork and exec functions, concurrent servers, getsockname and getpeername functions	3	10%
3.	TCP client/server example, TCO echo server, TCP echo client, normal startup, normal termination, POSIX signal handling, handling SIGCHILD signals, wait and waitpid functions, connection abort before accept returns, termination of server process, SIGPIPE signal, crashing, rebooting and shutdown of server host,	4	10%
4.	I/O multiplexing: select and poll functions, I/O models, select function, str_cli function, batch input and buffering, shutdown function, pselect function, poll function, socket option introduction, getsocketopt and setsocketopt functions, socket states, generic socket options, IPv4 socket options, ICMPv6 socket option, TCP socket option, SCTP socket option, fcntl function	5	10%
5.	Elementary UDP sockets introduction, recvfunction and sendto	8	15%

	functions, UDP echo server, UDP echo client, lost datagrams, verifying received responses, server not running, connect function with UDP, lack of flow control with UDP, TCP and UDP echo server using select, elementary SCTP sockets introduction, interface models, sctp_bindx function, sctp_connectx function, sctp_getpaddrs function, sctp_freepaddrs function, sctp_freeladdrs function, sctp_sendmsg function, sctp_recvmsg function, sctp_opt_info function, sctp_peeloff function, shutdown function		
6.	SCTP client/server example introduction, one-to-many style streaming echo server and client, exploring head-of-line blocking, controlling number of streams, controlling termination	3	10%
7.	IPv4 and IPv6 interoperability, IPv4 client-IPv6 server, IPv6 client-IPv4 server, IPv6 address-testing macros, source code portability	6	10%
8.	Daemon processes and inetdsuperserver introduction, syslogd daemon, syslog function, daemon_init function, inetd daemon, daemon_inetd function, Advanced i/o functions introduction, socket timeouts, recv and send functions, readv and writev functions, recvmsg and sendmsg functions, ancillary data, sockets and standard i/o, advanced polling	8	10%
9.	Unix domain protocols introduction, unix socket address structure, socket functions, unix domain stream client/server and datagram client/server, receiving sender credential	5	10%
10.	Nonblocking i/o introduction, nonblocking reads and writes, connect and accept	4	5%
11.	Introduction to advanced UDP and SCTP sockets	3	5%

Reference Books:

1. Unix Network Programming by W. Richard Stevens, Bill Fenner and Andrew M. Rudoff - Addison Wesley, Third edition
2. Linux Socket Programming by Example by Warren Gay – Que
3. Client Server Programming with Java and CORBA by Robert Orfali and Dan Harkey, Wiley

Course Outcomes:
- A comprehensive coverage of the theory, concepts, design principles and technologies for network security
- Design principles and techniques of two major aspects of network security: (a) how to secure a network; and (b) how to secure data transactions.
- A solid foundation for the design principles for the design of networks at all levels.
- Understand network architecture protocols the placement of servers and monitor. Internetworking, bridging, routing, and encapsulation are covered.
- Deep understanding of transport layer protocols and socket programming.

List of Experiment:

1. Analysis report of TCP/IT attack, Heartbleed attack, Local DNS attack, Remote DNS attack, Packet Sniffing and spoofing, Minix IPSec with lab setup from SEED project.
2. Analysis report of Linux capability Exploration, Role-Based Access Control with lab set up from SEED Project.

3. Launch an attack to exploit the vulnerabilities of the TCP/IP protocol, including session hijacking.
4. Launch an attack to exploit the vulnerabilities of the TCP/IP protocol, including SYN flooding and TCP reset attacks.
5. To perform DNS Pharming attack using any method on computers in a LAN Environment.
6. Write a program to sniff packet sent over the local network.
7. Write a program to spoof various types of packet.
8. Implement the IPSec protocol in the Minix operating system and use it to set up Virtual Private Networks.

Major Equipments/Software:
- Main Server
- Backup Server
- Virtual Machine software(Virtual box)
- Open Source operating system