Specialization: Minor Degree (Electronics and Telecommunication)					
SWAYAM/NPTEL Course List					
Sr. No.	**Sem**	**Name of Course**	**Duration**	**Instructor**	**Organizing Institute**
1	V	Analog Electronic Circuit	12 Weeks	Prof. Shouribrata Chatterjee	IITD
2	V	Analog communication	12 Weeks	Prof. Goutam Das	IIT KGP
3	VI	Microprocessors And Microcontrollers	12 Weeks	Prof. Santanu Chattopadhyay	IIT KGP
4	VI	Embedded Systems Design	12 Weeks	Prof. Anupam Basu	IIT KGP
5	VII	Control engineering	12 Weeks	Prof. Ramkrishna.P	IITM

Note:

1) **Minimum 8 to 12 week course is required to allot 4 credits for the course.**
2) **Structure should be uniform, across all branches.**

Syllabus

1. Analog Electronic Circuit

Week	Contents
Week 1	Non-linear circuit analysis, diodes, load line concepts, introduction to the MOSFET
Week 2	DC operating point, biasing the MOSFET, small signal model of the MOSFET, small signal analysis
Week 3	Thevenin and Norton models, common source, common gate, common drain Circuits
Week 4	Source degenerated common source amplifier, cascode and cascaded circuits
Week 5	Current sources and current mirrors, biasing with current sources, constant gm circuits
Week 6	Differential amplifiers, common mode and differential mode gains, CMRR, structure of a complete amplifier
Week 7	Folded cascode differential amplifier, self-biased active-load differential Amplifier
Week 8	Feedback: examples of feedback amplifiers, current and voltage sensing, current and voltage feedback; op-amps and op-amp circuits
Week 9	High frequency model of the MOSFET, revision of common-gate, common-source, common-drain circuits; poles and zeros in the transfer function
Week 10	Poles and zeros of cascode amplifier, Miller theorem, phase margin, unity gain bandwidth, compensation of the cascaded amplifier
Week 11	Voltage regulators, LDOs, stability of regulators, power supply rejection, bandwidth
Week 12	Power amplifiers, audio power amplifier, class-A/class-AB/class-B/class-C; push-pull class-AB power amplifier

2. Analog Communication

Week	Contents
Week 1	Introduction to Fourier Series and Fourier Transform (4 hours)
Week 2	Energy and Power Spectral Densities (3 hours)
Week 3	Modulation Theory (2 hours)
Week 4	Amplitude Modulation – AM and DSB-SC (3 hours)
Week 5	SSB-SC and VSB (3 hours)
Week 6	Angle Modulation – FM, PM (3 hours)
Week 7	Sampling Theorem (2 hours)
Week 8	Pulse Modulation and PCM (2 Hours)
Week 9	Introduction to Random Process (2 Hours)
Week 10	Spectral Analysis of Random Process (2 Hours)
Week 11	Characteristics of Band-pass noise (2 Hours)
Week 12	Performance Analysis of AM, DSB-SC with Noise (2 Hours)

3. Microprocessors And Microcontrollers

Week	Contents
Week 1	Introduction: General processor architecture, Microprocessors, Microcontrollers
Week 2	8085: Part I
Week 3	8085: Part II
Week 4	8085: Part III
Week 5	8085: Part IV
Week 6	8051: Part I
Week 7	8051: Part II
Week 8	PIC, AVR
Week 9	ARM: Part I
Week 10	ARM: Part II
Week 11	Interfacing examples: Part I
Week 12	Interfacing examples: Part II

4. Embedded Systems Design

Week	Contents
Week 1	Introduction to Embedded System, ASICs and ASIP
Week 2	Designing Single Purpose Processors and Optimization
Week 3	Introduction to FPGAs and Synthesis
Week 4	Verilog Hardware Description Language (Verilog HDL)
Week 5	Microcontrollers and Power Aware Embedded System Design
Week 6	Real Time Operating System
Week 7	Real Time Scheduling Algorithms

Week 8	Modelling and Specification
Week 9	Design Synthesis
Week 10	Digital Camera Design and Hardware Software Partitioning
Week 11	Design Optimization
Week 12	Simulation and Verification

5. Control Engineering

Week	Contents
Week 1	Introduction to Control, Classification of Dynamic Systems, Closed Loop Control System with Feedback, Mathematical Preliminaries – Complex Variables, Laplace Transform.
Week 2	Standard Inputs, Free and Forced Response, Transfer Function, Poles and Zeros.
Week 3	Response to various Inputs, Effect of Poles, Notion of Bounded Input Bounded Output (BIBO) stability
Week 4	Effect of Zeros, Closed Loop Transfer Function, Dynamic Performance Specification, First Order Systems.
Week 5	Second Order Systems, Unit Step Response of Underdamped Second Order Systems, Concepts of Rise Time, Peak Time, Maximum Peak Overshoot and Settling Time.
Week 6	Controllers – Proportional (P), Integral (I) and Derivative (D) Blocks, Examples of PID controller design.
Week 7	Routh's Stability Criterion, Use in Control Design, Incorporation of Performance Specifications in Controller Design, Analysis of Steady State Errors.
Week 8	Root Locus and its Application in Control Design.
Week 9	Frequency Response, Bode Plots, Nyquist Plots.
Week 10	Nyquist Stability Criterion, Relative Stability – Gain and Phase Margins.
Week 11	Control System Design via Frequency Response – Lead, Lag and Lag-Lead Compensation.
Week 12	Case Studies.