Semester III (ECE)

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs./wk.	Marks		Credits
							Internal	External	
1	BTAM-18302	Mathematics-III	3	1	0	4	40	60	4
2	BTEC-18301	Electronic Devices	3	0	0	3	40	60	3
3	BTEC-18302	Digital System Design	3	0	0	3	40	60	3
4	BTEC-18303	Network Theory	3	1	0	4	40	60	4
5	BTCS-18303	Object Oriented Programming Language	3	0	0	3	40	60	3
6	BTEC-18305	Electronics Devices Lab	0	0	2	2	30	20	1
7	BTEC-18306	Digital System Design Lab	0	0	2	2	30	20	1
8	BTCS-18306	Object Oriented Programming Language Lab	0	0	2	2	30	20	1
9	BTEC-18307	Institutional Practical Training					60	40	1
10	ECMC-1	Constitution of India/Essence of Indian Traditional Knowledge	-	-	-	-			0
							350	**400**	**21**

Semester IV (ECE)

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs./wk.	Marks		Credits
							Internal	External	
1	BTEC-18401	Analog Communication	3	0	0	3	40	60	3
2	BTEC-18402	Analog Circuits	3	0	0	3	40	60	3
3	BTEC-18403	Microprocessor & Microcontroller	3	1	0	4	40	60	4
4	BTEC-18404	Electromagnetic Waves	3	0	0	3	40	60	3
5	BTEC-18405	Signals and Systems	3	0	0	3	40	60	3
6	BTEC-18406	Analog Communication Lab	0	0	2	2	30	20	1
7	BTEC-18407	Analog Circuits Lab	0	0	2	2	30	20	1
8	BTEC-18408	Microprocessor & Microcontroller Lab	0	0	2	2	30	20	1
							290	**360**	**19**

Semester V (ECE)

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs./wk.	Marks		Credits
							Internal	External	
1	BTEC-18501	Digital Communication	3	0	0	3	40	60	3
2	BTEC-18502	Digital Signal Processing	3	0	0	3	40	60	3
3	BTEC-18503	Control Systems	3	0	0	3	40	60	3
4	BTEC-18504	Computer Architecture	3	0	0	3	40	60	3
5	BTEC-189XX	Department Elective – 1	3	0	0	3	40	60	3
6	BTXX-18XXX	OE-1	3	0	0	3	40	60	3
7	BTEC-18505	Digital Communication Lab	0	0	2	2	30	20	1
8	BTEC-18506	Digital Signal Processing Lab	0	0	2	2	30	20	1
9	BTEC-18507	Institutional /Industrial Training					60	40	1
							360	**380**	**21**

Semester VI (ECE)

Sr. No.	Course Code	Course Title	L	T	P	Contact hrs. /wk.	Marks		Credits
							Internal	External	
1	BTEC-18601	Electronic Measurement & Instruments	3	0	0	3	40	60	3
2	BTEC-18602	Computer Networks	3	0	0	3	40	60	3
3	BTEC-189XX	Department Elective – 2	3	0	0	3	40	60	3
4	BTHS-18906	Economics for Engineers	3	0	0	3	40	60	3
5	BTXX-18XXX	OE-2	3	0	0	3	40	60	3
6	BTEC-18603	Computer Networks Lab	0	0	2	2	30	20	1
7	BTEC-18604	Electronic Measurement Lab	0	0	2	2	30	20	1
8	BTEC-18605	Mini Project/Electronic Design workshop	0	0	4	4	30	20	2
							290	**360**	**19**

Semester VII (ECE)

Sr. No.	Course Code	Course Title	L	T	P	Contact hrs /week	Marks		Credits
							Internal	External	
1	BTEC-189XX	Department Elective -3	3	0	0	3	40	60	3
2	BTEC-189XX	Department Elective -4	3	0	0	3	40	60	3
3	BTEC-189XX	Department Elective -5	3	0	0	3	40	60	3
4	BTXX-18XXX	OE -3	3	0	0	3	40	60	3
5	BTHS-18905	Effective Technical Communication	3	0	0	3	40	60	3
6	BTEC-18702	Project Stage-I	0	0	10	10	40	20	5
7	BTEC-18703	Industrial Training					60	40	1
		TOTAL CREDITS					**300**	**360**	**21**

Semester VIII (ECE)

Sr. No.	Course Code	Course Title	L	T	P	Contact hrs /week	Marks		Credits
							Internal	External	
1	BTEC-189XX	Department Elective -6	3	0	0	3	40	60	3
2	BTEC-189XX	Department Elective -7	3	0	0	3	40	60	3
3	BTEC-189XX	Department Elective -8	3	0	0	3	40	60	3
4	BTXX-18XXX	OE -4	3	0	0	3	40	60	3
5	BTEC-18801	Project Stage-II	0	0	18	18	100	50	9
							260	**290**	**21**

Department Elective Courses Sem 5

Sr. No.	Course Code	Course Title
1	BTEC-18901	Scientific computing
2	BTEC-18902	Advanced Microprocessors and Microcontroller
3	BTEC-18903	Introduction to MEMS

Department Elective Courses Sem 6

1	BTEC-18904	Antennas and Propagation
2	BTEC-18905	Information Theory and Coding
3	BTEC-18906	Power Electronics

Department Elective Courses Sem 7

1	BTEC-18907	Microwave Theory and Techniques
2	BTEC-18908	Mobile Communication and Networks
3	BTEC-18909	Speech and Audio Processing
4	BTEC-18910	Error correcting codes
5	BTEC-18911	Adaptive Signal Processing
6	BTEC-18912	Fiber Optic Communication
7	BTEC-18913	Bio-Medical Electronics
8	BTEC-18914	CMOS Design

Department Elective Courses Sem 8

1	BTEC-18915	Wireless Sensor Networks
2	BTEC-18916	Embedded Systems
3	BTEC-18917	Satellite Communication
4	BTEC-18918	Digital Image & Video Processing
5	BTEC-18919	Mixed Signal Design
6	BTEC-18920	Nano Electronics
7	BTEC-18921	High Speed Electronics
8	BTEC-18922	Wavelets

Open Electives

Open Elective-1 (OE-1)

Sr. No.	Course Code	Course Title
1	BTEC-18951	Analog Communication
2	BTEC-18952	Electronics Measurements And Instrumentation
3	BTEC-18953	Analog Circuits

Open Elective-2 (OE-2)

Sr. No.	Course Code	Course Title
1	BTEC-18961	Digital Signal Processing
2	BTEC-18962	Digital System Design using VHDL
3	BTEC-18963	Control Systems

Open Elective-3 (OE-3)

Sr. No.	Course Code	Course Title
1	BTEC-18971	Power Electronics
2	BTEC-18972	Satellite Communication
3	BTEC-18973	Microcontrollers

Open Elective-4 (OE-4)

Sr. No.	Course Code	Course Title
1	BTEC-18981	Fiber Optic Communication
2	BTEC-18982	Computer Networks
3	BTEC-18983	Mobile Communication

BTAM18302 Mathematics-III

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**1**	**0**
Total Marks	:	100			

Fourier Series:
Periodic functions, Euler's formula. Even and odd functions, half range expansions, Fourier series of different wave forms. (6)

Laplace Transforms:
Laplace transforms of various standard functions, properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function, periodic functions, applications to solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equation. (8)

Partial Differential Equations:
Formation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients, Solution by the method of separation of variables. (8)

Linear Systems and Eigen- Values:
Gauss–elimination method, Gauss- Jordan method, Gauss- Seidel iteration method, Rayleigh's Power method for Eigen values and Eigenvectors. (8)

Solution of Initial value Problems
Solution of initial value problems: using Euler's Method, Modified Euler's Method and Runge Kutta Method of fourth order. (6)

Books Recommended:

1. Higher Engineering Mathematics - by Dr. B.S. Grewal; Khanna Publishers.
2. Ian N. Sneedon, Elements of Partial Differential Equations, McGraw- Hill, Singapore, 1957.
3. Peter. V. O'Nil, Advanced Engineering Mathematics, Wadsworth Publishing Company.
4. Babu Ram, Advance Engineering Mathematics, Pearson Education.
5. Bindra, J. S., Applied Mathematics, Volume-III, Kataria Publications.
6. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons

BTEC18301 Electronic Devices

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Introduction to Semiconductor Physics:
Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams. Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance, design of resistors (6)

Semiconductor Diode:
Generation and recombination of carriers, P-N junction diodes, I-V characteristics of diodes and small signal switching models; Avalanche breakdown, Zener diode, Schottky diode (6)

Bipolar Junction Transistor (BJT):
Construction, Principle of Operation, Ebers-Moll Model, Transistor current components, Transistor as a switch and as an Amplifier, Common Emitter, Common Base and Common Collector configurations and I-V Characteristics, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Emitter Feedback Bias, Collector to Emitter feedback bias, Voltage divider bias, Bias stability, Stabilization against variations in VBE and β, Bias Compensation using Diodes and Transistors. (8)

Field Effect Transistor (FET):
Construction, Principle of Operation, Pinch-Off Voltage, Volt-Ampere Characteristic, Comparison of BJT and FET (4)

Metal Oxide Semiconductor Field Effect Transistor (MOSFET):
Different types of MOSFET's, Working operation and V-I Characteristics of different types of MOSFET's, MOS capacitor, small signal models of MOS transistor, LED, photodiode and solar cell. (6)

Integrated Circuit Fabrication Process:
Oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process. (6)

Text /Reference Books:

1. G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson,2014.

2. Milliman, J. and Halkias, C.C., Electronic Devices and Circuits, Tata McGraw Hill,2007
3. D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education
4. S. M. Sze and K. N. Kwok, "Physics of Semiconductor Devices," 3rd edition, John Wiley &Sons, 2006.
5. C.T. Sah, "Fundamentals of solid state electronics," World Scientific Publishing Co. Inc, 1991.
6. Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford Univ.Press, 2011.

BTEC-18302 Digital System Design

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion. (8)

MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU. (5)

Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation (7)

Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices like FPGA. Logic implementation using Programmable Devices. (5)

VLSI Design flow: Design entry: Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation (12)

VHDL constructs and codes for combinational and sequential circuits. (3)

Text/Reference Books:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition, 2002.
3. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition , 2006
4. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989
5. Charles Roth, "Digital System Design using VHDL", Tata McGraw Hill 2nd edition 2012.

BTEC-18303 Network Theory

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**1**	**0**
Total Marks	:	100			

Introduction to various signals: Step, Ramp, Impulse. Node and Mesh Analysis, matrix approach of network containing voltage and current sources, and reactances, source transformation and duality. (6)

Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC. circuits. Steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation. Behaviors of series and parallel resonant circuits. (12)

Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions. (4)

Transient behavior, concept of complex frequency, Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem and Two port network and interconnections. (10)

Introduction to band pass, low pass, high pass and band reject filters. (4)

Text/Reference Books

1. Van, Valkenburg.; "Network analysis"; Prentice hall of India, 2000
2. Sudhakar, A., Shyammohan, 8S. P.; "Circuits and Network'; Tata McGraw-Hill New Delhi, 1994
3. A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education
4. Abhijit Chakrabarti, "Circuit Theory: Analysis & Synthesis" , Edition: 6 ,Publisher: S.Chand, Dhanpat Rai Publishing Co Pvt Ltd

BTCS-18303 Object Oriented Programming Language

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Introduction
What is object oriented programming? Procedural Vs. Object-Oriented Programming , Basic Concepts and Principles of OOP.

C++ Programming basics
Overview of C++, Program Structure, Exploring the Basic Components of C++ , Type Casting in C++, Operators in C++, Control Structures

Functions
Explore Functions , Describing Call by Value and Call by Reference , Inline Function, Overloading of Functions, String Library Functions, Recursive Functions, Friend Function.

Objects and Classes
Basics of Object and Class, Private and Public Members, Member Functions, Scope Resolution Operator, Constructors and their types, Destructors, Passing Objects as Function Parameters, Returning Objects from Functions.

Inheritance
Concept of inheritance, Derived class and base class, Types of Inheritance, Ambiguity and solution while implementing Multiple Inheritance.

Polymorphism
Concept of Polymorphism, Types of polymorphism, Function Overloading, Operator Overloading, Function Overriding.

Memory Management
Introduction to Pointers, Pointers and Objects, Dynamic Memory Management using new and delete operators, The this Pointer, pointer to object.

Templates and Exception Handling
Concept of Generic Programming, Function Template, Class Template, Exception handling mechanism, use of try, catch and throw keywords

Streams and Files
File Stream Operations, Opening and Closing a File, File Modes, File Pointers, Input Output Operations, Reading/Writing an object into file.

The concepts should be practiced using C++.

Suggested books

1. Lafore R., Object Oriented Programming in C++, Waite Group
2. E. Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill

BTEC18305 Electronic Devices Lab

Internal Marks	:	30	**L**	**T**	**P**
External Marks	:	20	**0**	**0**	**2**
Total Marks	:	50			

Note: The teacher can introduce any new experiment as per the requirements of syllabus.

List of Experiments

1. To familiarize with the various electronic component and multimeter.
2. To familiarize with the CRO, DSO and signal generator.
3. To study the operation of half wave rectifier.
4. To study full wave & bridge rectifiers and calculate efficiency and ripple factor.
5. To study simple capacitive, T & π filters.
6. To observe the application of Zener diode as voltage regulator.
7. To implement any one application of photodiode.
8. To study the characteristics of a solar cell.
9. To study the action of a transistor as an electronic switch.
10. To plot the input and output characteristics of CE configuration.
11. To plot the input and output characteristics of CB configuration.
12. To plot JFET characteristics in CS configuration.

BTEC-18306 Digital System Design Lab

Internal Marks	:	30	**L**	**T**	**P**
External Marks	:	20	**0**	**0**	**2**
Total Marks	:	50			

Note: The Lab teacher may introduce new experiments as per the requirements of the course using VHDL.

List of Experiments:

1. Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates.
2. Realization of OR, AND, NOT and XOR functions using universal gates.
3. Realization of half adder / full Adder using logic gates.
4. Realization of half Subtractor / full Subtractor using logic gates.
5. Design a 4-bit binary-to-gray & gray-to-binary code converter.
6. Design of basic gates: And, OR, NOT and Universal gates.
7. Design of half-Adder, full Adder, half Subtractor, full Subtractor.
8. Design of 3:8 Decoder.
9. Design of 8:3 Priority Encoder.
10. Design of 4-bit Binary to Gray Code Converter.
11. Design of 4-bit Binary to BCD Converter using Sequential statement.
12. Design an 8-bit Parity Generator (with for loop and Generic statements).
13. Design of all type of Flip-Flops using (if-then-else) Sequential constructs.
14. Design of Synchronous 8-bit Johnson Counter.
15. Design of Synchronous 8-bit Universal Shift Register (PIPO).
16. Design MOD Counters (MOD 3, MOD 5, MOD 8, and MOD 16).
17. Design of ALU.
18. Design of Mealy and Moore FSM.

BTCS-18306, Object Oriented Programming Language Lab

Internal Marks	:	30	**L**	**T**	**P**
External Marks	:	20	**0**	**0**	**2**
Total Marks	:	50			

1. Introduction to OOP lab (Simple C++ program)
2. WAP to demonstrate the use of Classes and Objects
3. Constructors and Destructors; Write a program to demonstrate different types of constructors and destructors.
4. Operator overloading; Write a program for overloading various unary operators
5. Write a program for overloading various binary operators
6. Memory Management; Write a program to demonstrate the use of new and delete keywords
7. Inheritance; Write a program to demonstrate different types of inheritance
8. Write a program to remove ambiguity from hybrid inheritance
9. Polymorphism; Write a program for polymorphism(virtual function)
10. Write a program for templates (class and function template)
11. File handling; Write a program to copy contents of one file to another file.
12. Program using streams

BTEC-18401 Analog Communication

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Base Band Signals and Systems:
Introduction, Elements of communication system, Noise, types of noise and characteristics; Noise Figure & noise factor, Noise equivalent temperature. Modulation & Demodulation, Mixing; Linear & Nonlinear, need of modulation, types of modulation systems, basic transmission signals, Frequency multiplexing technique. (3)

Analog Modulation Techniques:
Introduction, theory of amplitude modulation; AM power calculations, AM current calculations, AM modulation with a complex wave, theory of frequency modulation; mathematical analysis of FM, spectra of FM signals, narrow band of FM, Wide band FM, Theory of phase modulation, phase modulation obtained from frequency modulation, comparison of AM & FM, Comparison of PM & FM. (4)

AM Transmission & Reception:
Introduction, generation of Amplitude Modulation, Low level and high level modulation, basic principle of AM generation; square law modulation, Amplitude modulation in amplifier circuits, suppressed carrier AM generation (Balanced Modulator) ring Modulator, Product Modulator/balanced Modulator.
Receiver Parameters; Selectivity, Sensitivity, Fidelity, Tuned Ratio Frequency (TRF) Receiver, Super heterodyne Receiver; Basic elements of AM super heterodyne Receiver; RF Amplifiers, Image Frequency Rejection, Tracking & Alignment, IF Amplifier, AM detector; square law detector, Envelope or Diode detector, AM detector with AGC, Distortion in diode detectors, AM detector Circuit using Transistor, Double hetro -dyne receiver, AM receiver using a phase locked loop (PLL), AM receiver characteristics. (10)

FM Transmission & Reception:
FM allocation standards, generation of FM by direct method, varactor diode Modulator, Cross by Direct FM Transmitter, Phase-Locked-Loop Direct FM Transmitter, Indirect generation of FM; Armstrong method, RC phase shift method, Frequency stabilized reactance FM transmitter.
Frequency demodulators, Tuned circuit frequency discriminators; Slope Detector, Balance Slope Detector, Foster Seeley discriminator, Ratio Detector, FM detection using PLL, Zero crossing detector as a Frequency Demodulator, quadrature FM demodulator, pre emphasis and de-emphasis, limiter circuits, FM Capture effect, FM receiver, FM stereo transmission and reception, Two way FM Radio Transmitter and Receiver. (8)

SSB Transmission & Reception:

Introduction, Single Side band systems, AM-SSB; Full carrier, Suppressed carrier , reduced carrier, Independent side band, and Vestigial side band, Comparison of SSB Transmission to conventional AM, Generation of SSB; Filter method, Phase Shift Method, Third Method.

SSB Product Demodulator, Balanced Modulator as SSB Demodulator, Single Side band receivers; Single side band BFO Receivers, Coherent Single side band BFO Receivers, Single Side band Envelop detection receiver, (7)

Pulse Modulation Transmissions and Reception:

Introduction, Sampling Theorem, Pulse Amplitude Modulation (PAM), Natural PAM Frequency Spectra for PAM , Flat-top PAM, Sample and hold circuits, Time division Multiplexing, PAM Modulator Circuit, Demodulation of PAM Signals, Pulse Width Modulation(PWM) and Demodulation, Pulse Position Modulation (PPM) and Demodulation. (4)

Suggested / Recommended Books:

1. Electronic communication Systems by Kennedy & Davis, Tata Mcgraw Hill.
2. Analog Communication Systems by Manoj Kumar &Manisha, SatyaPrakashan, New Delhi, 2nd Edition.
3. Electronic Communication System, Tomasi, Pearson Education.
4. Electronic Communication, Roddy, Pearson Education.
5. Analog Communication Systems by SymonHykens, John Wiley &Sons .
6. Principles of Communication System, Taub& Schilling, Tata Mc-Graw Hill.

BTEC-18402 Analog circuits

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Diode Circuits, Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. (5)

Single stage and multistage amplifiers, cascode amplifier. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues. (4)

Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., concept of stability, gain margin and phase margin. (4)

Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators(phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators. Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load. (6)

Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR. OP-AMP design: design of differential amplifier for a given specification, design of gain stages and output stages, compensation. (5)

OP-AMP applications: review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications. Active filters: Low pass, high pass, band pass and band stop, design guidelines. (6)

Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc. Analog-to-digital converters (ADC): Single slope, dual slope, successive approximation, flash etc. (6)

Text/Reference Books:

1. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
2. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
3. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.
4. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, Edition IV.
5. Paul R. Gray and Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition.
6. Ramakant A Gayakwad Op-Amps and Linear Integrated Circuits, 4th Edition

BTEC-18403 Microprocessor and Microcontroller

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

History and Evolution of Microprocessors, Architecture Philosophy, 8085 Microprocessor, Memory Interfacing, Memory Mapped I/O and Peripheral Mapped I/O 8085 Microprocessor Programming Model. Introduction to 8085 Instructions, Programming Techniques, Time Delays, Stack and Subroutines, Interrupts. (12)

8051 Microcontroller Comparison of Microprocessor and Microcontroller, Microcontroller and Embedded Processors, Architecture and Pin Configuration of 8051. (7)

8051 Assembly Language Programming Introduction to 8051, 8051 Flag bits and PSW Register, Assembly Programming, Register Banks and Stack, Jump Loop and Call Instructions, I/O Port Programming, Addressing Modes and Accessing Memory using various Addressing Modes, Arithmetic Instructions and Programs, Logic Instructions and Programs, Single Bit Instructions and Programming, Timer/Counter Programming and Interrupts in 8051. (11)

Serial Communication 8051 connection to RS-232, 8051 Serial Communication programming, Interfacing of 8051 Microcontroller with LCD, ADC and DAC, stepper motor. (10)

Text/Reference Books:

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the8085/8080A, Penram International Publishing, 1996.
2. Ali Mazidi- The 8051 Microcontroller and embedded Systems, Pearson Education
3. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.

BTEC-18404 Electromagnetic Waves

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

1. Maxwell's Equations

Basics of Vectors, Vector calculus, Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface. (5)

2. Uniform Plane Wave

Uniform plane wave, Propagation of wave, Wave polarization, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor. (7)

3. Transmission Lines

Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements. (8)

4. Plane Waves at a Media Interface

Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary. (7)

5. Wave propagation in parallel plane waveguide

Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide. (5)

6. Introduction to antennas

Radiation Parameters of antenna, Monopole and Dipole antenna Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole. (4)

Text/Reference Books:

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
3. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.
4. David Cheng, Electromagnetics, Prentice Hall

BTEC18405 Signals and System

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability, LTI systems. (8)

Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input- output behavior with aperiodic convergent inputs. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations. (8)

Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT). (8)

The z-Transform for discrete time signals and systems- eigen functions, region of convergence, z-domain analysis. (4)

The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. (8)

Text/Reference books:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall,
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
3. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
4. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
5. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: c1999.
6. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.

BTEC-18406 Analog Communication Lab

Internal Marks	:	30	**L**	**T**	**P**
External Marks	:	20	**0**	**0**	**2**
Total Marks	:	50			

Note:- Attempt any eight experiments. The teacher can introduce any new experiment as per the requirements of syllabus.

List of Experiments:

1. Generation & detection of DSBFC amplitude modulated signal.
2. Generation & detection of frequency modulated Signal
3. Generation & detection of SSB AM signal.
4. Detection of FM Signal using PLL.
5. To study the circuit of PAM modulator & Demodulator
6. To study the circuit of PWM modulator & Demodulator
7. To study the circuit of PPM modulator & Demodulator
8. Study of Frequency Division Multiplexing / Demultiplexing .
9. Generation & study of Analog TDM at least 4 channels.
10. To Study Super heterodyne AM receiver and measurement of receiver parameters viz. sensitivity, selectivity & fidelity.
11. Sampling Theorem & Reconstruction of Signal from its samples using Natural Sampling, Flat Top Sampling & Sample & Hold Circuits & effect of duty cycle.

BTEC-18407 Analog Circuit Lab

Internal Marks	:	30	**L**	**T**	**P**
External Marks	:	20	**0**	**0**	**2**
Total Marks	:	50			

Note:- Attempt any eight experiments. The teacher can introduce any new experiment as per the requirements of syllabus.

List of Experiments:

1. To study the characteristics of a Class- A amplifier.
2. To study the characteristics of Class- B amplifier.
3. To study the characteristics of Class- B push-pull amplifier.
4. To study the characteristics of complementary symmetry amplifier.
5. To study the response of RC phase shift oscillator and determine frequency of oscillation.
6. To study the response of Hartley oscillator and determine frequency of oscillation.
7. To study the response of Colpitt's oscillator and determine frequency of oscillation.
8. To study the response of Wien Bridge oscillator and determine frequency of oscillation
9. Application of op-amp as inverting and non inverting amplifier.
10. To study frequency response of op-amp.
11. Application of op-amp as summing, scaling and averaging amplifier.
12. Application of op-amp as schmitt trigger.

BTEC-18408 Microprocessor & Microcontroller Lab

Internal Marks	:	30	**L**	**T**	**P**
External Marks	:	20	**0**	**0**	**2**
Total Marks	:	50			

List of Experiments using 8085/8051

Note: The Lab teacher may introduce new experiments as per the need of the course.

1. Study of 8085Microprocessor kit.
2. Write a program to add two 8/16-bit number using 8085.
3. Write a program to subtract two 8/16-bit number using 8085.
4. Write a program to multiply two 8 bit numbers by repetitive addition method using 8085.
5. Write a program to sort series using bubble sort algorithm using 8085.
6. Study of 8051 Microcontroller kit.
7. Write a program to add two numbers lying at two memory locations and display the result using 8051.
8. Write a program for multiplication of two numbers lying at memory location and display the result using 8051.
9. Write a Program to arrange 10 numbers stored in memory location in Ascending and Descending order in 8051.
10. Write a program of flashing LED connected to port 2 of the Micro Controller 8051.
11. Study of Interrupt structure in 8051.
12. Interfacing of an LCD Display with 8051
13. Write a program to interface an ADC using 8051.
14. Write a program to generate a Ramp waveform using DAC interface using 8051.

BTEC-18501 Digital Communication

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Elements of Digital Communication System

Block diagram of digital communication system, Digital representation of analog signals, Advantages and disadvantages of digital communication system, Bandwidth – S/N trade off, Hartley Shannon Law, Sampling theorem. Concept of amount of Information and Entropy, Shannon Fano Source Coding, Huffman Source Coding and Lampel-Ziv Source Coding Algorithm**.** (8)

Pulse Code Modulation

Sampling, Sampling rate, Aliasing, Quantization error, Uniform and Non-uniform quantization, Dynamic Range, Coding efficiency, A law & μ law Companding, Bandwidth of PCM, Block diagram of PCM system, Delta Modulation, Continuously Variable Slope Delta Modulator (CVSDM) or Adaptive Delta Modulation, Differential Pulse Code Modulation, Intersymbol Interference, Eye Patterns, Signal power in binary digital signals. (10)

Line Coding & Multiplexing Techniques

Line Coding & its properties. NRZ & RZ types, Signaling format for unipolar, polar, bipolar (AMI) & Manchester coding and their power spectra (no derivation), HDB and B8ZS Signaling, Nyquist's criterions for pulse shaping, Fundamentals of time division multiplexing, Bit versus Word Interleaving, Statistical TDM, Codecs & Combo Chips. (8)

Basics of TDMA, FDMA and CDMA

Introduction, Amplitude Shift Keying (ASK), ASK spectrum, ASK modulator, Coherent ASK detector, Noncoherent ASK Detector, Frequency Shift Keying (FSK), FSK bit rate and baud rate, Bandwidth and frequency spectrum of FSK, FSK transmitter, Non-coherent FSK detector, Coherent FSK detector, FSK detection using PLL, Binary Phase Shift Keying, Binary PSK Spectrum, BPSK transmitter, Coherent PSK detection, Quadrature Phase Shift Keying (QPSK), QPSK demodulator, Offset QPSK, n/4 QPSK, Comparison of conventional QPSK, Offset QPSK and n/4 QPSK, M-Ary BPSK, Quadrature Amplitude Modulation (QAM); MQAM transmitters and receivers, Bandwidth efficiency, Carrier recovery; Squaring Loop & Costas Loop, Differential PSK, DBPSK transmitter and receiver, Constant Envelop Modulation; Minimum Shift Keying (MSK) & Gaussian Minimum Shift Keying (GMSK), Matched filter receivers, Bandwidth consideration and probability of error calculations for ASK, PSK, FSK schemes. **(12)**

Suggested Books:

1. Wayne Tomasi, Electronic Communication System Fundamentals through Advanced, 5th ed., Pearson Education.
2. Simon Haykin, Communication Systems, Fourth Edition, Wiley publication.
3. Gary M. Miller, Modern Electronic Communication, 6th ed., Prentice-Hall.
4. F. G. Stremler, Introduction to Communication Systems, 3rd ed., Addison Wesley.
5. E.A. Lee and D.G. Messerschmitt, Digital Communication, Kluwer Academic Publishers.

BTEC-18502: Digital Signal Processing

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

1. Discrete-time signals and systems: Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate (8)

2. Discrete Fourier Transform: Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Implementation of Discrete Time Systems. (8)

3. Z-transform: Z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z-transform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms. (7)

4. Design of Digital filters: Introduction to Digital Filters, FIR and IIR Filters, Structures of realization of discrete time system, direct form, Cascade form, Parallel form and lattice structure of FIR and IIR systems., Design of FIR Filters, IIR filter design by Impulse Invariance, Bilinear Transformation, Matched Z-Transformation. (12)

5. Applications of Digital Signal Processing, Introduction to DSP Processors. (5)

Suggested Books:

1. Digital Signal Processing principles, Algorithms and application, John G Proakis, Dimtris G Manolakis.
2. Alan V Oppenheim, Ronald W Schafer, John R Back-Discrete-Time Signal Processing, Prentice Hall.
3. S. Salivahan, A Vallavaraj, Gnanpiya-Digital Signal Processing, Tata McGraw Hill.
4. S. K. Mitra- Digital Signal Processing-A computer based approach, Tata McGraw Hill
5. Emmanuel Ifeachor and Barrie Jervis- Digital Signal Processing, Pearson Education India.
6. Johny R.Johnson-Introduction to Digital Signal Processing Prentice Hall.

BTEC-18503 Control Systems

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Introduction to linear control system, open loop control systems, Closed-loop systems, Block diagram and signal flow graph analysis. Proportional, integral and derivative systems. Feedforward and multi-loop control configurations, stability concept, relative stability, Routh stability criterion. (8)

Time response of second-order systems, steady-state errors and error constants. Performance specifications in time-domain. (6)

Root Locus Technique: The extreme points of the root loci for positive gain. Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain and sketch of the root locus plot. (8)

Frequency-response analysis- Polar plots, Bode plot, stability in frequency domain, Nyquist plots. Nyquist stability criterion. Performance specifications in frequency-domain. (6)

Compensation: Necessity of compensation, series and parallel compensation, compensating networks, applications of lag and lead-compensation. (3)

State variable formulation and solution. State variable Analysis- Concepts of state, state variable, state model, state models for linear continuous time functions, diagonalization of transfer function, solution of state equations, concept of controllability & observability. (5)

Text/Reference Books:

1. Gopal. M., “Control Systems: Principles and Design”, Tata McGraw-Hill, 1997.
2. Kuo, B.C., “Automatic Control System”, Prentice Hall, sixth edition, 1993.
3. Ogata, K., “Modern Control Engineering”, Prentice Hall, second edition, 19914.
4. Nagrath & Gopal, “Modern Control Engineering”, New Age International, New Delhi

BTEC-18504 Computer Architecture

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Basic Structure of Computer: Computer Types, Memory, CPU, Input-Output subsystem, Control Unit, Number Representation and Arithmetic operations, Character representation, historical Perspective. (6)

Computer Arithmetic: Addition and subtraction of signed numbers, Carry look ahead adder, Multiplication of unsigned numbers using array multiplier, The Booth algorithm, Fast multiplication using carry save addition, Division restoring and non-restoring techniques, Floating point Arithmetic (6)

Instruction Set Architecture: Instruction set characteristics and functions, Addressing modes and Instruction formats with case study of x86 and ARM. (6)

Control Unit: Hardwired and micro programmed control unit.

Memory Organization: Memory Hierarchy, Main memory, Auxiliary memory, Associative memory, Cache memory, Virtual memory,, Memory management hardware. (7)

I/O Organization: Input output interface, Asynchronous data transfer, Modes of data transfer, Priority interrupt, Direct memory access, I/O processor. Interconnection standard: USB, SCSI and PCI express. (5)

Pipelining and Parallel Processing: Pipelining Organization, pipeline hazards, Pipeline in CISC processors, Multiprocessor organization, symmetric multiprocessors, Cache coherence and MESI protocol, Clusters, Multicore organization. Heterogeneous Multicore organization. (6)

Suggested books:

1. “Computer Organization and Architecture: Designing for Performance”, 10th Edition by William Stallings, Pearson Education.
2. “Computer Organization and Embedded Systems”, 6th Edition by CarlHamacher, McGraw Hill Higher Education.
3. "Computer system architecture"3rd edition by M. Morris Mano, Pearson Education.

Suggested Reference books:

1. “Computer Architecture and Organization”, 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2. “Computer Organization and Design: The Hardware/Software Interface”, 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
3. “Computer System Design and Architecture”, 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

BTEC-18505 Digital Communication Lab

Internal Marks	:	30	**L**	**T**	**P**
External Marks	:	20	**0**	**0**	**2**
Total Marks	:	50			

List of Experiments:

Note: Teacher can introduce any new experiment as per the requirement of the syllabus.

1. Study of Time Division Multiplexing system.
2. Study of Pulse Code Modulation and demodulation.
3. Study of Delta Modulation and demodulation and observe effect of slope overload.
4. Study pulse data coding techniques for various formats.
5. Study pulse data decoding techniques for various formats.
6. Study of amplitude shift keying modulator and demodulator.
7. Study of frequency shift keying modulator and demodulator.
8. Study of phase shift keying modulator and demodulator.
9. Error detection & correction using Hamming Code.
10. Digital link simulation; error introduction & error estimation in a digital link using MATLAB (SIMULINK)/ communication simulation packages.

BTEC-18506 Digital Signal Processing Lab

Internal Marks	:	30	**L**	**T**	**P**
External Marks	:	20	**0**	**0**	**2**
Total Marks	:	50			

List of Experiments: Note: Teacher can introduce any new experiment as per the requirement of the syllabus.

1. To develop elementary signal function modules (m-files) for unit sample, unit step, exponential and unit ramp sequences in MATLAB.
2. Write a program in MATLAB to generate standard sequences.
3. Write a program in MATLAB to compute power density spectrum of a sequence.
4. To develop program using MATLAB for operation on sequences like signal Shifting, signal folding, signal addition and signal multiplication.
5. Write a program in MATLAB to verify linear convolution.
6. Write a program in MATLAB to verify the circular convolution.
7. To develop program for computing inverse Z-transform.
8. To develop program for computing DFT and IDFT.
9. To develop program for conversion of direct form realization to cascade form realization.
10. To develop program for cascade realization of IIR and FIR filters.
11. To develop program for designing FIR filter.
12. To develop program for designing IIR filter.

BTEC-18507 Institutional/Industrial Training

Internal Marks : 60
External Marks : 40

Six week Institutional and Industrial training will equip the students with practical understanding and training about industry practices in a suitable industry or organization.

BTEC-18601 Electronic Measurement and Instruments

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Generalized instrumentation system – Units and Standards, Calibration Methods, Standards of measurements, Classification of errors, error analysis. Static Characteristics- Accuracy, Precision, sensitivity, linearity, resolution, hysteresis, threshold, input impedance, loading effects etc. Dynamic Characteristics. (7)

Electronic Meters: Electronic Analog voltmeter: DC voltmeters-Choppers type-DC amplifier, Digital Voltmeter:- Introduction, Ramp Techniques, dual slope, integrating type DVM, Successive approximation type DVM, CRO's study of various stages in brief, measurement of voltage, current phase and frequency, special purpose oscilloscope. Introduction to analog and digital signal conditioning. (8)

Measuring Instruments: Principle of operation of galvanometer, PMMC, Moving Iron instruments, Resistance measurements using Wheatstone bridge, Kelvin Double Bridge, Ohm meter, AC bridges: Maxwell bridge, Maxwell wein bridge, Hey's Bridge, Schering Bridge, Anderson Bridge, Campbell Bridge. (6)

Instrumentation for Generation and Analysis of Waveforms: Signal generators: Fixed and variable AF oscillators, AF sine and square wave generator, Function generator: Square and pulse generator, Sweep generator, wave analyzer, harmonic distortion analyzer, spectrum analyzer, spectrum analysis. (5)

Storage and Display Devices: Necessity of recorders, recording requirements, graphic recorders, strip chart recorders, magnetic tape recorders, digital tape recorders. Electronic indicating instruments, seven segment display, fourteen segmental display Nixie tube. (6)

Transducers and DATA Acquisition Systems: Strain gauge, LVDT, thermocouple, piezoelectric, crystal and photoelectric transducers and their applications. Data acquisition systems. (4)
Telemetry: Introduction, method of data transmission, types of telemetry systems and applications. (3)

Suggested Readings / Books:

1. Electrical and Electronic Measurements and Instrumentation, by K. Sawhney.
2. Electronic Instrumentation and Measurement Techniques, by D Cooper.
3. Electronic Instrumentation, by H.S. Kalsi, Tata McGraw Hill
4. Applied Electronics Instrumentation and measurement, David Buchla, Wayne Melachlan:
5. Electronics Measurement and Instrumentation,Oliver by B.H and Cag J.M.

McGrawHill.
6. Element of Electronic Instrumentation &Measurment, by Carr, Pearson Education.
7. Electronic Measurments& Instrumentation, by Kishore, Pearson Education.

BTEC-18602 Computer Networks

			L	T	P
Internal Marks	:	40			
External Marks	:	60	3	0	0
Total Marks	:	100			

Introduction to computer networks and the Internet: Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic mail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts. (6)

Switching in networks: Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical Multiplexing. (7)

Transport layer: Connectionless transport - User Datagram Protocol, Connection-oriented transport– Transmission Control Protocol, Remote Procedure Call. Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines, (6)

TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service. (5)

Network layer: Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing (6)

Link layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, Switches. (6)

Text Reference books:

1. J.F. Kurose and K. W. Ross, “Computer Networking – A top down approach featuring the Internet”, Pearson Education, 5th Edition
2. L. Peterson and B. Davie, “Computer Networks – A Systems Approach” Elsevier Morgan Kaufmann Publisher, 5th Edition.
3. T. Viswanathan, “Telecommunication Switching System and Networks”, Prentice Hall
4. S. Keshav, “An Engineering Approach to Computer Networking” , Pearson Education
5. B. A. Forouzan, “Data Communications and Networking”, Tata McGraw Hill, 4th Edition
6. Andrew Tanenbaum, “Computer networks”, Prentice Hall
7. D. Comer, “Computer Networks and Internet/TCP-IP”, Prentice Hall
8. William Stallings, “Data and computer communications”, Prentice Hall

BTHS-18906 Economics for Engineers

			L	T	P
Internal Marks	:	40			
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Unit 1: Meaning, Nature and Scope of Business Economics - Micro and Macro ,Concept of Demand, Elasticity of Demand ,individual demand, market demand.
Unit 2 Concept and Law of Supply and factors Affecting Supply, Want, Utility, National income, inflation concepts and its types, Business cycle stages.
Unit 3: Economic Costs ,Short Run Cost Analysis : Fixed, Variable and Total Cost Curves, Average and Marginal Costs ,Long Run Cost Analysis : Economies and Diseconomies of Scale and Long Run Average and Marginal Cost Curves.
Unit 4: Perfect Competition - Equilibrium of Firm and Industry under Perfect Competition, Monopoly, Price Determination under Monopoly , Monopolistic Competition Features, Concept of oligopoly and features.

RECOMMENDED BOOKS

1. Textbook of Economic Theory - Stonier and Hague; Longman Green and Co., London.
2. Business Economics (Micro) - Dr. Girijashankar; Atharva Prakashan, Pune. 4
3. Micro Economics - M. L. Seth
4. Managerial Economics - Theory and Application - D. M. Mithani

BTEC-18603 Computer Networks Lab

Internal Marks	:	30	**L**	**T**	**P**
External Marks	:	20	**0**	**0**	**2**
Total Marks	:	50			

Note: Teacher can introduce any new experiment as per the requirement of the syllabus.

1. To study various topologies for establishing computer networks.
2. To learn the usage of various basic tools (crimping, krone etc.) used in establishing a LAN.
3. To familiarize with switch and hub used in networks
4. To learn the usage of connecters and cables (cabling standards) used in networks
5. To make certain copper and fiber patch cords using different standards.
6. To familiarize with routers & bridges
7. Use commands like ping, ipconfig for trouble shooting network related problems.
8. Develop a program to compute the Hamming Distance between any two code words.
9. Develop a program to compute checksum for an ‘m’ bit frame using a generator polynomial.

BTEC-18604 Electronic Measurement Lab

Internal Marks	:	30	**L**	**T**	**P**
External Marks	:	20	**0**	**0**	**2**
Total Marks	:	50			

Note: Teacher can introduce any new experiment as per the requirement of the syllabus.

List of Experiments

1. Measurement of Inductance by Maxwell's Bridge.
2. Measurement of small resistance by Kelvin's Bridge.
3. Measurement of Capacitance by Schering Bridge.
4. Measurement of Frequency by Wein Bridge.
5. Measurement of medium resistance by Wheat Stone's Bridge.
6. Determination of frequency & phase angle using C.R.O.
7. To find the Q of a coil using LCR-Q meter.
8. To study input- output characteristics of a potentiometer and to use two potentiometers as an error detector.
9. Designing DC bridge for Resistance Measurement (Quarter, Half and Full bridge)
10. Designing AC bridge Circuit for capacitance measurement
11. Designing signal Conditioning circuit for Pressure Measurement
12. Designing signal Conditioning circuit for Temperature Measurement
13. Designing signal Conditioning circuit for Torque Measurement
14. Designing signal Conditioning circuit for Strain Measurement
15. Experimental study for the characteristics of ADC and DAC
16. Error compensation study using Numerical analysis using MATLAB (regression)

BTEC-18605 Mini Project/Electronic Design workshop

Internal Marks	:	30	**L**	**T**	**P**
External Marks	:	20	**0**	**0**	**4**
Total Marks	:	50			

Guidelines:

1. The mini-project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The mini project may be a complete hardware or a combination of hardware and software. The software part in mini project should be less than 50% of the total work.
3. Mini Project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital ICs, microcontroller with which functional familiarity is introduced.
5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.
9. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.
10. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

BTHS-18905 Effective Technical Communication

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Module 1: Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media. (7)

Module 2: Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization. (7)

Module 3: Self Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity. (7)

Module 4: Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report. (7)

Module 5: Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity. (7)

Text/Reference Books:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
2. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
3. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
4. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.

BTEC-18702 Project Stage-I

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	20	**0**	**0**	**10**
Total Marks	:	60			

The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/ Feasibility;
4. Preparing a Written Report on the Study conducted for presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental committee.

BTEC-18703 Industrial Training

Internal Marks : 60
External Marks : 40

Six week Industrial training will equip the students with practical understanding and training about industry practices in a suitable industry or organization.

BTEC-18801 Project Stage-II

Internal Marks	:	100	**L**	**T**	**P**
External Marks	:	50	**0**	**0**	**18**
Total Marks	:	150			

The object of Project Stage-II is to enable the student to extend further the investigative study taken up under Project Stage-I, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under Project Stage-I;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.

BTEC-18901 Scientific Computing

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Introduction: Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy (4)

Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating- Point Arithmetic, Cancellation (4)

System of liner equations: Linear Systems, Solving Linear Systems, Gaussian elimination, Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems (6)

Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting, Eigenvalues and singular values: Eigenvalues and Eigenvectors, Methods for Computing All Eigenvalues, Jacobi Method, Methods for Computing Selected Eigenvalues, Singular Values Decomposition, Application of SVD (6)

Nonlinear equations: Fixed Point Iteration, Newton's Method, Inverse Interpolation Method Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares (6)

Interpolation: Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation , Numerical Integration And Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation (4)

Initial Value Problems for ODES, Euler's Method, Taylor Series Method, Runga-Kutta Method, Extrapolation Methods, Boundary Value Problems For ODES, Finite Difference Methods, Finite Element Method, Eigenvalue Problems, Partial Differential Equations, Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative Methods (4)

Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets, Random Numbers And Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences (4)

Text/ Reference Books:

1. Heath Michael T., "Scientific Computing: An Introductory Survey", McGraw-Hill, 2nd Ed., 2002
2. Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, "Numerical Recipes: The Art of Scientific Computing", Cambridge University Press, 3rd Ed., 2007
3. Xin-she Yang (Ed.)., "Introduction To Computational Mathematics", World Scientific Publishing Co., 2nd Ed., 2008
4. Kiryanov D. and Kiryanova E., "Computational Science", Infinity Science Press, 1st Ed., 2006
5. Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, "Scientific Computing With MATLAB And Octave", Springer, 3rd Ed., 2010

BTEC-18902 Advanced Microprocessors and Microcontrollor

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

INTEL 8086 Microprocessor: Pin Functions, Architecture, Characteristics and Basic Features of Family, Segmented Memory, Addressing Modes, Instruction Set, Data Transfer Instructions, Arithmetic, Logical, Shift and Rotate Instructions, String Instructions, Flag Control Instructions, Transfer of Control Instructions, Processor Control Instructions, Programming Examples, Interrupt Structures, Multitasking and Multiprogramming, MIN/MAX Modes of 8086, Introduction to 8087. Introduction to other x86 microprocessors. (15)

Introduction to RISC processors: ARM Processor Architecture Architecture, Registers, Interrupts & Vector table, I/O Ports, ARM Processor Family, JTAG, I2C Bus. (8)

ARM Programming: Instructions Instruction Set, Data Processing Instructions, Addressing Modes, Load Store Instructions, PSR (Program Status Register) Instructions, Conditional Instructions, Interrupt Instructions. (8)

ARM microcontrollers interface designs: Peripherals Interfacing of ADC & DAC, Memory, LCD Display, Stepper Motor, DC Motor, RFID (5)

.

Suggested Books:

1. Hall, D.V., Microprocessor- Interfacing Programming and Hardware, Tata McGraw Hill (1997).
2. Brey, B.B., The INTEL Microprocessors, Prentice□Hall of India Private Limited (2002).
3. Liu, Y. C. and Gibson, G.A., Microcomputer Systems: The 8086/8088 Family Architecture, Programming and Design, Prentice Hall of India Private Limited (2007).
4. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield, -ARM System Developer's Guide Designing and Optimizing System Software ,Elsevier 2008.
5. Steve Furber, -ARM system on Chip Architecture, Addision Wesley
6. Brooks, Cole, -Embedded Microcontroller Systems, Real Time Interfacing, Thomson Learning.

BTEC-18903 Introduction to MEMS

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Introduction and Historical Background, Scaling Effects. (4)

Micro/Nano Sensors, Actuators and Systems overview: Case studies. Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography(LIGA),and Etching. (8)

Micromachining: Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding. (8)

Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; (8)

Energy methods, Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems. (8)

Text/Reference Book:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2. S. E. Lyshevski, Nano-and Micro-Electromechanical systems:
3. Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).
4. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
5. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.
6. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.
7. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, 2000.

BTEC-18904 Antennas and Propagation

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Fundamental Concepts- Physical concept of radiation, Radiation pattern, near-and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions. (6)

Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop. (5)

Aperture and Reflector Antennas- Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas. (6)

Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas. (4)

Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas. (4)

Antenna Arrays- Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method. (6)

Basic Concepts of Smart Antennas- Concept and benefits of smart antennas, fixed weight beam forming basics, Adaptive beam forming. (3)

Different modes of Radio Wave propagation used in current practice. (2)

Text/Reference Books:

1. J.D. Kraus, Antennas, McGraw Hill, 1988.
2. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.
3. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
4. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw Hill, 1984.
5. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.
6. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005
7. R.E. Crompton, Adaptive Antennas, John Wiley

BTEC-18905 Information Theory and Coding

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Basic Concepts of Information Theory : The concept of amount of information, average information, entropy, information rate, Shannon's Theorem, Markov sources mutual information; Channel capacity; BSC and other channels, capacity of a Gaussian Channel, Bandwidth – S/N Trade-off, introduction to channel capacity & coding, channel models, Channel Capacity Theorem, Shannon Limit. Techniques of coding and decoding; Huffman codes and uniquely detectable codes. (9)

Linear block codes: Introduction to error control coding, types of codes , types of errors, error detection and correction, linear block codes, syndrome and error detection, minimum distance of block code, Hamming code. (9)

Cyclic codes: Description of cyclic codes, generator and parity check matrices of cyclic codes, error detection decoding of cyclic codes. (6)

Convolution codes: Encoding of convolution codes, structural properties of convolution codes, distance properties of convolution codes. Arithmetic codes (6)

Automatic Repeat Request Strategies: Stop and wait, Go back and selective repeat ARQ strategies, Hybrid ARQ Schemes. (4)

Text/Reference Books:

1. N. Abramson, Information and Coding, McGraw Hill, 1963.
2. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.
3. R.B. Ash, Information Theory, Prentice Hall, 1970.
4. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.
5. Rajan Bose, Information theory, Coding and Cryptography, McGraw Hill, 1963.

BTEC-18906 Power Electronics

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based), Concept of fast recovery and schottky diodes as freewheeling and feedback diode. (10)

Controlled Rectifiers: Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor. (10)

Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Step upc hopper. Multiphase Chopper. (6)

Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, WM inverters and comparison of their performance. Driver circuits for above inverters and Filters at the output of inverters, Single phase current source inverter (6)

Switching Power Supplies: Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, and sizing of UPS. (6)

Text /Reference Books:

1. Muhammad H. Rashid, “Power electronics” Prentice Hall of India.
2. Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.
3. P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.
4. V.R.Moorthi, “Power Electronics”, Oxford University Press.
5. Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.
6. G K Dubey, S R Doradla,: Thyristorised Power Controllers”, New Age International Publishers. SCR manual from GE, USA.

BTEC-18907 Microwave Theory and Techniques

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Introduction to Microwaves - History of Microwaves, Microwave Frequency bands; Applications of Microwaves: Civil and Military, Medical, EMI/ EMC. (2)

Microwave Transmission Basics - Concept of Mode, Features of TEM, TE and TM Modes, Losses and Concept of Impedance in Microwave transmission. (4)

Microwave Transmission Lines- Coaxial line, Rectangular waveguide, Circular waveguide, Strip line, Micro strip line,Impedance transformation, Impedance Matching (4)

Microwave Network Analysis- Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters. (3)

Passive and Active Microwave Devices- Microwave passive components: Directional Coupler, Circulator, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Oscillators, Mixers. Microwave Semiconductor Devices: Tunnel diode,Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave Tubes: Klystron, TWT, Magnetron. (12)

Microwave Measurements- Power, Frequency and impedance measurement at microwave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure. Measurement of Microwave antenna parameters. (6)

Microwave Systems- Radar, Terrestrial and Satellite Communication, Radio Aids to Navigation, RFID, GPS. Modern Trends in Microwaves Engineering- Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference and Electromagnetic Compatibility (EMI & EMC), Monolithic Microwave ICs, RFMEMS for microwave components, Microwave Imaging. (5)

Text/Reference Books:

1 R.E. Collins, Microwave Circuits, McGraw Hill
2 K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house
3. Samuel Liao, Microwave devices and circuits,PHI

BTEC-18908 Mobile Communication and Networks

			L	T	P
Internal Marks	:	40			
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Cellular concepts: Cell structure, frequency reuse concept, A basic cellular system, performance criteria, operation of cellular system, , Various Mechanism for Capacity Increase, cell splitting, channel assignment, hand off process, interference, Co-Channel and adjacent channel interference. (**5)**

Multiple access Techniques for wireless Communication: FDMA, TDMA, CDMA and SDMA. Packet radio Protocols: Pure ALOHA, Slotted ALOHA Protocols & multicarrier modulation, OFDM. (**5)**

Wireless Communication System and Standards**:** Second Generation Cellular System: GSM services, features, system Architecture Air interface and Channel types. 2.5 G systems: GPRS/EDGE specifications and features. 3G system: UMTS & CDMA 2000 standards and specifications, CDMA digital standards (IS95) and WCDMA. (9**)**

Signal propagation: Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation . Fading channels-Multipath and small scale fading-Doppler shift, delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, Rayleigh fading Distribution, Ricean Fading Distribution. (**7)**

Antennas and Receiver structure: Antennas for mobile terminal, PIFA, Base Station Antennas and Arrays Diversity receivers- selective diversity combining and MRC receivers, Equal gain Combining, RAKE receiver., equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Altamonte scheme.
MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing trade-off, Performance measures- out-stage, average SNR, average symbol/bit error rate with wireless systems. (**6)**

Future trends: 4G and 5G Technology and its techniques, LTE advance system**. (4)**

Text/Reference Books:

1. WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.
2. WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall, 1993.
3. Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.
4. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley,1995.
5. VK Garg &JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall,1996.

BTEC-18909 Speech and Audio Processing

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Introduction- Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness. (3)

Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters,convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation. (4)

Linear Prediction of Speech- Basic concepts of linear prediction; Linear Prediction Analysis of nonstationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction. (5)

Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types. (5)

Scalar Quantization of LPC- Spectral distortion measures, Quantization based on reflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF. (5)

Linear Prediction Coding- LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model. (4)

Code Excited Linear Prediction- CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero-state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP. (6)

Speech Coding Standards- An overview of ITU-T G.726, G.728 and G.729standards (4)

Text/Reference Books:

1. "Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students‟ Edition), 2004.
2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C. Chu, Wiley Inter science, 2003.

BTEC-18910 Error Correcting Codes

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Linear block codes: Systematic linear codes and optimum decoding for the binary symmetric channel; Generator and Parity Check matrices, Syndrome decoding on symmetric channels; Hamming codes; Weight enumerators and the McWilliams identities; Perfect codes. (8)
Introduction to finite fields and finite rings; factorization of (X^n-1) over a finite field; CyclicCodes. (5)

BCH codes; Idempotents and Mattson-Solomon polynomials; Reed-Solomon codes, Justeen codes, MDS codes, Alterant, Goppa and generalized BCH codes; Spectral properties of cyclic codes. (8)

Decoding of BCH codes: Berlekamp's decoding algorithm, Massey's minimum shift register synthesis technique and its relation to Berlekamp's algorithm. (8)

A fast Berlekamp - Massey algorithm. Convolution codes; Wozencraft's sequential decoding algorithm, Fann's algorithm and other sequential decoding algorithms; Viterbi decoding algorithm. (8)

Text/Reference Books:

1. F.J. McWilliams and N.J.A. Slone, The theory of error correcting codes, 1977.
2. R.E. Balahut, Theory and practice of error control codes, Addison Wesley, 1983.

BTEC-18911 Adaptive Signal Processing

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices. (6)

Optimal FIR (Wiener) filter, Method of steepest descent, extension to complex valued The LMS algorithm (real, complex), convergence analysis, weight error correlation matrix, excess mean square error and mis-adjustment. (6)

Variants of the LMS algorithm: the sign LMS family, normalized LMS algorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering. (6)

Signal space concepts - introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram-Schmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces. (6)

Vector space of random variables, correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice. (6)

Introduction to recursive least squares (RLS), vector space formulation of RLS estimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array. (6)

Text/Reference Books:

1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986.
2. C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

BTEC-18912 Fiber Optic Communication

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Introduction to vector nature of light, propagation of light, Need of Fiber Optic Communications, Evolution of Light wave Systems, Basic Concepts; Analog & Digital Signals, Channel Multiplexing, Modulation Formats, Optical Communication Systems, Lightwave System Components; Optical Fibers as a Communication Channel, (8)

Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and Measurement techniques like OTDR. (7)

Optical sources - LEDs and Lasers, Photo-detectors - pin-diodes, APDs, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties. (8)

Optical switches - coupled mode analysis of directional couplers, electro-optic switches. (4)

Optical amplifiers - EDFA, Raman amplifier. (3)

WDM and DWDM systems. Principles of WDM networks. (4)

Nonlinear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and solition based communication. (4)

Text/Reference Books

1. J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
2. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.
3. J. Gowar, Optical communication systems, Prentice Hall India, 1987.
4. S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979.
5. G. Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.
6. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1997
7. F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, New York (1990).

BTEC-18913 Bio-Medical Electronics

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Brief introduction to human physiology. : Cells and their structure, action events of nerve; the origin of bio potentials, Introduction to the physiology of cardiac, nervous and muscular and respiratory systems. Biomedical transducers: displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases. Bio-electrodes and bio potential amplifiers for ECG, EMG, EEG, etc. (10)

Biopotential Electrodes: Signal acquisition; electrode theory, electrodes for biophysical sensing; electrode-electrolyte interface; electrode-skin interface and motion artifact; Different types of electrodes Hydrogen Calomel, Ag-AgCl, pH, Disposable electrodes, selection criteria of electrodes surface electrodes. (8)

Bioelectrical Activities: The electro-conduction system of the heart; the ECG waveform; the standard lead system; Electrocardiography, Electromyography, Electroencephalograph and their interpretation. (8)

Non-electrical Measurements: Measurement of Blood Pressure, Blood flow, Cardiac output and Cardiac rate, Heart Sounds, Respiratory System Measurements, Measurement of pH value of blood, ESR measurements, Impedance plethysmography. Ultrasonic, X-ray and nuclear imaging. Prostheses and aids: pacemakers, defibrillators, heart-lung machine, Artificial kidney, aids for the handicapped. Safety aspects. (10)

Text/Reference Books:

1. W.F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical Publishers, 1977.
2. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, 1978.
3. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982.
4. Rao C R and Guha S K, “Principles of Medical Electronics and Biomedical Instrumentation”, Universities Press (India) Limited (2001).
5. Cromwell L, Weibell F J and Pfeiffer E A, “Biomedical Instrumentation and Measurements”, 2nd ed., New Delhi: Pearson Education India (2003).
6. Carr Joseph J. and Brown John M., “Introduction to Biomedical Equipment Technology”, 4th Ed., New Delhi: Pearson Education India (2001).
7. Webster John G (Ed.), “Medical Instrumentation, Application and Design”, 3rd ed., Singapore: John Wiley & Sons (Asia) Pte. Ltd. (2003).
8. Khandpur R S, “Handbook on Biomedical Instrumentation”, TMH, 13th reprint, New Delhi (2000).

BTEC-18914 CMOS Design

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Review of MOS transistor models, Non-ideal behaviour of the MOS Transistor. Transistor as a switch. Inverter characteristics. (10)

Integrated Circuit Layout: Design Rules, Parasitics. Delay: RC Delay model, linear delay model, logical path efforts. Power, interconnect and Robustness in CMOS circuit layout. (12)

Combinational Circuit Design: CMOS logic families including static, dynamic and dual rail logic. (6)

Sequential Circuit Design: Static circuits. Design of latches and Flip-flops. (8)

Text/Reference Books:

1. N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4th Edition, Pearson Education India, 2011.
2. C.Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.
3. J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997.
4. P. Douglas, VHDL: programming by example, McGraw Hill, 2013.
5. L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, 1985.

BTEC-18915 Wireless Sensor Networks

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks. (6)

Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks. (6)

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee. (6)

Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols. (6)

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication. (4)

Single-node architecture, Hardware components & design constraints. (4)

Operating systems and execution environments, introduction to TinyOS and nesC. (4)

Text/Reference Books:

1. Waltenegus Dargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications ,2011.
2. Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009.
3. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications,2004.
4. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science.
5. Philip Levis, And David Gay "TinyOS Programming” by Cambridge University Press 2009.

BTEC-18916 Embedded Systems

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Introduction: Introduction to embedded systems and general purpose computer systems, architecture of embedded system, classifications, Embedded microcontroller cores, embedded memories, applications and purpose of embedded systems, challenges and design issues in embedded systems, operational and non-operational quality attributes of embedded systems, elemental description of embedded processors.Examples of embedded systems. (12)

Technological aspects of embedded systems: Interfacing between analog and digital blocks, signal conditioning, digital signal processing. sub-system interfacing, interfacing with external systems, user interfacing, Design tradeoffs due to process compatibility, thermal considerations, etc. (18)

Software aspects of embedded systems: Real time programming languages and operating systems for embedded systems. (6)

Text/Reference Books:

1. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.
2. Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.
3. V.K. Madisetti, "VLSI Digital Signal Processing", IEEE Press (NY, USA), 1995.
4. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.
5. K.J. Ayala, "The 8051 Microcontroller: Architecture, Programming, and Applications", Penram Intl, 1996.

BTEC-18917 Satellite Communication

			L	T	P
Internal Marks	:	40			
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Course Objectives:

Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication. (4)

Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day. (7)

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc. (6)

Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift. (7)

Satellite link budget
Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions. (6)

Modulation and Multiple Access Schemes: Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA. (6)

Text /Reference Books:

1. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002
2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009
3. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill,2009

BTEC-18918 Digital Image & Video Processing

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Digital Image & Video Processing

Digital Image Fundamentals-Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighbourhood, adjacency, connectivity, distance measures. (4)

Image Enhancements and Filtering-Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass. (6)

Color Image Processing-Color models–RGB, YUV, HSI; Color transformations–formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation. (4)

Image Segmentation- Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation. (3)

Wavelets and Multi-resolution image processing- Uncertainty principles of FourierTransform, Time-frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Sub band filter banks, wavelet packets. (5)

Image Compression-Redundancy–inter-pixel and psycho-visual; Lossless compression –predictive, entropy; Lossy compression- predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000. (5)

Fundamentals of Video Coding- Inter-frame redundancy, motion estimation techniques – fullsearch, fast search strategies, forward and backward motion prediction, frame classification – I, P and B; Video sequence hierarchy – Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards – MPEG and H.26X. (6)

Video Segmentation- Temporal segmentation–shot boundary detection, hard-cuts and soft-cuts; spatial segmentation – motion-based; Video object detection and tracking. (3)

Text/Reference Books:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd
edition 2004
3. Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015

BTEC-18919 Mixed Signal Design

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous-time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform. (8)

Switched-capacitor filters- Nonidealities in switched capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications. (6)

Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs. (6)

Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission. (8)

Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs; Digital PLLs; DLLs. (8)

Text/Reference Books:

1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.
2. Behzad Razavi , Design of analog CMOS integrated circuits, McGraw-Hill, 2003.
3. R. Jacob Baker, CMOS circuit design, layout and simulation, Revised second edition, IEEE press, 2008.
4. Rudy V. dePlassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.
5. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.
6. R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer additions).
7. M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford university press, first Indian edition, 2008.

BTEC-18920 Nano Electronics

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Introduction to nanotechnology, meso structures, Basics of Quantum Mechanics: Schrodinger equation, Density of States. Particle in a box Concepts, Degeneracy. Band Theory of Solids. Kronig-Penny Model. Brillouin Zones. (12)

Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.) (12)

Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation (12)

Text/ Reference Books:

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Material and Novel Devices), Wiley-VCH, 2003.
3. K.E. Drexler, Nanosystems, Wiley, 1992.
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003

BTEC-18921 High Speed Electronics

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Transmission line theory (basics) crosstalk and nonideal effects; signal integrity: impact of packages, vias, traces, connectors; non-ideal return current paths, high frequency powerdelivery, methodologies for design of high speed buses; radiated emissions and minimizing system noise. . (6)

Noise Analysis: Sources, Noise Figure, Gain compression, Harmonic distortion, Intermodulation,Cross-modulation, Dynamic range (5)
Devices: Passive and active, Lumped passive devices (models), Active (models, low vs high frequency) (5)

RF Amplifier Design, Stability, Low Noise Amplifiers, Broadband Amplifiers (and Distributed) Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations, Cross-over distortion Efficiency RF power output stages (8)

Mixers –Up conversion Down conversion, Conversion gain and spurious response. Oscillators Principles. PLL Transceiver architectures (6)

Printed Circuit Board Anatomy, CAD tools for PCB design, Standard fabrication, Microvia Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges. (6)

Text/Reference Books:

1. Stephen H. Hall, Garrett W. Hall, James A. McCall "High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices", August 2000, Wiley-IEEE Press
2. Thomas H.Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", Cambridge University Press, 2004, ISBN 0521835399.
3. Behzad Razavi, "RF Microelectronics", Prentice-Hall 1998, ISBN 0-13-887571-5.
4. Guillermo Gonzalez, "Microwave Transistor Amplifiers", 2nd Edition, Prentice Hall.
5. Kai Chang, "RF and Microwave Wireless systems", Wiley.
6. R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011

BTEC-18922 Wavelets

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Introduction to time frequency analysis; the how, what and why about wavelets. (5)

Short-time Fourier transform, Wigner-Ville transform. (6)

Continuous time wavelet transform, Discrete wavelet transform, tiling of the time-frequency plane and wave packet analysis, Construction of wavelets. (8)

Multiresolution analysis. Introduction to frames and biorthogonal wavelets, Multirate signal processing and filter bank theory (8)

Application of wavelet theory to signal denoising, image and video compression, multi-tone digital communication, transient detection. (8)

Text/Reference Books:

1. Y.T. Chan, Wavelet Basics, Kluwer Publishers, Boston, 1993.
2. I. Daubechies, Ten Lectures on Wavelets, Society for Industrial and Applied Mathematics, Philadelphia, PA, 1992.
3. C. K. Chui, An Introduction to Wavelets, Academic Press Inc., New York, 1992.
4. Gerald Kaiser, A Friendly Guide to Wavelets, Birkhauser, New York, 1995.
5. P. P. Vaidyanathan, Multirate Systems and Filter Banks, Prentice Hall, New Jersey, 1993.
6. A.N. Akansu and R.A. Haddad, Multiresolution signal Decomposition: Transforms, Subbands and Wavelets, Academic Press, Oranld, Florida, 1992.
7. B.Boashash, Time-Frequency signal analysis, In S.Haykin, (editor), Advanced Spectral Analysis, pages 418--517. Prentice Hall, New Jersey, 1991.

BTEC-18951 ANALOG COMMUNICATION

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Unit I Base Band Signals and Systems: Introduction, Elements of communication system, Noise & its types; Noise Figure & noise factor, Noise equivalent temperature. Modulation & Demodulation, Mixing; Linear & Nonlinear, need of modulation, types of modulation systems, basic transmission signals, Frequency multiplexing technique. (4)

Unit II Analog Modulation Techniques: Introduction, theory of amplitude modulation; AM power calculations, AM current calculations, AM modulation with a complex wave, theory of frequency modulation; mathematical analysis of FM, spectra of FM signals, narrow band of FM, Wide band FM, Theory of phase modulation, phase modulation obtained from frequency modulation, comparison of AM & FM, Comparison of PM & FM. (5)

Unit III AM Transmission & Reception: Introduction, generation of Amplitude Modulation, Low level and high level modulation, basic principle of AM generation; square law modulation, Amplitude modulation in amplifier circuits, suppressed carrier AM generation (Balanced Modulator) ring Modulator, Product Modulator/balanced Modulator.

Receiver Parameters; Selectivity, Sensitivity, Fidelity, Tuned Ratio Frequency (TRF) Receiver, Super heterodyne Receiver; Basic elements of AM super heterodyne Receiver; Image Frequency Rejection, Tracking & Alignment, IF Amplifier, AM detector; square law detector, Envelope or Diode detector, AM detector with AGC, AM receiver characteristics. (13)

Unit IV FM Transmission & Reception: FM allocation standards, generation of FM by direct method, varactor diode Modulator, Cross by Direct FM Transmitter, Phase-Locked-Loop Direct FM Transmitter, Indirect generation of FM; Armstrong method, RC phase shift method.

Frequency demodulators, Tuned circuit frequency discriminators; Slope Detector, Balance Slope Detector, Foster Seeley discriminator, Ratio Detector, FM detection using PLL, Zero crossing detector as a Frequency Demodulator, pre emphasis and de emphasis. (6)

Unit V SSB Transmission & Reception: Introduction, Single Side band systems, AM-SSB; Full carrier, Suppressed carrier , reduced carrier, Independent side band, and Vestigial side band, Comparison of SSB Transmission to conventional AM, Generation of SSB; Filter method, Phase Shift Method, Third Method. SSB Product Demodulator, Balanced Modulator as SSB Demodulator, Single Side band receivers. (6)

Unit VI Pulse Modulation Transmissions and Reception: Introduction, Sampling Theorem Pulse Amplitude Modulation (PAM), Natural PAM Frequency Spectra for PAM , Flat-top PAM, Sample and hold circuits, Time division Multiplexing, PAM Modulator Circuit, Demodulation of PAM Signals, Pulse Time Modulation (PTM); Pulse Width Modulation(PWM), Pulse Position Modulation (PPM), PPM Demodulator. (5)

Suggested / Recommended Books:

1. Electronic communication Systems by Kennedy & Davis, Tata Mcgraw Hill.
2. Analog Communication Systems by Manoj Kumar & Manisha, Satya Prakashan, New Delhi, 2nd Edition.
3. Electronic Communication System, Tomasi, Pearson Education.
4. Electronic Communication, Roddy, Pearson Education.
5. Analog Communication Systems by Symon Hykens, John Wiley & Sons .
6. Principles of Communication System, Taub & Schilling, Tata Mc-Graw Hill.

BTEC-18952 Electronics Measurements And Instrumentation

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Unit I Fundamentals: Generalized instrumentation system – Units and Standards, Calibration Methods, Standards of measurements, Classification of errors, error analysis. Static Characteristics- Accuracy, Precision, sensitivity, linearity, resolution, hysteresis, threshold, input impedance, loading effects etc. Dynamic Characteristics. (7)

Unit II Electronic Meters: Electronic Analog voltmeter: DC voltmeters-Choppers type-DC amplifier, solid state voltmeter, Differential voltmeter, peak responding voltmeter, True RMS voltmeter, calibration of DC voltmeters. Digital Voltmeter:- Introduction, Ramp Techniques, dual slope, integrating type DVM, Successive approximation type DVM, Resolution and sensitivity of digital meters, general specification of a DVM. CRO's study of various stages in brief, measurement of voltage, current phase and frequency, special purpose oscilloscope. (8)

Unit III Measuring Instruments: Principle of operation of galvanometer, PMMC, Moving Iron instruments, Resistance measurements using Wheatstone bridge, Kelvin Double Bridge, Ohm meter, AC bridges: Maxwell bridge, Maxwell wein bridge, Hey's Bridge, Schering Bridge, Anderson Bridge, Campbell Bridge. (8)

Unit IV Instrumentation for Generation and Analysis of Waveforms: Signal generators: Fixed and variable AF oscillators, AF sine and square wave generator, Function generator: Square and pulse generator, Sweep generator, wave analyzer, harmonic distortion analyzer, spectrum analyzer, spectrum analysis. (5)

Unit V Storage and Display Devices: Necessity of recorders, recording requirements, graphic recorders, strip chart recorders, magnetic tape recorders, digital tape recorders. Electronic indicating instruments, seven segment display, fourteen segmental display Nixie tube. (6)

Unit VI Transducers and DATA Acquisition Systems: Strain gauge, LVDT, thermocouple, piezoelectric, crystal and photoelectric transducers and their applications. Data acquisition systems. (8)

Unit VII Telemetry: Introduction, method of data transmission, types of telemetry systems and applications. (3)

Suggested Readings / Books:

1. Electrical and Electronic Measurements and Instrumentation, by K. Sawhney.
2. Electronic Instrumentation and Measurement Techniques, by D Cooper.

3. Electronic Instrumentation, by H.S. Kalsi, Tata McGraw Hill
4. Applied Electronics Instrumentation and measurement, David Buchla, Wayne Melachlan:
5. Electronics Measurement and Instrumentation,Oliver by B.H and Cag J.M. McGrawHill.
6. Element of Electronic Instrumentation & Measurment, by Carr, Pearson Education.
7. Electronic Measurments & Instrumentation, by Kishore, Pearson Education.
8. Process Control Systems and Instrumentation, Bartelt, Cengage Learning

BTEC-18953 Analog Circuits

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Diode Circuits, Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. (5)

Single stage and multistage amplifiers, cascode amplifier. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues. (4)

Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., concept of stability, gain margin and phase margin.. (4)

Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators(phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt), non-sinusoidal oscillators. Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load. (6)

Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR. OP-AMP design: design of differential amplifier for a given specification, design of gain stages and output stages. (5)

OP-AMP applications: review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications. Active filters: Low pass, high pass, band pass and band stop, design guidelines. (6)

Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc. Analog-to-digital converters (ADC): Single slope, dual slope, successive approximation converter. (6)

Text/Reference Books:

7. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
8. J. Millman, and C. C. Halkias, Integrated Electronics,TATA McGraw-Hill Edition, 1991.
9. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.
10. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, Edition IV.

11. Paul R. Gray and Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition.
12. Ramakant A Gayakwad Op-Amps and Linear Integrated Circuits, 4th Edition

BTEC-18961: Digital Signal Processing

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Discrete-time signals and systems: Discrete time signals and systems: Representation of discrete systems using difference equations, Sampling and reconstruction of signals -aliasing; Sampling theorem and Nyquist rate. (8)

2. Discrete Fourier Transform: Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Implementation of Discrete Time Systems. (10)

3. Z-transform: Z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z-transform, Properties of z-transform for causal signals, Inverse z-transforms. (7)

4. Design of Digital filters: Introduction to Digital Filters, FIR and IIR Filters, Introduction to Window Design of FIR Filters. Introduction to design of IIR Digital Filters, Low-pass, Band-pass, Band stop and High-pass filters. (10)

5. Applications of Digital Signal Processing, Introduction to DSP Processors. (5)

Suggested Books:

1. Digital Signal Processing principles, Algorithms and application, John G Proakis, Dimtris G Manolakis.
2. Alan V Oppenheim, Ronald W Schafer, John R Back-Discrete-Time Signal Processing, Prentice Hall.
3. S. Salivahan, A Vallavaraj, Gnanpiya-Digital Signal Processing, Tata McGraw Hill.
4. S. K. Mitra- Digital Signal Processing-A computer based approach, Tata McGraw Hill
5. Emmanuel Ifeachor and Barrie Jervis- Digital Signal Processing, Pearson Education India.
6. Johny R.Johnson-Introduction to Digital Signal Processing Prentice Hall.

BTEC-18962 Digital System Design using VHDL

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Introduction: Introduction to Computer-aided design tools for digital systems. Hardware description languages, Introduction to VHDL, Data objects, Classes and data types, Operators, Overloading, Logical operators. Types of delays, Entity and Architecture declaration. Introduction to behavioural, dataflow and structural models. (8)

VHDL Statements: Assignment statements, sequential Statements and process, Conditional statements, Case statements, Array and loops, Resolution functions, Packages & Libraries, Concurrent statements. (8)

Combinational Circuit Design: VHDL models and simulation of conbinational circuits such as Multiplexers, Encoders, Decoders, Code converters, Comparators, Implementation of Boolean functions etc. (8)

Sequential Circuit Design: VHDL Models and simulation of sequential circuits, Shift registers, Counters, Sequence detectors etc. (6)

Design with CPLDs and FPGAs: Introduction to CPLD and FPGA. Design and implementation using CPLDs and FPGAs. (6)

Text/Reference Books:

1. Circuit Design with VHDL by Volnei A. Pedroni, 3ed, MIT Press Ltd.
2. A VHDL Primmer by Bhasker; Prentice Hall.
3. Digital System Design using VHDL, by Charles. H. Roth.

BTEC-18963 Control Systems

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Introductory Concepts: Plant, Systems, Servomechanism, regulating systems, disturbances, Open loop control system, closed loop control systems, linear and non-linear systems, time variant and invariant, continuous and sampled-data control systems, Block diagrams, some illustrative examples. (2)

Modeling: Formulation of equation of linear electrical, mechanical, thermal, pneumatic and hydraulic system, electrical, mechanical analogies. Transfer function, Block diagram representation, signal flow graphs and associated algebra, characteristics equation. (8)

Time Domain Analysis: Typical test – input signals, Transient response of the first and second order systems. Time domain specifications, Dominant closed loop poles of higher order systems. Steady state error and coefficients, pole-zero location and stability, Routh-Hurwitz Criterion. (10)

Root Locus Technique: The extreme points of the root loci for positive gain. Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain and sketch of the root locus plot. (9)

Frequency Domain Analysis: Closed loop frequency response, Bode plots, stability and loop transfer function. Frequency response specifications, Relative stability, Relation between time and frequency response for second order systems. Log. Magnitude versus Phase angle plot, Nyquist criterion for stability. (9)

Compensation: Necessity of compensation, series and parallel compensation, compensating networks, applications of lag and lead-compensation. (4)

Control Components: Error detectors – potentiometers and synchros, servo motors, a.c. and d.c. techno generators, Magnetic amplifiers. (3)

Suggested Readings / Books

1. Dorf Richard C. and Bishop Robert H., Modern Control System, Addison –Wesley, Pearson New Delhi
2. Ogata K., Modern Control Engineering‖, Prentice Hall, □Kuo B. C., Automatic Control System‖, Prentice Hall

3. Nagrath I.J. and Gopal M., Control System Engineering, Wiley Eastern Ltd.
4. Singh / Janardhanan, Modern Control Engineering, Cengage Learning
5. Kilian, Modern Control Technology: Components and Systems, Cengage Learning

BTEC18971 Power Electronics

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based), Concept of fast recovery and schottky diodes as freewheeling and feedback diode. (10)

Controlled Rectifiers: Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor. (10)

Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Step upc hopper. Multiphase Chopper. (6)

Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, WM inverters and comparison of their performance. Driver circuits for above inverters and Filters at the output of inverters, Single phase current source inverter (6)

Switching Power Supplies: Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, and sizing of UPS. (6)

Text /Reference Books:

1. Muhammad H. Rashid, “Power electronics” Prentice Hall of India.
2. Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.
3. P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.
4. V.R.Moorthi, “Power Electronics”, Oxford University Press.
5. Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.
6. G K Dubey, S R Doradla,: Thyristorised Power Controllers”, New Age International Publishers. SCR manual from GE, USA.

BTEC-18972 Satellite Communication

			L	T	P
Internal Marks	:	40			
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Course Objectives:

Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication. (4)

Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day. (7)

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc. (6)

Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift. (7)

Satellite link budget
Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions. (6)

Modulation and Multiple Access Schemes: Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA. (6)

Text /Reference Books:

4. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002
5. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009
6. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill,2009

BTEC-18973 Microcontrollers

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Overview of microcomputer systems and their building blocks, memory interfacing, concepts of interrupts and Direct Memory Access, instruction sets of microprocessors (with examples of 8085); (10)

8051 Microcontroller Comparison of Microprocessor and Microcontroller, Microcontroller and Embedded Processors, Architecture and Pin Configuration of 8051 .8051 Flag bits and PSW Register, Assembly Programming, Register Banks and Stack, Jump Loop and Call Instructions, I/O Port Programming, Addressing Modes and Accessing Memory using various Addressing Modes, Arithmetic Instructions and Programs, Logic Instructions and Programs, Single Bit Instructions and Programming, Timer/Counter Programming and Interrupts in 8051. (12)

Interfacing of 8051 Microcontroller with LCD, ADC and DAC, stepper motor. (8)

Introduction to concepts of virtual memory, Cache memory, Advanced coprocessor Architectures- 286, 486, Pentium; RISC processors; ARM microcontrollers. (6)

Text/Reference Books:

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996
2. D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface. Morgan Kaufman Publishers.
3. Douglas Hall, Microprocessors Interfacing, Tata McGraw Hill, 1991.
4. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.

BTEC-18981 Fiber Optic Communication

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

1. Introduction Need of Fiber Optic Communications, Evolution of Light wave Systems, Basic Concepts; Analog & Digital Signals, Channel Multiplexing, Modulation Formats, Optical Communication Systems, Lightwave System Components; Optical Fibers as a Communication Channel, Optical Transmitters, Optical Receivers. (2)

Optical Fibers Geometrical-Optics Description; Step-Index Fibers, Graded Index Fibers, Wave Propagation; Maxwell's Equations, Fiber Modes, Single-Mode-Fibers, Dispersion in Single-Mode Fibers; Group Velocity Dispersion, Material Dispersion, Wave guide Dispersion, Higher-order Dispersion, Limitations on the Bit Rate, Fiber Bandwidth , Fiber Losses; Attenuation Coefficient, Material Absorption, Rayleigh Scattering, wave guide Imperfections, Nonlinear Optical effects. (10)

Optical Transmitters Basic Concepts; Emission and Absorption Rates, p-n Junctions, Non radiative Recombination, Semiconductor Materials, Light Emitting Diodes; Power-current Characteristics, LED spectrum, Modulation Response, LED Structures, Semiconductor Lasers; DFB Lasers, Coupled Cavity semiconductor Lasers, Tunable Semiconductor Lasers, Vertical Cavity Semiconductor Lasers, Laser Characteristics. (8)

Optical Receivers Basic concepts, p-n Photo Diodes, p-i-n Photo Diodes, Avalanche Photo Diode, MSM Photo detector, Receiver Design, Receiver Noise; Noise mechanism, Receiver sensitivity; Bit error rate, Minimum Receiver Power, Sensitivity Degradation, Receiver Performance. (8)

Light Wave Systems System Architecture, Loss limited Light wave systems, Dispersion limited Light wave systems, Power Budget, Long Haul systems, Sources of Power Penalty; Model Noise, Dispersive Pulse Broadening, Mode Partition Noise, Frequency Chirping, Reflection Feedback Noise. (8)

Multi channel Systems WDM Light wave systems, Optical TDM Systems, Subscriber Multiplexing, Code Division Multiplexing. (4)

Suggested Books:

1. Senior J. Optical Fiber Communications, Principles & Practice, PHI.
2. Keiser G., Optical Fiber Communication Mc graw-hill.
3. Govind P. Agrawal, Fiber Optics Communication Systems John Wiley & Sons (Asia) Pvt. Ltd.
4. Djafar K. Mynbeav, Fiber-Optics Communications Technology, Pearson.

BTEC-18982 Computer Networks

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Introduction to Computer Networks:
Data Communication System and its components, Data Flow, Computer network and its goals, Types of computer networks: LAN, MAN, WAN, Wireless and wired networks, broadcast and point to point networks, Network topologies, Network software: concept of layers, protocols, interfaces and services, ISO-OSI reference model, TCP/IP reference model. (6)

Physical Layer:
Concept of Analog & Digital Signal, Bandwidth, Transmission Impairments: Attenuation, Distortion, Noise, Data rate limits : Nyquist formula, Shannon Formula, Multiplexing : Frequency Division, Time Division, Wavelength Division, Introduction to Transmission Media : Twisted pair, Coaxial cable, Fiber optics, Wireless transmission (radio, microwave, infrared), Switching: Circuit Switching, Message Switching , Packet Switching & their comparisons. (6)

Data Link Layer:
Design issues, Framing, Error detection and correction codes: checksum, CRC, hamming code, Data link protocols for noisy and noiseless channels, Sliding Window Protocols: Stop & Wait ARQ, Go-back-N, ARQ, Selective repeat ARQ, Data link protocols: HDLC and PPP. (6)

Medium Access Sub-Layer:
Static and dynamic channel allocation, Random Access: ALOHA, CSMA protocols, Controlled Access: Polling, Token Passing, IEEE 802.3 frame format, Ethernet cabling, Manchester encoding, collision detection in 802.3. (6)

Network Layer:
Design issues, IPv4 classful and classless addressing, subnetting, Routing algorithms: distance vector and link state routing, Congestion control: Principles of Congestion Control, Congestion prevention policies,Leaky bucket and token bucket algorithms. (6)

Transport Layer:
Elements of transport protocols: addressing, connection establishment and release, flow control and buffering, multiplexing and de-multiplexing, crash recovery, introduction to TCP/UDP protocols and their comparison. (5)

Application Layer: World Wide Web (WWW), Domain Name System (DNS), E-mail, File Transfer Protocol (FTP), Introduction to Network security (5)

Suggested Readings/ Books:

1. Computer Networks, 4th Edition, Pearson Education by Andrew S. Tanenbaum
2. Data Communication & Networking, 4th Edition, Tata McGraw Hill. By Behrouz A. Forouzan.
3. Computer Networking, 3rd Edition, Pearson Education by James F. Kurose and Keith W. Ross
4. Internetworking with TCP/IP, Volume-I, Prentice Hall, India by Douglas E. Comer.
5. Guide to Networking Essentials, 5th Edition, Cengage Learning by Greg Tomsho, 6. Handbook of Networking, Cengage Learning by Michael W. Graves.

BTEC-18983 Mobile Communication

Internal Marks	:	40	**L**	**T**	**P**
External Marks	:	60	**3**	**0**	**0**
Total Marks	:	100			

Introduction : Cell structure, frequency reuse concept, A basic cellular system, operation of cellular system, hand off process, channel allocation in cellular systems, Bluetooth and Zigbee technology. (**7)**

Elements of Cellular Radio Systems Design: General description of the problem, concept of frequency reuse channels, co-channel interference reduction factor, desired C/I from a normal case in an omni directional antenna system, cell splitting, consideration of the components of cellular systems. (**7)**

Digital Communication through fading multipath channels: Fading channel and their characteristics- Channel modeling, Digital signaling over a frequency non selective slowly fading channel. Concept of diversity branches and signal paths. Combining methods: Selective diversity combining, Switched combining, maximal ratio combining, Equal gain combining. **(7)**

Multiple access Techniques & wireless standards : FDMA, TDMA, CDMA and SDMA. Packet radio Protocols: Pure ALOHA, Slotted ALOHA Protocols .Second Generation Cellular System: GSM services,features, system Architecture Air interface and Channel types. 2.5 G systems: GPRS/EDGE specifications and features. 3G system: UMTS & CDMA 2000 standards. (**10)**

Future trends: 4G and 5G Technology and its techniques, LTE advance system**. (5)**

Reference Books:

1. T.S.Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Pearson Education Asia, 2010.
2. William C Y Lee, Mobile Cellular Telecommunications, 2nd Edition, MGH, 2004.
3 J. Schiller, Mobile Communications, Addison-Wesley, second edition, 2004.
4. Raj Pandya, Mobile & Personal Communication Systems and Service, PHI.