

# PARUL UNIVERSITY - Faculty of Engineering and Technology

Department of Electronics & Communication Engineering

SYLLABUS FOR 7th Sem BTech PROGRAMME

Data Communication and Networking (03107401)

**Type of Course:** BTech

**Prerequisite:** Basic knowledge of Computer languages.

**Rationale:** Introduction to analysis and design of computer and communication networks through understanding the network layered architecture and the protocol stack and by conducting hands-on programming and lab activities.

**Teaching and Examination Scheme:**

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/ Week	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
3	0	2	4	60	30	20	20	20	150

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

**Contents:**

Sr.	Topic	Weightage	Teaching Hrs.
1	<b>Computer Networks and the Internet:</b> The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol Layers and their Service Models, Problem: Connecting to a Network , Framing, Error Detection, Reliable Transmission, Ethernet and Multiple Access Networks (802.3), Wireless, What's Next: "The Internet of Things"	10%	4
2	<b>Link layer :links, Access networks and LAN:</b> Introduction to Link layers, Error detection and correction techniques, MAC protocols, Switched LAN, link virtualization, Data center networking	15%	7
3	<b>Network layer:</b> Virtual Circuit and Datagram Network, Router, The Routing Algorithms, Internet Protocol (IP): Forwarding and Addressing in the Internet, Routing in the Internet, Broadcast and Multicast Routing.	15%	7
4	<b>Transport Layer:</b> Introduction and transport layer service, Multiplexing and Demultiplexing, Connectionless Transport: UDP, Principles of Congestion Control of Reliable Data Transfer, Connection-Oriented Transport: TCP, Principles of congestion control, TCP Congestion Control.	15%	7

5	<b>Application Layer:</b> Principles of network applications, HyperText Transfer Protocol (HTTP), Domain Name Service (DNS). FTP, Email, DNS—The Internet's Directory Service.	15%	7
6	<b>Wireless and Mobile networks:</b> wireless links and networks characteristics, 802.11, cellular internet access, mobility management, mobile IP	10%	4
7	<b>NETWORK SECURITY:</b> Cryptography, Symmetric-Key Algorithms, Public-Key Algorithms, Digital Signatures, Management Of Public Keys, IPsec, Firewalls.	10%	4
8	<b>Network Defense tools:</b> Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding	10%	5

**\*Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

**Reference Books:**

1. Computer Networking: A Top-Down Approach Featuring the Internet  
James F. Kurose, Keith W. Ross.; Addison-Wesley; 7th Edition
2. Computer Networks  
Andrew S Tannebaum; Pearson, 2012
3. Data Communication and Networking  
Behrouz Forouzan; TMH

**Useful Links:**

<http://www.ibm.com/Network/Communication>  
[https://www.tutorialspoint.com/data\\_communication\\_computer\\_network/download.nos.org/coa631/ch2.pdf](https://www.tutorialspoint.com/data_communication_computer_network/download.nos.org/coa631/ch2.pdf)  
[www.freetchbooks.com/data-communication-and-networks-f31.html](http://www.freetchbooks.com/data-communication-and-networks-f31.html)  
[mucins.weebly.com/1-data-communication.html](http://mucins.weebly.com/1-data-communication.html)

**Course Outcome:**

After Learning the course the students shall be able to:

Explain the concept of TCP/IP and OSI layers.  
 Analyse the Design issues and problems of all layers.  
 Analyse various algorithms. Design small projects based on security issues, the control algorithm

**List of Practical:**

1. Introduction to WIRESHARK
2. Generate DNS traffic and trace packets using wireshark.
3. Generate HTTP traffic, trace packets using wireshark.
4. Create a network using CISCO packet tracer
5. Packet capture and analysis of application that uses UDP .Investigate the header fields in the UDP segment as well as the checksum calculation
6. Introduction to NS2
7. To study and perform simple node connection using TCL (Tool Command language) script

8. To Perform Unequal packet drop using UDP protocol in NS2.
9. Introduction to NS3.
10. Creating point to point module using NS3.
11. Implementing CSMA protocol using NS3.
12. To study and execute Network Commands.
13. Implementation of Character stuffing and DE stuffing.
14. Implementation of Parity checker. Write a CRC code and verify it using C.

# PARUL UNIVERSITY - Faculty of Engineering and Technology

Department of Electronics & Communication Engineering

SYLLABUS FOR 7th Sem BTech PROGRAMME

Microwave Engineering (03107402)

**Type of Course:** BTech

**Prerequisite:** Knowledge of Electromagnetic, Communication Engineering and Basic knowledge of Mathematics.

**Rationale:** Microwave plays a vital role in our lives. Development in microwave technology has increased its application in allied fields of electronics, radar and mobile communication. Satellite and Radar communication is applied subject which stimulate interest in the exciting field of electronic communication

**Teaching and Examination Scheme:**

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/ Week	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
3	0	2	4	60	30	20	20	20	150

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

**Contents:**

Sr.	Topic	Weightage	Teaching Hrs.
1	<b>Introduction to microwaves::</b> Microwave frequencies, Advantages of microwaves and general applications of microwaves	5%	2
2	<b>Basic transmission line theory::</b> Transmission line equations & solutions, condition for distortion less line, standing wave and standing wave ratio, line impedance and admittance, impedance matching problem solutions using smith charts	18%	8
3	<b>Microwave wave-guides::</b> Rectangular wave guides (With all necessary details and derivations), Circular wave-guides, corrugated wave-guide	13%	6
4	<b>Microwave components::</b> Scattering Parameters, Wave-guide tees, magic tee, directional couples, circulars and isolators, corners, bends, twists, flanges, Attenuator	18%	8
5	<b>Microwave tubes and circuits:</b> Limitations of conventional tubes at UHF & Microwave, Klystrons, velocity modulation, multi cavity klystron, reflex klystron, travelling wave tube, Magnetron.	18%	8

6	<b>Semiconductor microwave devices::</b> Varactor diodes, step-recovery diodes, parametric amplifiers, tunnel diode, Gunn diode, PIN diode, Schottky barrier diodes, Microwave transistors Bipolar transistor, Hetrojunction Bipolar transistor, MESFET, High electron mobility transistor (HEMT)	18%	8
7	<b>Microstrip &amp; Integrated Circuits::</b> Strip lines and micro strip lines, MMIC	10%	5

**\*Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

**Reference Books:**

1. Microwave Engineering (TextBook)  
David M.Pozar; Wiley India; 3rd
2. Microwave Devices & Circuits (TextBook)  
Liao Samuel Y.; PHI Learning, New Delhi
3. Microwave engineering  
Das Annapurna & Das S. K.; Mc. Graw Hill, New Delhi
4. Microwave Engineering  
Manojit Mitra; Dhanpatrai & Co
5. Microwave Engineering (TextBook)  
Gupta Sanjeev; Khanna Publication, New Delhi

**Useful Links:**

1. <http://www.microwaves101.com>
2. <http://www.rfcafe.com>
3. <http://www.dtic.mil/dtic>
4. <http://www.jpier.org/PIER/>
5. <http://www.antune.net>
6. <https://www.anaren.com/>
7. <http://www.microwave-eetimes.com/>
8. [https://en.wikipedia.org/wiki/Microwave\\_engineering](https://en.wikipedia.org/wiki/Microwave_engineering)
9. <http://mwrf.com/>

**Course Outcome:**

After Learning the course the students shall be able to:

Understand basic concepts and applications of microwave systems  
 Design, analyze and solve problems related to microwave transmission lines  
 Design, analyze and solve problems related to microwave waveguide  
 Solve problem related to mismatching using Smith Chart  
 Analyze and use various passive microwave components for different applications  
 Design and implement the microwave layouts

**List of Practical:**

1. To study different microwave component
2. To study and perform V-I characteristic of Gunn Diode
3. To determine the standing wave ratio and reflection coefficient
4. To find frequency and wavelength of rectangular waveguide
5. To find insertion loss and isolation loss of circulator
6. To find insertion loss and isolation loss of isolator
7. To find S parameter of Magic Tee.
8. To determine the parameters of the E-Plane Tee

9. To determine the parameters of the H-Plane Tee
10. To study the working of transmitter and receiver
11. To study and perform directional coupler
12. Design Circular Waveguide in HFSS
13. Design E plane/ Hplane Tee in HFSS
14. Impedance matching using smith chart.
15. Study the Fixed and variable attenuator
16. Introduction to spectrum analyzer and measurement of spectrum of microwave signal using the same.

**Open Ended Problems:**

1. Design any one microwave component in HFSS

# PARUL UNIVERSITY - Faculty of Engineering and Technology

Department of Electronics & Communication Engineering

SYLLABUS FOR 7th Sem BTech PROGRAMME

Wireless Communicaton (03107403)

**Type of Course:** BTech

**Prerequisite:** Higher Engineering Mathematics, Fundamental knowledge of Signals and Systems, Digital Communication theory, Probability and random processes, Programming skills in Simulation Exercises

**Rationale:** The purpose of this course is to provide an understanding of modern Digital mobile and wireless communication systems. Also give knowledge of recent trends in the field of wireless communication

**Teaching and Examination Scheme:**

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/ Week	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
3	0	2	4	60	30	20	20	20	150

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

**Contents:**

Sr.	Topic	Weightage	Teaching Hrs.
1	<b>Introduction to Wireless Communication System:</b> Evolution of mobile communications, Mobile Radio System around the world, Types of Wireless communication System, Comparison of Common wireless system, Trend in Cellular radio and personal communication. Second generation Cellular Networks, Third Generation (3G) Wireless Networks , Wireless Local Loop(WLL), Wireless Local Area network(WLAN), Bluetooth and Personal Area Networks	5%	3
2	<b>The Cellular Concept- System Design Fundamentals:</b> Cellular system, Hexagonal geometry cell and concept of frequency reuse, Channel Assignment Strategies Distance to frequency reuse ratio, Channel & co-channel interference reduction factor, S/I ratio consideration and calculation for Minimum Co-channel and adjacent interference, Handoff Strategies, Umbrella Cell Concept, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular System-cell splitting, Cell sectorization , Repeaters, Micro cell zone concept	25%	12
3	<b>Mobile Radio Propagation Model, Small Scale Fading:</b> Large scale path loss:-Free Space Propagation loss equation, Path-loss of NLOS and LOS systems, Small scale multipath propagation, Impulse model for multipath channel, Delay spread, Feher's delay spread, upper bound Small scale, Multipath Measurement parameters of multipath channels, Types of small scale Fading, Rayleigh and rician distribution	20%	10

4	<b>Multiple Access Techniques::</b> Introduction, Comparisons of multiple Access Strategies TDMA,CDMA, FDMA CSMA Protocols	5%	3
5	<b>GSM System::</b> GSM system architecture, Radio interface, Protocols, Localization and calling, Handover, Authentication and security in GSM, GSM speech coding, international roaming in GSM.	15%	5
6	<b>CDMA (Code Division Multiple access)::</b> Concept of spread spectrum, Architecture of IS-95 CDMA system, Air interface, CDMA forward channels, CDMA reverse channels, Soft handoff, CDMA features, Power control in CDMA, Performance of CDMA System, RAKE Receiver, CDMA2000 cellular technology, GPRS system architecture	15%	5
7	<b>Mobile IP ::</b> Introduction ,Mobility requirements and constraints in an IP environment, Mobile IP Protocol Overview, Route Optimization, Mobility Support for IPv6, Connectivity with 3G Networks	10%	4
8	<b>Advances in wireless::</b> Introduction to OFDM, Wi-Fi, Wi-MAX, Wireless ad-hoc networks, MIMO system Introduction to 4G-LTE	5%	3

**\*Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

**Reference Books:**

1. Wireless Communication (TextBook)  
T.S.Rappaport; Pearson Edu.
2. Wireless Communications (TextBook)  
Andrea Goldsmith; Cambridge University Press
3. Mobile IP : Design Principles And Practice  
Charles E. Perkins; Wesley
4. Wireless and Mobile network Architectures (TextBook)  
Yi-Bang Lin and Imrich Chlamtac; Wiley-India Edition
5. MIMO Wireless Communications (TextBook)  
Ezio Biglieri; Cambridge University
6. OFDM for Multimedia Communications (TextBook)  
Richard, Van Nee & Ramjee Prasad; Artech House Publication

**Useful Links:**

[http://netcom.gwu.ac.kr/files/graduate/wireless\\_net\\_arch](http://netcom.gwu.ac.kr/files/graduate/wireless_net_arch)  
<http://www.eecs.berkeley.edu>  
<https://www.scribd.com/.../Wireless-and-Mobile-Network-Architecture>  
[www.fang.ece.ufl.edu/eel6591.pdf](http://www.fang.ece.ufl.edu/eel6591.pdf)  
<http://www.iitg.ernet.in>

**Course Outcome:**

After Learning the course the students shall be able to:



Understand the history of mobile communication and cellular concept.

Design a mobile cellular network.

Understanding the concept of GSM and call procedure.

Propose a suitable multiple access techniques such as CDMA, and OFDM for spectral allocation.

Have in-depth understanding of the radio resource management techniques such as power control, channel allocation and handoffs.

Gain knowledge of underlying mobile standards and the future mobile technologies such as W-CDMA, Wi-Max, and also the upcoming 4G mobile standards

#### **List of Practical:**

1. To study GSM architecture & CDMA fundamentals
2. (a) Introduction to GSM trainer kit & observe AT command concerning modem and sim card hardware (b) To observe AT commands for message handling
3. a) To observe AT commands for phone book network registration (b) To study at commands for call setting control
4. Implement EARLANG B & EARLANG C formula in MATLAB
5. Write a Matlab Code for Free Space Propagation Model And Ground Reflection (Two-Ray) Model
6. Write a MATLAB program to observe the effect of AWGN, Rayleigh & Rician fading channel on transmitted signal.
7. Write a Matlab Code for Hata Model and plot the graph for path loss
8. Create a frequency-flat Rayleigh fading channel object in MATLAB. a. Uses it to process a DBPSK signal. b. Compare the BER of the system for different values of SNR c. Compare the empirical results with theoretical results and plot them
9. Implement CDMA 2000 physical Layer in MATLAB.
10. To implement Encryption algorithm A5 for GSM in MATLAB
11. To study network simulator-3
12. Implement wireless scenario in ns-3 & calculate throughput

#### **Open Ended Problems:**

Design Frequency Hopping Spread Spectrum (FHSS)

Project based on reception of local GSM broadcast channel

Design CDMA System with matlab code

Long Term Evolution (LTE) based project in ns-3

To understand the cellular frequency reuse concept in virtual lab. (vlab.co.in)

# PARUL UNIVERSITY - Faculty of Engineering and Technology

Department of Electronics & Communication Engineering

## SYLLABUS FOR 7th Sem BTech PROGRAMME

### Advance Microprocessor (03107430)

**Type of Course:** BTech

**Prerequisite:** Basic knowledge of Microprocessor and Microcontroller.

**Rationale:** This course is providing an opportunity to the students to become familiar with Advance processor like ARM7. The student will familiar with ARM microprocessor architecture, instruction and programming.

#### Teaching and Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/ Week	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
3	0	2	4	60	30	20	20	20	150

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

#### Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	<b>Advance Microprocessir:</b> Introduction Need of advance microprocessors, Difference between RISC and CISC, RISC Design philosophy, ARM Design Philosophy, History of ARM microprocessor, ARM processor family, Development of ARM architecture	10%	
2	<b>The ARM Architecture and Programmers Model:</b> <b>The ARM Architecture and Programmers Model</b> The Acorn RISC Machine, ARM Core data flow model, Architectural inheritance, The ARM7TDMI programmer's model: General purpose registers, CPSR, SPSR, ARM memory map, data format, load and store architecture, Core extensions, Architecture revisions, ARM development tools	20%	
3	<b>ARM Instruction set:</b> Data processing instructions, Arithmetic and logical instructions, Rotate and barrel shifter, Branch instructions, Load and store instructions, Software interrupt instructions, Program status register instructions, Conditional execution, Multiple register load and store instructions, Stack instructions, Thumb instruction set, advantage of thumb instructions, Assembler rules and directives, Assembly language programs for shifting of data, factorial calculation, swapping register contents, moving values between integer and floating point registers	25%	
4	<b>C Programming for ARM:</b> Overview of C compiler and optimization, Basic C data types, C Looping structures, Register allocations, function calls, pointer aliasing, structure arrangement, bit-fields, unaligned data and Endianness, Division, floating point, Inline functions and inline assembly, Portability issues. C programs for General purpose I/O, general purpose timer, PWM Modulator, UART, I2C Interface, SPI Interface, ADC, DAC.	30%	

5	<b>Other Concepts:</b> Advanced Microprocessor Bus Architecture (AMBA) Bus System, User peripherals, Exception handling in ARM, ARM optimization techniques	15%	
---	--	-----	--

**\*Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

**Reference Books:**

1. ARM System on Chip Architecture  
Steve Furber; Pearson Education; 2nd
2. ARM Assembly Language Programming & Architecture  
Muhammad Ali Mazidi; Kindle edition
3. Arm Assembly Language, Fundamentals and Techniques  
William Hohl, Christopher Hinds; CRC Press; 2nd edition
4. Arm System Developer's Guide, Designing and Optimizing Software  
Andrew N. Sloss, Dominic Symes, Chris Wright; Elsevier

**Course Outcome:**

After Learning the course the students shall be able to:

1. Become familiar with importance and applications of advance microprocessor
2. Understand architecture of ARM processor
3. Understand instruction set of ARM processor
4. Able to design assembly & C program for ARM microprocessor
5. Able to interface Peripheral devices with microprocessor.

**List of Practical:**

1. Download and Install of ARM Software.
2. Write Basic C Programs using ARM Software Tool.
3. Study ARM7 Processor Development Platform.
4. Exploring the GPIO port of ARM7 CPU target by blinking the LED connected to the GPIO.
5. Exploring the GPIO port of ARM7 CPU target by Interfacing Key connected to the GPIO.
6. Write a program to generate 1KHz frequency using the Timer peripheral and check the result using the CRO or Logic Analyzer.
7. Write a program to demonstrate the external interrupt using a switch and LED.
8. Demonstrate the working of the PLL setting and show the result using the LED.
9. Write a program to demonstrate PWM with 50% duty cycle.
10. Write a program to generate square wave using the on-chip DAC of the ARM7 CPU.
11. Write a program to demonstrate the working of the Watchdog Timer.
12. Write a program to demonstrate the data transmission using UART.
13. Write a driver routine for LCD and demonstrate its working using the ARM7 target board.
14. Write a driver routine for Matrix keyboard and demonstrate its working using the ARM7 target board.
15. Demonstrate the working of the on-chip RTC by writing a program to display the different parameters on the LCD.

# PARUL UNIVERSITY - Faculty of Engineering and Technology

Department of Electronics & Communication Engineering

SYLLABUS FOR 7th Sem BTech PROGRAMME

Digital Circuit Design with HDL (03107431)

**Type of Course:** BTech

**Prerequisite:** VLSI Design basics, Logic gates and flip-flops, Combinational and sequential Logic circuits

**Rationale:** This course is first step for UG students in the field of ASIC prototyping which is also called FPGA (Field programmable gate array) / SoC (System on Chip) prototyping. With large resource of configurable logic blocks FPGA is designed to be configured by designer using hardware description language for digital system design. This Course offers a variety of topics of immediate relevance to digital VLSI System Design.

**Teaching and Examination Scheme:**

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/ Week	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
3	0	2	4	60	30	20	20	20	150

**Lect** - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

**Contents:**

Sr.	Topic	Weightage	Teaching Hrs.
1	<b>Introduction:</b> ASIC Design flow, Design Methodologies, Hardware modeling issues, Overview of FPGA and CPLD technology	5%	4
2	<b>Hardware Description Language:</b> Elements of VHDL, Entity, architecture, configuration declaration. Identifiers, data types and operators, Assignment statement, Objects in VHDL – signals, variables, constants, files, Attributes of objects.	5%	4
3	<b>Behavioral modeling:</b> Process statement, Signal and variable assignment, Wait statement, if statement, Case statement, Loops, exit, and next statement, Assertion and report statement, Multiple process, Postponed process. Subprograms – procedures and functions, Subprogram overloading and operator overloading. RTL description	15%	6
4	<b>Dataflow modeling:</b> Concurrent signal assignment, sequential signal assignment, delta delay, multiple drivers, conditional signal assignment using when ... else, selected signal assignment using with select, block statement, concurrent assertion signal	15%	6

5	<b>Structural modeling:</b> Component declaration, generics and component instantiation, Example of making hierarchical circuit. Generate statement, aliases, mixed modeling style	15%	5
6	<b>Finite State Machine (FSM):</b> Stat diagrams and state tables, Moore and Mealy finite state machine, encoding style, FSM issues, Timing issues, pipelining, resource sharing, metastability, synchronization, MTBF Analysis, setup/hold time of various types of flip-flops, synchronization between multiple clock domains, reset recovery	15%	6
7	<b>Configuration and packages:</b> Configuration specification and declaration, conversion functions, direct instantiation, incremental binding. Package declaration, package body, design file	5%	3
8	<b>Test Benches and library:</b> File I/O operations, Test bench architecture, test bench examples, library declaration and user defined library	5%	3
9	<b>Programmable Logic Design:</b> Basics of Programmable logic devices - PROM, PAL, PLA, etc, CPLD architecture and its building blocks, FPGA architectures and its building blocks, Carry chains in FPGA, Dedicated multipliers and memory in FPGA, RTL synthesis test methodology, Design synthesis, Technology mapping for FPGAs: SRAM, Fuse, Antifuse, EPROM programming techniques. Design implementation using CPLD and FPGA, Floor planning, Placement and routing	20%	8

**\*Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

**Reference Books:**

1. VHDL Primer  
J. Bhasker; Pearson Education Asia
2. Principles of Digital Systems Design using VHDL  
Charles H Roth,; Cengage Learning
3. Circuit design with VHDL  
Pedroni V.A; PHI
4. VHDL programming by examples  
.Douglas L. Perry; Tata McGraw Hill; 4TH
5. Xilinx and Altera Application Notes on the architecture of FPGAs and CPLDs

**Course Outcome:**

After Learning the course the students shall be able to:

1. Design digital systems using hardware description languages required for VLSI Design such as VHDL.
2. The students shall learn how to program and test programs on FPGAs or CPLD.
3. The students shall get exposure to the Various Digital Design Issues, ASIC Technology and Design techniques.

**List of Practical:**

1. Introduction to VHDL Testbench.

2. Implement full adder and full subtractor(VHDL code with testbench)
3. Implementation of multiplexer (with testbench)
4. Implementation of demultiplexer. (with testbench)
5. Implementation of D – Flipflop and T- Flipflop (with testbench)
6. Implementation of 4-Bit Full Adder Using Structural Modeling Style.
7. Implementation of 4 bit shift registers using behavior modeling style.
8. Implementation of Encoder with testbench code.
9. Implementation of Decoder with testbench code.
10. Implementations of 4-bit Synchronous UP counter using JK FF.
11. Implementations of 4 bit parity checker.
12. Implementations of 4 bit parity generator.
13. Implementations of 4 bit comparator with testbench.
14. Implementations of 4 bit comparator with testbench.

# PARUL UNIVERSITY - Faculty of Engineering and Technology

Department of Electronics & Communication Engineering

SYLLABUS FOR 7th Sem BTech PROGRAMME

Power Electronics (03107432)

**Type of Course:** BTech

**Prerequisite:** Semiconductor Physics, Electronic Devices and Circuits, Electrical Machines.

**Rationale:** This course provides strong foundation for understanding and designing of domestic and industrial power electronics circuits/ equipment's. Students can understand the conversion of power from AC to variable DC, Fixed DC to Variable DC, DC to variable AC using power electronics circuits. This subject also helps in understanding the speed control of DC and AC drives and design of UPS and SMPS.

**Teaching and Examination Scheme:**

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/ Week	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
3	0	2	4	60	30	20	20	20	150

Lect - Lecture, Tut - Tutorial, Lab - Lab, T - Theory, P - Practical, CE - CE, T - Theory, P - Practical

**Contents:**

Sr.	Topic	Weightage	Teaching Hrs.
1	<b>Introduction to Power Semiconductor Devices:</b> Concept of Power Electronics, Applications of Power Electronics, Power Electronics Systems-Block Diagram, Types of Power Electronics Converters, Power Diode, Its V-I Characteristics & Reverse Recovery Characteristic, Types of Power Diodes, Freewheeling Action Using Diode, Terminal Characteristics of Thyristor, Switching Characteristics of Thyristor, Thyristor Gate Characteristics, Two Transistor Model of Thyristor, Thyristor Turn-On Methods, Thyristor Commutation Techniques, Thyristor Ratings, Thyristor Protection : Design of Snubber Circuit, Over Voltage Protection, Over Current Protection, Construction, Operation & Characteristics of Other Static Power Devices (Diac, Triac, BJT, MOSFET, GTOs, IGBT, UJT ).	25%	13
2	<b>Phase Controlled Rectifiers:</b> Principle of Phase Control, Single Phase Full Wave Controlled Converter, Three Phase Full Wave Controlled Converter, Dual Converters, Some Worked Examples.	15%	7
3	<b>Choppers:</b> Principle of Chopper Operation- Step Down, Control Strategies, Step-Up, Types of Chopper Circuit: Type-A, Type-B, Type-C, Type-D and Type-E Chopper, Steady State Time Domain Analysis, Voltage and Current Commutated Chopper.	15%	8
4	<b>Inverters:</b> Single Phase Inverter (Operational Principle and Steady State Analysis), Fourier Analysis of Single-Phase Inverter Output.	15%	7

5	<b>Electric Drives:</b> Concepts Of Electric Drives, D.C. Drives, Half Wave Converter, Semi Converter & Full Converter Drive, Single Phase Dual Converter Drives, Three Phase Half Wave Converter, Semi Converter & Full Converter Drive, Dual Converter Drives, Chopper Drive, Power Control & Regenerative- Braking Control, Two Quadrant Chopper Drive, Performance of Induction Motors, Stator Voltage Control, Stator Frequency Control & Stator Voltage & Frequency Control.	20%	7
6	<b>Applications:</b> SMPS, UPS, Switches, Relay.	10%	4

**\*Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

**Reference Books:**

1. Power Electronics (TextBook)  
Dr P.S. Bhimbra; Khanna and Khanna Publishers, New Dehli
2. Power electronics  
M D Singh and K B Khanchandani; Tata MacGraw Hill
3. Power Electronics - Circuits, Devices and Applications  
Muhammad H. Rashid; Prentice Hall of India
4. An Introduction To Thyristors And Their Applications  
Ramamoorthy M, 1991
5. "Power Electronics: Devices, Converters, Applications"  
V. Subrahmanyam; "NEW AGE INTERNATIONAL PUBLISHERS LTD.-NEW DELHI"
6. Modern Power Electronics  
by-P. C. Sen,; TATA MCGRAW HILL
7. Modern Power Electronics and AC Drives  
Bimal. K. Bose; Pearson Education

**Useful Links:**

<https://www.coursera.org/specializations/power-electronics>  
[https://en.wikibooks.org/wiki/Power\\_Electronics](https://en.wikibooks.org/wiki/Power_Electronics)  
[https://en.wikipedia.org/wiki/Power\\_electronics](https://en.wikipedia.org/wiki/Power_electronics)

**Course Outcome:**

After Learning the course the students shall be able to:

After learning the course the students will be able to:

1. Understand the power semiconductor devices
2. Design and analyze various SCR firing and commutation methods.
3. Explain the operation of phase controlled rectification.
4. Understand the design and operation of various industrial based power electronics circuits like inverters & choppers.
5. Designing and repairing of SMPS, UPS, battery charger and circuit breakers.

**List of Practical:**

1. To study, Perform & plot characteristics of Thyristor.
2. To study, Perform & plot characteristics of DIAC
3. To study, Perform & plot characteristics of TRIAC.
4. To perform Resistance and RC triggered circuits of SCRs.
5. To study, Perform & plot UJT as a relaxation oscillator.
6. To Perform the operation of single-phase half wave controlled rectifier using RC phase shift triggering.



7. To study, Perform & observe the waveform of single phase half converter with resistive load.
8. To study, Perform & observe the waveform of single phase full converter with resistive load.
9. To study, Perform & observe the waveform of step up choppers.
10. To study, Perform & observe the waveform of step down choppers.
11. To study, Perform & observe the waveforms of series inverters.
12. To study, Perform & observe the waveforms of parallel inverters.
13. To Perform operation of voltage commutated thyristor based DC Chopper.
14. To Simulate operation of Buck Converter.
15. To Simulate operation of Boost Converter.

**Open Ended Problems:**

The students can work in a group to design SCR triggering circuits, Single phase controlled rectifier, Fan regulator, series inverter, chopper, battery charger, SMPS and flasher circuits.