**NPTEL : Adv. Digital Signal Processing - Multirate and wavelets (Electronics and Communication Engineering)**

**Co-ordinators : Prof. V.M. Gadre**

**NPTEL : Advanced Optical Communication (Electronics and Communication Engineering)**

**Co-ordinators : Prof. R.K. Shevgaonkar**

**NPTEL : Advanced VLSI Design (Electronics and Communication Engineering)**

**Co-ordinators : Prof. A.N. Chandorkar, Prof. D.K. Sharma, Prof. Sachin Patkar, Prof. Virendra Singh**

**NPTEL : Broadband Networks: Concepts and Technology (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Abhay Karandikar**

Lecture 32 - Metro Ethernet Access Networks

**NPTEL : Digital Communication (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Bikash Kumar Dey**

Lecture 32 - Conclusion

**NPTEL : Information Theory and Coding (Electronics and Communication Engineering)**

**Co-ordinators : Prof. S.N. Merchant**

**NPTEL : Transmission Lines and EM Waves (Electronics and Communication Engineering)**

**Co-ordinators : Prof. R.K. Shevgaonkar**

**NPTEL : CMOS Analog VLSI Design (Electronics and Communication Engineering)**

**Co-ordinators : Prof. A.N. Chandorkar**

**NPTEL : Analog Circuits (Electronics and Communication Engineering)**

**Co-ordinators : Prof. A.N. Chandorkar**

**NPTEL : NOC:Microwave Integrated Circuits (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Jayanta Mukherjee**

**NPTEL : NOC:Foundations of Wavelets and Multirate Digital Signal Processing (Electronics and Communication Engineering)**

**Co-ordinators : Prof. V.M. Gadre**

**NPTEL : RF Integrated Circuits (Electronics and Communication Engineering)**

**Co-ordinators : Dr. Shouribrata Chatterjee**

**NPTEL : Communication Engineering (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Surendra Prasad**

**NPTEL : Digital Signal Processing (Electronics and Communication Engineering)**

**Co-ordinators : Prof. S.C. Dutta Roy**

**NPTEL : Wireless Communication (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Ranjan Bose**

**NPTEL : Basic Electronics (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Chitralekha Mahanta**

**NPTEL : NOC:VLSI Design Verification and Test (Electronics and Communication Engineering)**

**Co-ordinators : Dr. Santosh Biswas, Jatindra Kumar Deka, Prof.Arnab sarkar**

**NPTEL : NOC:Design of Power Electronic Converters (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Shabari Nath**

**NPTEL : NOC:Operation and Planning of Power Distribution Systems (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Sanjib Ganguly**

**NPTEL : NOC:Nanophotonics, Plasmonics, and Metamaterials (Electronics and Communication Engineering)**

**Co-ordinators : Dr. Debabrata Sikdar, Dr. Debabrata Sikdar**

**NPTEL : NOC:Power Electronics Applications in Power Systems (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Sanjib Ganguly**

**NPTEL : Signals and Systems (Electronics and Communication Engineering)**

**Co-ordinators : Prof. K.S. Venkatesh**

**NPTEL : Advanced 3G and 4G Wireless Mobile Communications (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Aditya K. Jagannatham**

**NPTEL : Digital Switching (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Yatindra N Singh**

**NPTEL : NOC:Principles of Modern CDMA-MIMO-OFDM Wireless Communications (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Aditya K. Jagannatham**

**NPTEL : NOC:Probability and Random Variables, Processes for Wireless Communications (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Aditya K. Jagannatham**

**NPTEL : NOC:Estimation for Wireless Communications, MIMO, OFDM Cellular and Sensor Networks (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Aditya K. Jagannatham**

**NPTEL : NOC:Error Control Coding - An Introduction to Convolutional Codes (Electronics and Communication Engineering)**

**Co-ordinators : Dr. Adrish Banerjee**

**NPTEL : NOC:Error Control Coding - An Introduction to Linear Block code (Electronics and Communication Engineering)**

**Co-ordinators : Dr. Adrish Banerjee**

**NPTEL : NOC:Bayesian, MMSE Estimation for Wireless Communications MIMO, OFDM Cellular and Sensor Networks (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Aditya K. Jagannatham**

**NPTEL : NOC:Optical communications (Electronics and Communication Engineering)**

**Co-ordinators : Dr. Pradeep Kumar K**

**NPTEL : NOC:Digital Switching-I (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Yatindra N Singh**

**NPTEL : NOC:An Introduction to Information Theory (Electronics and Communication Engineering)**

**Co-ordinators : Dr. Adrish Banerjee**

**NPTEL : NOC:5G Wireless Standard Design (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Rohit Budhiraja**

**NPTEL : Adaptive Signal Processing (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Mrityunjoy Chakraborty**

**NPTEL : Digital Computer Organization (Electronics and Communication Engineering)**

**Co-ordinators : Prof. P.K. Biswas**

**NPTEL : Digital Image Processing (Electronics and Communication Engineering)**

**Co-ordinators : Prof. P.K. Biswas**

**NPTEL : Digital Systems Design (Electronics and Communication Engineering)**

**Co-ordinators : Prof. D. Roychoudhury**

**NPTEL : Digital Voice and Picture Communication (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Somnath Sengupta**

**NPTEL : MEMS and Microsystems (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Santiram Kal**

Lecture 32 - MEMS for Biomedical Applications (Bio-MEMS)

**NPTEL : Neural Networks and Applications (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Somnath Sengupta**

**NPTEL : Probability and Random Processes (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Mrityunjoy Chakraborty**

**NPTEL : Pattern Recognition and Application (Electronics and Communication Engineering)**

**Co-ordinators : Prof. P.K. Biswas**

**NPTEL : NOC:Basic Tools of Microwave Engineering (Electronics and Communication Engineering)**

**Co-ordinators : Dr. Amitabha Bhattacharya**

**NPTEL : NOC:Basic Building Blocks of Microwave Engineering (Electronics and Communication Engineering)**

**Co-ordinators : Dr. Amitabha Bhattacharya**

**NPTEL : NOC:Satellite Communication Systems (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Kalyankumar Bandyopadhyay**

**NPTEL : NOC:Fundamentals of MIMO Wireless Communication (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Suvra Sekhar Das**

**NPTEL : NOC:Audio System Engineering (Electronics and Communication Engineering)**

**Co-ordinators : Prof. S. Dasmandal**

**NPTEL : NOC:Discrete Time Signal Processing (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Mrityunjoy Chakraborty**

**NPTEL : NOC:Digital Image Processing (Electronics and Communication Engineering)**

**Co-ordinators : Prof. P.K. Biswas**

**NPTEL : NOC:Spread Spectrum Communications and Jamming (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Debarati Sen**

**NPTEL : NOC:Digital VLSI Testing (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Santanu Chattopadhyay**

**NPTEL : NOC:Design Principles of RF and Microwave Filters and Amplifiers (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Amitabha Bhattacharya**

**NPTEL : NOC:Millimeter Wave Technology (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Mrinal Kanti Mandal**

**NPTEL : NOC:Power System Analysis (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Debapriya Das**

**NPTEL : NOC:Analog Communication (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Goutam Das**

Lecture 56 - Sampling Theorem

Lecture 57 - Sampling Theorem (Continued...)

Lecture 58 - FDM Vs TDM

Lecture 59 - Flat Top Vs Natural Sampling

Lecture 60 - Pulse Coded Modulation

**NPTEL : NOC:Modern Digital Communication Techniques (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Suvra Sekhar Das**

**NPTEL : NOC:Digital Speech Processing (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Shyamal Kumar Das Mandal**

**NPTEL : NOC:Analog Circuits and Systems through SPICE Simulation (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Mrigank Sharad**

**NPTEL : NOC:Communication Networks (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Goutam Das**

**NPTEL : NOC:Signal Processing Techniques and its Applications (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Shyamal Kumar Das Mandal**

**NPTEL : Analog IC Design (Electronics and Communication Engineering)**

**Co-ordinators : Dr. Nagendra Krishnapura**

**NPTEL : Coding Theory (Electronics and Communication Engineering)**

**Co-ordinators : Dr. Andrew Thangaraj**

**NPTEL : Semiconductor Device Modeling (Electronics and Communication Engineering)**

**Co-ordinators : Prof. S. Karmalkar**

**NPTEL : VLSI Data Conversion Circuits (Electronics and Communication Engineering)**

**Co-ordinators : Dr. Shanthi Pavan**

**NPTEL : Digital Circuits and Systems (Electronics and Communication Engineering)**

**Co-ordinators : Prof. S. Srinivasan**

**NPTEL : Electronics for Analog Signal Processing - I (Electronics and Communication Engineering)**

**Co-ordinators : Prof. K. Radhakrishna Rao**

**NPTEL : Electronics for Analog Signal Processing - II (Electronics and Communication Engineering)**

**Co-ordinators : Prof. K. Radhakrishna Rao**

**NPTEL : High Speed Devices and Circuits (Electronics and Communication Engineering)**

**Co-ordinators : Prof. K.N. Bhat**

**NPTEL : Solid State Devices (Electronics and Communication Engineering)**

**Co-ordinators : Prof. S. Karmalkar**

**NPTEL : VLSI Circuits (Electronics and Communication Engineering)**

**Co-ordinators : Prof. S. Srinivasan**

**NPTEL : VLSI Technology (Electronics and Communication Engineering)**

**Co-ordinators : Dr. Nandita Dasgupta**

**NPTEL : Basic Electrical Circuits (Electronics and Communication Engineering)**

**Co-ordinators : Dr. Nagendra Krishnapura**

**NPTEL : NOC:Basic Electrical Circuits (Electronics and Communication Engineering)**

**Co-ordinators : Dr. Nagendra Krishnapura**

**NPTEL : Advanced Logic Synthesis (Electronics and Communication Engineering)**

**Co-ordinators : Mr. Dhiraj Taneja**

**NPTEL : ARM Based Development (Electronics and Communication Engineering)**

**Co-ordinators : Mr. S. Chandramouleeswaran**

Lecture 1 - Types of computer Architectures, ISA's and ARM History

Lecture 2 - Embedded System Software and Hardware, stack implementation in ARM, Endianness, condition codes

Lecture 3 - Processor core VS CPU core, ARM7TDMI Interface signals, Memory Interface, Bus Cycle types, Register set, Operational Modes

Lecture 4 - Instruction Format, ARM Core Data Flow Model, ARM 3 stage Pipeline, ARM family attribute comparision

Lecture 5 - ARM 5 stage Pipeline, Pipeline Hazards, Data forwarding - a hardware solution

Lecture 6 - ARM ISA and Processor Variants, Different Types of Instructions, ARM Instruction set, data processing instructions

Lecture 7 - Shift Operations, shift Operations using RS lower byte, Immediate value encoding

Lecture 8 - Dataprocessing Instructions

Lecture 9 - Addressing Mode-1, Addressing Mode-2

Lecture 10 - Addressing Mode-2, LDR/STR, Addressing mode-3 with examples

Lecture 11 - Instruction Timing, Addressing Mode-4 with Examples

Lecture 12 - Swap Instructions, Swap Register related Instructions, Loading Constants

Lecture 13 - Program Control Flow, Control Flow Instructions, B & BL instructions, BX instruction

Lecture 14 - Interrupts and Exceptions, Exception Handlers, Reset Handling

Lecture 15 - Aborts, software Interrupt Instruction, undefined instruction exception

Lecture 16 - Interrupt Latency, Multiply Instructions, Instruction set examples

Lecture 17 - Thumb state, Thumb Programmers model, Thumb Implementation, Thumb Applications

Lecture 18 - Thumb Instructions, Interrupt processing

Lecture 19 - Interrupt Handelling schemes, Examples of Interrupt Handlers

Lecture 20 - Coprocessors

Lecture 21 - Coprocessor Instructions, data Processing Instruction, data transfers, register transfers

Lecture 22 - Number representations, floating point representation

Lecture 23 - Flynn's Taxonomy, SIMD and Vector Processors, Vector Floating Point Processor (VFP), VFP and ARM interactions, An example vector operation

Lecture 24 - Memory Technologies, Need for memory Hierarchy, Hierarchical Memory Organization, Virtual Memory

Lecture 25 - Cache Memory, Mapping Functions

Lecture 26 - Cache Design, Unified or split cache, multiple level of caches, ARM cache features, coprocessor 15 for system control

Lecture 27 - Processes, Memory Map, Protected Systems, ARM systems with MPU, memory Protection Unit (MPU)

Lecture 28 - Physical Vs Virtual Memory, Paging, Segmentation

Lecture 29 - MMU Advantage, virtual memory translation, Multitasking with MMU, MMU organization, Tightly coupled Memory (TCM)

Lecture 30 - ARM Development Environment, Arm Procedure Call Standard (APCS),

Lecture 31 - Example C program

Lecture 32 - Embedded software Development, Image structure, linker inputs and outputs, memory map, application startup

Lecture 33 - AMBA Overview, Typical AMAB Based Microcontroller, AHB bus features, AHB Bus transfers, APB bus transfers, APB bridge

Lecture 34 - DMA, Peripherals, Programming Peripherals in ARM

Lecture 35 - DMA:Direct Memory Access

Lecture 36 - Protocols (I2c, SPI), UART, GPIO

Lecture 37 - ARM ISAs, ARMv5, ARMv6, ARM v7, big.little technology, ARMv8

**NPTEL : Embedded Software Testing (Electronics and Communication Engineering)**

**Co-ordinators : Mr. Madhukeshwara H.M**

**NPTEL : Linux Programming and Scripting (Electronics and Communication Engineering)**

**Co-ordinators : Mr. Anand Iyer**

**NPTEL : NOC:Digital Circuits and Systems (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Shankar Balachandran**

**NPTEL : NOC:Networks and Systems (Electronics and Communication Engineering)**

**Co-ordinators : Prof. V.G.K. Murti, Mr. C. S. Ramalingam, Dr. Andrew Thangaraj**

**NPTEL : NOC:Circuit Analysis for Analog Designers (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Shanthi Pavan**

**NPTEL : NOC:Design and Analysis of VLSI Subsystems (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Madhav Rao**

**NPTEL : NOC:Nonlinear Dynamical Systems and Control (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Sanjay Bhat, Prof. Vijaysekhar Chellaboina**

**NPTEL : NOC:Digital Protection of Power System (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Bhaveshkumar R. Bhalja**

**NPTEL : NOC:Physics of Nanoscale Devices (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Vishvendra Singh Poonia**

**NPTEL : NOC:Low Voltage CMOS Circuit Operation (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Anand Bulusu**

**NPTEL : Circuits for Analog System Design (Electronics and Communication Engineering)**

**Co-ordinators : Prof. M.K. Gunasekaran**

**NPTEL : Digital System design with PLDs and FPGAs (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Kuruvilla Varghese**

**NPTEL : Error Correcting Codes (Electronics and Communication Engineering)**

**Co-ordinators : Prof. P. Vijay Kumar**

**NPTEL : Nanoelectronics: Devices and Materials (Electronics and Communication Engineering)**

**Co-ordinators : Dr. Navakanta Bhat, Prof. K.N. Bhat, Dr. S.A. Shivashankar**

**NPTEL : Pattern Recognition (Electronics and Communication Engineering)**

**Co-ordinators : Prof. P.S. Sastry**

**NPTEL : Analog Circuits and Systems 1 (Electronics and Communication Engineering)**

**Co-ordinators : Prof. K. Radhakrishna Rao**

**NPTEL : NOC:Design and Simulation of DC-DC converters using Open Source Tools (Electronics and Communication Engineering)**

**Co-ordinators : Prof. L. Umanand**

**NPTEL : NOC:Enclosure Design of Electronics Equipment (Electronics and Communication Engineering)**

**Co-ordinators : Prof. N. V Chalapathi Rao**

**NPTEL : NOC:Design of Photovoltaic Systems (Electronics and Communication Engineering)**

**Co-ordinators : Prof. L. Umanand**

Lecture 56 - Input impedance of DC-DC converters - Boost converter

Lecture 57 - Input impedance of DC-DC converters - Buck converter

Lecture 58 - Input impedance of DC-DC converters - Buck-Boost converter

Lecture 59 - Input impedance of DC-DC converters - PV module in SPICE

Lecture 60 - Input impedance of DC-DC converters -Simulation - PV and DC-DC interface

Lecture 61 - Impedance control methods

Lecture 62 - Impedance control methods- Reference cell - voltage scaling

Lecture 63 - Impedance control methods- Reference cell - current scaling

Lecture 64 - Impedance control methods- Reference cell - Sampling method

**NPTEL : NOC:Photonic Integrated Circuits (Electronics and Communication Engineering)**

**Co-ordinators : Dr. Srinivas Talabatulla**

**NPTEL : NOC:Neural Science for Engineers (Electronics and Communication Engineering)**

**Co-ordinators : Prof. Vikas V**

**NPTEL : NOC:Analog Circuits and Systems (Electronics and Communication Engineering)**

**Co-ordinators : Prof. K Radhakrishna Rao**