Course Curriculum under CBCS for
M. Sc. (Electronic Science) 2015 – 2017

Berhampur University
Bhanja Bihar

Course Numbering Scheme

Course numbers shall be denoted by eight alpha-numerals with a dot between the 0^{th} & 1^{st} position. The course numbers BSL102.C and ESL412.S are explained bellow.

Subject category	Nature	Level of course indicating Semester	Unique identification code for the course		Core, Allied Elective and Specialization indicator
6& 5	4	3	2 & 1		0
BS	**L**	**1**	**02**	**.**	**C**
ES	**L**	**4**	**12**	**.**	**S**
ES	**L**	**4**	**12**	**.**	**AE**

Subject Codes

The codes of the subjects shall be as under:

BS Basic science courses

ES Electronic Science courses

Codes for the nature of the course

The nature of the course corresponding to the fourth alphabet in the course code is as follows:

L Lecture based Courses are primarily based on lecture hours, though they can also contain Tutorial and Practical hours, *e.g.* L-T-P structures 3-0-0, 3-1-2, 3-0-2, 2-0-0, etc.

P Laboratory based Courses are primarily based on practical or laboratory work though they can also contain Lecture and Tutorial hours, *e.g.* LTP structures like 0-0-3, 0-0-4, 1-0-3, 0-1-3, etc.

D Project based courses leading to dissertation (e.g. Major, Minor, Mini Projects), Viva Voce and Seminar

Level of the course

It usually indicates the Semester in which the Course is being offered.

Required Number of Earned Credits for award of classes and degree: Sum of the Total Credits of all Four Semesters.

Course Scheduling

FIRST SEMESTER

Sl. No.	**Course No.**	Course Title	L-T-P	Credits
1	BSL101.C	Quantum & Material Physics	4-0-0	4
2	BSL102.C	Electrodynamics	3-0-0	3
3	ESL103.C	Numerical Methods using C	3-0-0	3
4	ESL104.C	Network Analysis	3-0-0	3
5	ESL105.C	Semiconductor Devices	4-0-0	4
6	ESL106.C	Passive RF Techniques	3-0-0	3
7	ESP107.C	Applied Numerical Computing Lab	0-1-6	4
8	ESP108.C	Devices Lab	0-0-6	3
		Total Credits	20-1-12	27

SECOND SEMESTER

Sl. No.	**Course No.**	Course Title	L-T-P	Credits
1	ESL201.C	Analog Circuits	3-0-0	3
2	ESL202.C	Active RF Devices & Circuits	4-0-0	4
3	ESL203.C	Digital Electronics	3-0-0	3
4	ESL204.C	Light-wave Theory	3-0-0	3
5	ESL205.C	Basic Control Theory	3-0-0	3
6	ESP206.C	Digital Electronics Lab	0-0-6	3
7	ESP207.C	Analog Circuits Lab	0-0-6	3
		Total Credits	16-0-12	22

THIRD SEMESTER

Sl. No.	**Course No.**	Course Title	L-T-P	Credits
1	ESL301.C	Microprocessor	3-0-0	3
2	ESL302.C	Instrumentation	3-0-0	3
3	ESL303.C	Basic Communication Theory	4-0-0	4
4	ESL304.C	Signals and Systems	4-0-0	4
5	ESL305.C	Radiating Systems and Electromagnetic Propagation	4-0-0	4
6	CBCS*	-	-	4
7	ESP306.C	Microprocessor and Microcontroller Lab	0-0-6	3
8	ESP307.C	Communication Lab	0-0-6	3
		Total Credits	18-0-12	28

***** to be taken from other departments

Allied Elective Courses

Sl. No.	**Course No.**	Course Title	L-T-P	Credits
1	ESL301.AE	Semiconductor Devices (Same as ESL105.C)	4-0-0	4
2	ESL302.AE	Signals and Systems (Same as ESL304.C)	4-0-0	4

FOURTH SEMESTER

Core Courses

Sl. No.	**Course No.**	Course Title	L-T-P	Credits
1		Specialization Course Module - I	3-0-0	3
2		Specialization Course Module – II	3-0-0	3
3	ESD401.C	Project	0-0-12	6
4	ESD402.C	Seminar	0-1-6	4
5	ESD403.C	Grand Viva Voce	0-1-6	4
		Total Credits	6-2-24	20

Specialization

There will be the following Four (4) groups, each with Two Theory Papers. The students will be required to take any one group being offered by the Department.

GROUP-1 MICROCONTROLLER & EMBEDDED SYSTEM DESIGN
GROUP-2 ADVANCED ELECTRONIC INSTRUMENTATION
GROUP-3 TELEMATICS
GROUP-4 OPTICAL COMMUNICATION TECHNOLOGY

Group	Course Number	Course Title
1	ESL411.S	MICROCONTROLLER
	ESL412.S	EMBEDDED SYSTEM DESIGN
2	ESL413.S	MICROPROCESSOR BASED & BIOMEDICAL INSTRUMENTATION
	ESL414.S	PROCESS & INTELLIGENT CONTROL SYSTEMS
3	ESL415.S	RADAR, TV AND SATELLITE COMMUNICATION
	ESL416.S	WIRELESS AND COMPUTER COMMUNICATION
4	ESL417.S	FIBRE OPTICS
	ESL418.S	OPTICAL COMMUNICATION: DEVICES & SYSTEMS

BSL101.C QUANTUM & MATERIAL PHYSICS

Unit – I: Wave-particle duality, Schrodinger equation, wave function and its significance, Postulates of quantum mechanics, observables, expectation values, Eigenvalue problem, Eigen-function, Ortho-normality, degeneracy, Dirac-delta function.

Unit – II: Applications to Potential Problem: Motion of Free particle, Particle in a square potential well, motion of a particle through a square potential barrier, Tunneling Effect.

Unit-III: Periodic structure, Lattice Translation vector, Primitive Cell, Cubic Lattices, Hexagonal close packed lattices, Sodium Chloride structure, Diamond structure, Zinc Chloride structure-Wurtzite structure, Indices for crystal planes and directions, Reciprocal lattices, Brilloun zone, Miller indices

Unit – IV: Formation of energy bands in a solid: metal, semiconductor and insulator, Direct and indirect band. gap, Electrons and holes. Effective mass. Intrinsic and extrinsic materials, Fermi Dirac distribution function. Density of states, Fermi level, Electron and hole concentration of intrinsic and extrinsic semiconductors at thermal equilibrium.

Texts and References:

1] Ghatak and Lokanathan: Quantum Mechanics
2] Schiff: Quantum mechanics
3] Mathews and Venkatesan: A text Book of Quantum Mechanics.
4] Introduction Solid State Physics : C. Kittel
5] Solid State Electronic devices B. G. Streetman (PHI).
6] Semiconducto~0ptoelectrooic devices, P. Bhattacharya (PHI).

BSL102.C ELECTRODYNAMICS

Unit – I: Maxwell's equations, Conservation laws and Electromagnetic potentials: Maxwell's equations (No derivation), Equation of continuity and conservation of charge, Concept of magnetic charge; Scalar & Vector potentials, Gauge transformation: Lorentz and Coulomb gauge, Lorentz force law in potential form; Poynting's theorem and conservation of energy.

Unit – II: Propagation of plane Electromagnetic waves: Wave equation in one dimension, Polarization, Boundary conditions: Reflection and Transmission. Monochromatic plane electromagnetic waves in free space, Energy of plane electromagnetic waves, Propagation in Linear Media; The modified wave equation, Monochromatic plane waves in conducting Media, Reflection & Transmission at a conducting surface.

Unit – III: Radiation and Dispersion: Retarded potentials, fields and radiation due to electric dipole, Radiation from current elements (infinitesimal and half-wave). Dispersion - The frequency dependence of permittivity, permeability and conductivity, Dispersion in non-conductors, free electrons in conductors and plasma.

Texts and References:

1] J. D. Jackson: Classical Electrodynamics.

2] E. C. Jordan, K. G. Balman: Electromagnetic Waves & Radiating Systems by PHI 2nd Edition.
3] Hyat: Engineering Electromagnetics, TMH.
4] Paul, Whites, Nasar: Introduction to E.M. Fields, TMH.

ESL103.C NUMERICAL METHODS USING C

Unit-1: Elementary ideas on C: Data types, constants & variables, Arithmetic & logical operators, loops & control, function, pointers, structure, union, file handling.

Unit-2: C programs for applications of numerical techniques in electronic sciences – I: solution of linear algebraic equations (Gauss-Jordan Elimination, Gaussian Elimination with Back-substitution, LU Decomposition and Its Applications), Root Finding (Bisection, Secant Method, False Position Method, Newton-Raphson Method Using Derivative, Newton-Raphson Method for Nonlinear Systems of Equations).

Unit – 3: C programs for applications of numerical techniques in electronic sciences – II: differentiation of a function of single variable, partial differentiation of a multivariable function, integration of a function of single variable using Trapezoidal Rule & Simpson's 1/3rd rule.

Unit – 4: C Programs for applications of numerical techniques in electronic sciences – III: solution of a differential equation using Runge-Kutta 2nd Order Method, Predictor-Corrector Method; solution of partial differential equation using finite difference time domain technique.

BOOKS & REFERENCES:

1. Numerical Recipes in C – W. H. Press, S. A. Tukolsky, W. T. Vetterling & B. P. Flannery, Cambridge University Press.
2. C Language and Numerical Methods – C. Xavier, New Age International.

ESL104.C NETWORK ANALYSIS

Unit-1: Circuit elements: Resistance, inductance and capacitance parameters, active element conventions, Transformation of energy sources, loop variable and node variable analysis, Y-Δ transformation, Transfer impedance/admittance, **Network theorems**: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power transform theorem, Millman's theorem.

Unit-2 Characterization of linear time invariant two port network, Open circuit Impedance Parameter, Short circuit Admittance parameter, Transmission parameter, Inverse transmission parameter, Hybrid parameter, Inverse hybrid parameter, hybrid parameter in terms of other parameter, Output impedance, Image impedance.

Unit-3 Laplace transform of Unit step, Shifted unit step, Ramp and Impulse function, Transform impedance and transform circuits.
Network functions: Network functions for one port and two port networks, calculation of network functions Ladder network and general network, Poles and Zeros of network function, restriction of Poles and Zeros Location on transfer function and driving function.

BOOKS & REFERENCES:

1. Network Analysis – Van Valkenberge – PHI

ESL105.C SEMICONDUCTOR DEVICES

Unit – 1: Conductivity, Mobility and Hall Effect, Diffusion and drift of excess carriers, recombination mechanism, Trapping, Shockley–Read–Hall theory, Continuity Equation, Diffusion Length.

Unit-2 : P-N Junction Diode: Diffusion potential, Depletion region. Junction capacitance for an abrupt junction. Current voltage characteristics-Schottky equation. Photo-voltaic effect in pn junction.

Zener Diode: Junction Break down, tunneling and avalanche multiplication I-V characteristics, maximum rating of a Zener diode, application of Zener diode in voltage regulation.

Unit-3: Bipolar Junction Transistor (BJT): Basic current-voltage characteristics, current gain, Device Modeling: Ebers-Mol model.

Junction Field Effect Transistor (JFET): Basic current-voltage characteristics for uniform charge distribution, Diffusion of the linear saturation and breakdown regions in the I-V characteristics Equivalent circuit of JFET and frequency limitations.

Unit 4: Metal semiconductor junction and MOSFET : Metal semiconductor junction, Shottky effect**;** MOSFET: Different types of MOSFET: depletion and enhancement, n-channel and p-channel; Basic device characteristics, comparison of JFET and MOSFET

BOOKS & REFERENCES:

1. Solid state Electron Devices-B. G. Streetman.
2. Physics of semiconductor Devices-S. M. Sze.
3. Semiconductor Physics and Device – Neamen, McGraw Hill 3/e
4. Electronic Devices & Circuits – J. Millman and C. C. Halkias.

ESL106.C PASSIVE RF TECHNIQUES

Unit-I:

Transmission line: Transmission line characteristics; Transmission line equations and solution; Reflection coefficient and Transmission equation; Standing wave and standing wave ratio; Terminated Lossless Line impedance and admittance; Smith chart.
Waveguides & Planar Transmission Lines: Rectangular Waveguide - TE & TM modes, Dominant Mode, Cut-off frequency; Circular Waveguide - TE & TM modes, Dominant Mode, Surface wave concept - TM & TE Modes. Planar Transmission Line: Strip Line, Microstrip Line, Coplanar Waveguide (CPW). Wave Velocity & Dispersion- Group Velocity.

Unit-II:

Resonators & Networks: Series & Parallel Resonances, Transmission Line Resonator - Open & Short Circuited half-wavelength resonators; Dielectric Resonator - Resonant Frequencies.

Impedance & Equivalent Voltages & Currents - Even & Odd Properties; Z & Y Matrices - Reciprocal networks, Loss less networks; ABCD Matrix - Relation to Z Matrix, Equivalent Circuit for 2-Port Network; S Matrix - Reciprocal & Lossless Networks, Shift in Reference Planes. Signal Flow Graphs - Decomposition.

Unit-III:

Single & Double Stub Matching; Quarter Wave Transformer; Small Reflections - Single-Section & Multi-section transformers; Binomial & Chebyshev Multi-section Matching Transformers; Bode-Fano Criterion.

Unit-IV:

Dividers & Couplers: Basic Properties - 3 & 4 Port Networks; T-Junction Divider - Loss Less, Resitive; Wilkinson Divider - Even-Odd Mode Analysis; Quadrature (90^0) Hybrid; Coupled Line Directional Coupler (Excluding Multi section Coupler); Lange Coupler; The 180^0 Hybrid (only Ring Type).

Unit-V:

RF/Microwave Passive Filters: Periodic Structures - Analysis of Infinite Periodic Structure, Terminated Periodic Structure, k-beta diagram; Insertion Loss method; Filter Transformation; Coupled Line Filter; Coupled Resonator Filter - Bandpass filters using Quarterwave-Resonators & Capacitively coupled resonators.

BOOKS & REFERENCES:

1. Microwave Engineering – D. M. Pozar, Wiley Publication
2. Microwave Engineering – R. E. Collin, McGraw Hill Publication.

ESP107.C Applied Numerical Computing Lab

At least 12 Programs using C/ C++/ ForTran/ MATLAB/ SCILAB, depending on the facilities available in the Laboratory.

1. To Find out the root of the Algebraic and Transcendental equations using Bisection, Regula-falsi, Newton Raphson and Iterative Methods. Also find the rate of convergence of roots in tabular form for each of these methods.
2. To develop computer programs for solution of system of simultaneous linear equations using Gauss Elimination Technique, without and with specified boundary conditions, for full as well as bounded symmetric and unsymmetrical matrices
3. Solution of a system of simultaneous algebraic equations using the Gauss-Seidel iterative method employing the technique of successive relaxation.
4. To implement Newton's Forward and Backward Interpolation formula.
5. Linear and Non-Linear curve fitting technique.
6. To Integrate numerically using Trapezoidal rule.
7. To Integrate numerically using Simpson's rules.
8. To find the largest eigen value of a matrix by power-method.
9. To find numerical solution of ordinary differential equations by Euler's method.
10. Numerical solution of an ordinary differential equation using the Predictor – corrector method.
11. To find numerical solution of ordinary differential equations by Runge-Kutta method.
12. Numerical solution of a system of two ordinary differential equation using Numerical integration.
13. Numerical solution of an elliptic boundary value problem using the method of Finite Differences.

14. Numerical solution of an elliptic boundary value problem using the method of Finite Elements.
15. To find the numerical solution of Laplace equation.
16. To find numerical solution of wave equation.
17. Solution of difference equations.
18. Determination of time response of an R-L-C circuit.

ESP108.C Devices Lab

At least 8 Experiments depending on the facilities available in the Laboratory.

1. To study V-I characteristics of diode, and its use as a capacitance.
2. Study of Half wave & full wave rectifiers.
3. Study of Diode as clipper & clamper.
4. Study of Zener diode as a voltage regulator.
5. Study of the characteristics of transistor in Common Base configuration.
6. Study of the characteristics of transistor in Common Emitter configuration.
7. Study of CC amplifier as a buffer.
8. Graphical determination of small signal hybrid parameters of bipolar junction transistor.
9. Study of V-I characteristics of a photo-voltaic cell.
10. Study of characteristics of MOSFET/JFET is CS configuration.
11. To plot characteristics of thyristor.
12. To plot characteristics of UJT .
13. To plot characteristics of diac & Triac.
14. Study of loss factor in a dielectric by an impedance bridge.
15. Study of photo-resist in metal pattern for planar technology/PCB technology.

ESL201.C ANALOG CIRCUITS

Unit I: Amplifiers: Transistor parameters and equivalent circuit, amplifier characteristics of transistor in CE, CB and CC configurations, small signal low and high frequency transistor circuits and analysis, the Miller effect, RC Coupled amplifier-gain band width product, effect of cascading.

Unit II: Feedback in amplifiers, effect of negative feedback on gain, distortion, input and output resistances.

Unit III: Operational amplifiers: Differential amplifier, Basics of OP-AMP, inverting and non-inverting type, use of OP-AMP in scale changing, phase shifting, summing, voltage to current (and vice-versa) conversion, multiplying, differentiating and integrating circuits, Schmitt Trigger, Comparator.

Unit IV: Oscillators: Criterion for oscillation, analysis of Hartley, Colpitt, RC (phase shift) and Wein-bridge oscillator, circuit analysis of astable, monostable and bistable multivibrators using OP-Amps.

BOOKS & REFERENCES:

1. Electronic Device & Circuits – Millman, Halkies & Satyabrata Jit, TMH Publications.
2. Electronic Devices & Circuit Theory – Boylested and Nashelsky, PHI Publications
3. Operational Amplifier and Linear Integrated Circuits – R. F. Coughlin & F. F. Driscoll.

ESL202.E Active RF Devices & Circuits

Unit-1: Tunnel Diode: Degenerate semiconductors. Energy level diagrams of a tunnel diode with and without biasing, Transport mechanism and the origin of negative resistance region in I.-V characteristics.
IMPATT Diode: Static characteristics, Field distribution, Breakdown voltage, Space charge effect, dynamic characteristics, small signal Analysis.
Unit-2: Transferred-Electron Device (TED): Bulk negative differential resistivity (NDR). Energy band structures of GaAs and the transferred-electron effect.
Unit-3: Small signal amplifiers: Low noise, maximum gain, stability.
Broad band amplifiers: Matching circuits, traveling wave amplifiers.
Power amplifiers: Efficiency, device modeling, measurement.
Unit-4: Mixers: Single ended, balanced, double balanced, different configurations for microstrip, noise properties, simulations.
Oscillators: Various configurations using diode, BJT & FET, stability and noise, resonators, VCO.

BOOKS & REFERENCES:

1. Microwave Engineering – D. M. Pozar, Wiley Publication
2. Microwave Engineering – R. E. Collin, McGraw Hill Publication.

ESL203.C DIGITAL ELECTRONICS

Unit-1 Boolean algebra, DeMorgan's Law, Standard and K-map representation of logic functions, Simplification of Logical functions Using K-map, minimization of logical function specified in Minterms/Max terms, Don't care condition, NAND & NOR DTL Gates, Modified DTL Gates, TTL.

Unit-2 Binary adder, Binary substractor, Digital comparator, Parity checker/generator, Encoder/ Multiplexer, Decoder/Demultiplexer, Code Converters, BCD-to-7-segment Decoder/Driver.

Unit-3 Analog to Digital and Digital to Analog converters, ROM, 2-dimensional addressing of a ROM and their applications, elementary idea of RAM, EPROM and EEPROM**.**

Unit-4 1 bit-memory cell, Clocked S-R Flip Flop, J-K Flip flop, Master slave Flip Flop, T and D type Flip Flop, excitation table of Flip Flop, Conversion from one type of Flip Flop, Ripple counter, Synchronous counter, applications of counters, Shift register.

Text BOOKS & REFERENCES:

1. Modern Digital Electronics, 3rd edition by R.P.Jain, (TMH**)**
2. Digital Design by Mano (PHI)

ESL204.C LIGHTWAVE THEORY

Unit – I: Optical absorption, Electron-hole pair formation, Radiative and non-radiative recombination, light emitting diode: Electroluminiscent processes, LED materials, Device configuration and efficiency, Coupling Loss, Light output from LED, Heterojunction LED.

Unit – II: LASER Operating Principles: Spontaneous emission, stimulated emission and absorption of radiation in a two-level system, Einstein coefficients, population inversion, Gain in a two-level lasing medium; need for optical resonators, threshold condition for lasing, line shape function and line broadening mechanism, modes of rectangular cavity and open resonator.

Unit – III: Properties of LASER beam and Types of LASER:- Coherence: temporal, spatial; directionality. Doped insulator LASER (Ruby, Nd, YAG); Gas LASER: He-Ne, CO_2), Liquid dye LASER.

Unit – IV: Semiconductor LASER: - Lasing condition and gain coefficient in a semiconductor, relation of the gain co-efficient to current density, junction laser and operating principles, threshold current density for semi-conductor laser, threshold current density from spontaneous emission rate, power output, Heterojunction laser.

TEXT & REFERENCES

1. Semiconductor Electronic Devices – P. Bhattacharya
2. Optoelectronics: An introduction – J. Willson & J. F. B. Hawakakis (PHI)
3. LASERS-Theory & Applications: K. Thyagarajan & A. K. Ghatak
4. Semicondutor optoelectronic devices – P. Bhattacharya (PHI)
5. Optoelectronics and Fiber Optics Communications – C. K. Sarkar and D. C. Sarkar

ESL205.C BASIC CONTROL THEORY

Unit-I: Concept of control systems - Open & closed loop systems, Linear & Non-linear Systems, Difference between open & closed loop systems.
Mathematical models of physical systems: Electrical systems, Mechanical systems & their conversions, Transfer function, Block diagrams and signal flow graph, Mason's gain formula, Application of SFG.
Types of Feedback, Difference between positive and negative feedbacks, effects of feedback on control systems.
Unit-II: Time Domain Analysis - Types of standard signals (step, ramp, impulse & parabolic), 1st & 2nd Order Systems, Time response of 1st & 2nd order systems to Unit Step and Ramp input signals, Time Specifications, Steady State and transient response of systems, steady state error.
Unit-III: Stability Analysis of Control System - Necessary conditions of stability, Hurwitz stability criterion, Routh stability criterion and its applications. Root Locus concepts, Rules for construction of root loci.
Unit-IV: Frequency domain analysis - Bode plot, Stability from bode plots, Nyquist criterion & its application to determine stability. Gain & phase margin.

BOOKS/ References:

1. Control System Engineering - Dr. R. Anandanatarajan & P. Ramesh Babu, Scitech Publications (India) Pvt. Ltd. 92008)
2. Automatic Control System by B.C.Kuo (PHI)
3. Moden Control Engineering by K. Ogata (PHI)
4. Control Engineering by Nagarath & Gopal (New Age)
5. Modern Control Engineering by D. Roy Choudhury (PHI)
6. Control Systems, Theory and Applications by S. Ghos (Pearson Education).

ESP206.C Digital Electronics Lab

3 Credits (0-0-6)

At least 8 Experiments depending on the facilities available in the Laboratory.

1. Study of TTL gates – AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
2. Design & realize a given function using K-maps and verify its performance.
3. To verify the operation of multiplexer & Demultiplexer.
4. To verify the operation of comparator.
5. To verify the truth tables of S-R, J-K, T & D type flip flops.
6. To verify the operation of bi-directional shift register.
7. To design & verify the operation of 3-bit synchronous counter.
8. To design and verify the operation of synchronous UP/DOWN decade counter using J K flip-flops & drive a seven-segment display using the same.
9. To design and verify the operation of asynchronous UP/DOWN decade counter using J K flip-flops & drive a seven-segment display using the same.
10. To design & realize a sequence generator for a given sequence using J-K flip-flops.
11. Study of CMOS NAND & NOR gates and interfacing between TTL and CMOS gates.
12. Design a 4-bit shift-register and verify its operation . Verify the operation of a ring counter and a Johnson counter.
13. Design all gates using computer simulations.
14. Write programs for the following circuits, check the wave forms and the hardware generated
    a. half adder
    b. full adder
15. Write programs for the following circuits, check the wave forms and the hardware generated
    c. multiplexer
    d. demultiplexer
16. Write programs for the following circuits, check the wave forms and the hardware generated
    e. decoder
    f. encoder
17. Write a program for a comparator and check the wave forms and the hardware generated
18. Write a program for a code converter and check the wave forms and the hardware generated
19. Write a program for a FLIP-FLOP and check the wave forms and the hardware generated
20. Write a program for a counter and check the wave forms and the hardware generated
21. Write programs for the following circuits, check the wave forms and the hardware generated
    g. register
    h. shift register
22. Implement any three (given above) on FPGA/CPLD kit.
23. Simulate logic expressions and determine their truth tables.
24. Simulate logic expression of full adder circuit and determine its truth table.
25. Simulate a synchronous 4-bit counter and determine its count sequence.
26. Simulate a master-slave flip-flop using NAND gates and study its operation. Study the operation of asynchronous preset and clear.

ESP207.C Analog Circuits Lab

3 Credits (0-0-6)

At least 8 Experiments depending on the facilities available in the Laboratory.

1. To study Phase Shift Oscillator with and without buffer between RC Section.
2. To study operation of Hertly Oscillator.
3. To study operation of Instrumentation Amplifier.
4. To study the operation of Half wave voltage doubler.
5. To study Wein Bridge Oscillator and the effect on Output frequency of variation in RC combination.
6. To study the change in frequency of triangular wave with change in input voltage.
7. To study change in frequency of square wave with change in input voltage.
8. To determine CMRR of a differential amplifier.
9. To study op-amp based inverting and non-inverting amplifiers, voltage comparator and zero crossing detector.
10. To study op-amp based Adder and integrator circuits.
11. To study RC low pass and high pass active filters and draw outlput voltage waveform for square wave input.
12. To study Op-Amp based triangular wave generator.
13. To study operation of IC74123 as monostable multivibrator.
14. To design and fabricate Op-Amp. Base astable multivibrator and verify experimentally frequency of oscillation.
15. To study operation of IC NE/SE 566 voltage controlled oscillator and determine output frequency for various voltage levels.
16. To study Op-Amp. Based V to I and I to V converters.
17. To study a PLL circuit and determine the free running frequency.
18. To study Op-Amp. based sample and hold circuit.
19. Simulate and study half-wave, full-wave, and bridge-rectifier.
20. Simulate and study diode clipper and clamper circuits.
21. Simulate and study emitter bias and fixed bias BJT and JFET circuits, and determine quiescent conditions.
22. Simulate a common emitter amplifier using self biasing and study the effect of variation in emitter resistor on voltage gain , input and output impedance.
23. Determine the frequency response of Vo/Vs for CE BJT amplifier. Study the effect of cascading of two stages on band width.
24. Simulate and study Darlington pair amplifier circuit and determine dc bias and output ac voltage.
25. Study an operational amplifier and find out: CMMR, gain band width product, slew rate, 3-db frequency, and input offset voltage.
26. Simulate and study active low pass, high pass, and band pass filters.
27. Simulate and study class A, B, C, and AB amplifier.
28. Study the operation of 555 timer oscillator.

ESL301.C MICROPROCESSOR

Unit – I: Evolution. Architecture of 8085. CPU, Address & Data Bus. Memory mapping & organization. Register Organization. Memory mapped I/O & I/O mapped I/O.

Unit – II: Assembly Language Programming: Timing diagram of different cycles. Types of Addressing Modes. Instruction Set of 8085. Arithmetic, Data transfer, stack I/O instruction & programming as assembly language.

Unit – III: Architecture of 16-bit microprocessor: 8086, 8088. Types of addressing modes, Addressing & addressing decoding. Instructions set & assembly language programming.

Unit – IV: General purpose programmable peripheral devices 8255. Interfacing of 8151, 8251, 8253, 8257, 8259, 8279.

BOOKS & REFERENCES:

1. Microprocessor Architecture, Programming and Applications – R. S. Gaonkar
2. Microprocessor and Digital Systems – D. Hall
3. Microprocessor – S. I. Ahson

ESL302.C INSTRUMENTATION

Unit-1 Classification of Instrument, Errors in measurement, accuracy, precision, significant figures, statistical analysis, probability of error, limiting error.
DC volt meter, DC Ammeters, Ohm meter, analogue multimeter (VOM), a.c indicating instrument, electrodynamometer in power measurement, power factor meter.

Unit-2 Wheatstone bridge, A.C bridge and their application, Maxwell bridge, Hay bridge, Schering bridge, Wein bridge. Electronic multimeter, Digital voltmeter, Digital frequency meter , time period measurement technique.

Unit-3 CRO: CRT, electron gun, electrostatic focusing, electrostatic deflection, post deflection acceleration, Screen of CRT, Graticule, Acquadag, time base generator, Oscilloscope amplifier, Attenuator, measurement of voltage, current, phase and frequency in CRO. Multi input CRO, Analog storage oscilloscope and digital storage oscilloscope; seven segment display, Liquid crystal display.

Unit-4 Transducers: Classification of transducer, Displacement transducers, LVDT, strain gauge, resistance thermometer, thermistor, thermocouple, tachogenerators, Inductance, Capacitance, Piezoelectric, thermo electric, Hall Effect & Photoelectric Transducers.

BOOKS & REFERENCES:

1. Modern Electronic Instrumentation and Measurement techniques by A. Helfrick, W. Cooper (PHI)
2. Measurement Systems, Applications & Design – E. O. Deoblin
3. A course in Electrical and Electronics Measurement & Instrumentation by A.K.Sawhney
4. Principles of Industrial Instrumentation: D.Patronbis,
5. Electronics Measurement and Instrumentation : Oliver and Cage
6. Electronic Instrumentation – Rajan & Sharma
7. Instrumentation: Devices & Systems – Rangan, Sarma, Mani (TMH 3rd Ed.)

ESL303.C BASIC COMMUNICATION THEORY

Unit –1: Transmission through Linear System; Ideal and Practical Filters; Distortion over a channel; Energy and Energy Spectral Density; Power and Power Spectral Density (2 hours)

Unit –2: Linear Modulation: Principle, Generation, and Detection of DSB, DSB-SC, AM, and SSB; **Exponential Modulation:** Concept of Instantaneous Frequency, Bandwidth of Angle Modulated Wave, Indirect (Armstrong) and Direct Generation of FM, FM Demodulation***(6 hours)***

Unit – 3: Low Pass Signal Sampling approximations, Quantization, PCM, DPCM, Delta Modulation, Adaptive Delta Modulation, ASK, PSK, DPSK, and FSK. ***(7 hours)***

Unit – 4: AM receiver SNR, Noise in DSB-SC & SSB using coherent receiver, Noise in AM using envelop detection, Noise in FM system, FM threshold effects, Pre-emphasis and De-emphasis in FM, BW requirements for CW Modulation. ***(7 hours)***
Unit – 5: Discrete message, Concept of Information amount, Entropy, Information Rate, Coding to increase Average Information per Bit, Shannon's Theorem, Channel capacity, Gaussian Channel Capacity, BW-S/N Tradeoff, Orthogonal Signals for Shannon's Limit, Orthogonal Signal Transmission efficiency. ***(8 hours)***

BOOKS & REFERENCES:

1. Principles of Communication Systems – *Taub & Scheiling*, TMH – 2nd Edition.
2. Modern Digital and Analog Communication Systems – *B. P. Lathi*, OXFORD University Press, 3rd Edition.
3. Communication Systems – *Symon Hykins*, New Age International.
4. Electronic Communication System – *Kennedy*, TMH Publication.

ESL304.C SIGNALS AND SYSTEMS

Unit –1
Signals, Transformation of independent variables, Basic continuous time signals, Basic discrete time signals, Systems, properties of systems, Representation of signals in terms of impulses, continuous time systems, convolution integral, properties of LTI systems, Digital signal processing and its benefits, Discrete time LTI systems, Convolution sum. ***(6 hours)***

Unit-2
Typical real-time DSP systems, analog to digital conversion process, sampling-low pass and band pass signals, uniform and non-uniform quantisation and encoding, over sampling in A/D conversion, digital to analog conversion process: signal recovery, The DAC, anti-imaging filtering, over sampling in D/A conversion. ***(6 hours)***

Unit- 3
Response of continuous time LTI system to complex exponentials, representation of periodic signals, the continuous time Fourier series, Approximation of periodic signals using Fourier series, **Representation of aperiodic signals**: Frequency and impulse response of a LTI system characterized by differential equation, First order systems. ***(6 hours)***
Unit-4
Discrete Transform: introduction, Fourier series, The Fourier transform, DFT and its inverse, properties of the DFT, computational complexity of the DFT, **The decimation in time FFT algorithm**: the butterfly, computational advantage in FFT, Inverse FFT. ***(6 hours)***

Unit- 5
Discrete time signals and systems, The z-transform, **The inverse z-transform**: power series method, partial fraction expansion method, properties of the z-transform, some applications of the z-transform in signal processing: pole zero description of discrete time system, frequency response estimation via FFT, Difference equation, application in digital filter design. ***(6 hours)***

BOOKS & REFERENCES:
1. Fundamentals of Signals & Systems – M. J. Roberts (TMH)
2. Digital Signal processing A practical approach, by Emmanuel C. Ifeachor, Barrie W. Jervis, Pearson education 2nd edition.
3. Digital Signal Processing Principles, Algorithms and Applications by J. Prokais and D. G. Manolakis (PHI 3rd edition)
4. Theory and Problems of Signals and Systems Schaum Series

ESL305.C Radiating Systems and Electromagnetic Propagation

Unit – I: Antennas: radiation concepts (diploes, infinitesimal current element, half-wave current element), Antenna parameters (gain, efficiency, directivity, beam-width, bandwidth).
Unit – II: Analysis and synthesis of simple linear arrays (Array Factor, Pattern Multiplication, Array Directivity).
Unit – III: Principle of Reciprocity, Equivalence theorems and application to horns. Microstrip Antenna - Transmission Line Model.
Unit – IV: Ionospheric Propagation: Elementary ideas on formation of ionospheric layers, Ionosphere as a Plasma medium (determination of its dielectric constant), Skip Distance, Maximum Usable Frequency, Virtual Height, Secant Law, effects of earth's magnetic field.

BOOKS & REFERENCES:
1. R. E. Collin, Antennas and Radiowave Propagation, McGrawHill.
2. C. A. Ballanis, Antennas.
3. Raju, Antennas and Wave Propagation, Pearson Education.

ESP306.C Microprocessor and Microcontroller Lab
3 Credits (0-0-6)
At least 8 Experiments depending on the facilities available in the Laboratory.

1. Introduction to 8085 kit.
2. Addition of 2-8 bit number, sum 8- bit
3. Addition of 2-8 bit number, sum 16- bit
4. Subtraction of 2-8 bit number.
5. a) Find 1s complement of 8 bit number.
   b) Find 1s complement of 16 bit number.
6. a) Find 2s complement of 8 bit number.
   b) Find 2s complement of 16 bit number.
7. a) Shift an 8 -bit no. by one bit.
   b) Shift a 16 -bit no. by one bit.
8. Find Largest of two 8 bit numbers.
9. Find Largest among an array of ten numbers (8-bit).
10. Sum of series of 8 bit numbers.

8051 Micro Controller

11. Write an Assembly language Programme (ALP) to generate 10kHz square wave.
12. Write an ALP to generate 10 kHz frequency using interrupts.
13. Write an ALP to interface one Microcontroller with other wring serial/parallel communication.
14. Write an ALP for temperature & pressure measurement & to display on intelligent LCD display

PIC Microcontroller.

15. Write an ALP for PWM based speed control of motor .
16. Write an ALP for PWM based regulator of voltage.
17. Write an ALP to send/receive the data from an computer to MC through serial communication

General

18. Study of Development tools/environment for Microcontroller Programme.
19. Develop an embedded system for traffic light controller using Micro controller
20. Develop an embedded system for the automatic motion of a car (Model of car) & Subsequent display on LCD using Microcontroller.

ESP307.C Communication Lab

3 Credits (0-0-6)

At least 8 Experiments/ Simulations depending on the facilities available in the Laboratory.

1. To study amplitude modulation and determine depth of modulation.
2. To study generation of DSB-SC signal using balanced modulator.
3. To study generation of SSB signal
4. To study envelope detector for demodulation of AM signal and observe diagonal peak clipping effect.
5. To study super heterodyne AM receiver and measurement of sensitivity, selectivity and fidelity.
6. To study frequency modulation using voltage controlled oscillator.
7. To study operation of phased lock loop.
8. To detect FM signal using Phase Locked Loop.
9. To study operation of PLL as frequency multiplier/divider.
10. To study the operation of LM331 as V.F. converter.
11. To study the intensity modulation technique using digital input signal.
12. To measure noise figure using a noise generator.
13. To study PAM, PWM and PPM.
14. To realize PCM signal using ADC and reconstruction using DAC and 4 bit/8bit system. Observe quantization noise in each case.
15. To study Delta Modulation and Adaptive Delta Modulation.
16. To study PSK-modulation system.
17. To study FSK-modulation system.
18. To study sampling through a Sample-Hold circuit and reconstruction of the sampled signal and observe the effect of sampling rate & the width of the sampling pulses.
19. To study functioning of colour television
20. Fabricate and test a PRBS generator
21. Realization of data in different forms, such as MRZ-L,NRZ – M&N,NRZ-S.
22. Manchester coding & decoding (Biphase L) of NRZ-L data.
23. Study of wave guide components.

24. To study the characteristics of reflex Klystron and determine its timing range.
25. To measure frequency of microwave source and demonstrate relationship among guide dimensions, free space wave length and guide wavelength.
26. To measure VSWR of unknown load and determine its impedance using a smith chart.
27. To match impedance for maximum power transfer using slide screw tuner.
28. To measure VSWR, insertion losses and attenuation of a fixed and variable attenuator.
29. To measure coupling and directivity of direction couplers.
30. To measure insertion loss, isolation of a three port circulator.
31. To measure the Q of a resonant cavity.
32. To study the V-I characteristics of GUNN diode.
29. To represent basic signals (Unit step, unit impulse, ramp, exponential, sine and cosine).
30. To develop program for discrete convolution.
31. To develop program for discrete correlation.
32. To understand stability test.
33. To understand sampling theorem.
34. To design analog filter(low-pass, high pass, band-pass, band-stop).
35. To design digital IIR filters(low-pass, high pass, band-pass, band-stop).
36. To design FIR filters using windows technique.
37. To design a program to compare direct realization values of IIR digital filter
38. To develop a program for computing parallel realization values of IIR digital filter.
39. To develop a program for computing cascade realization values of IIR digital filter
40. To develop a program for computing inverse Z-transform of a rational transfer function.

ESL411.S MICROCONTROLLER

Unit-1 Intro to Microcontroller, Microprocessor vs. Microcontroller, CPU, The buses, Input output devices, Pin configuration of 8051.

Unit-2: I/O port structure, memory organization, Special function register, External RAM.

Unit-3: Addressing modes, Instruction types, Assembly language instructions.

Unit-4: Timer mode register, timer control register, timer modes & overflow flag, clocking sources, starting, stopping and controlling the timer, initializing and controlling timer, Baud rate generation.

BOOKS & REFERENCES:

1. The 8051 Microcontroller by I. Scott Mackenzie 2nd edition
2. The 8051 Microcontroller architecture, programming and application by K. J. Ayala.
3. The 8051 Microcontroller and embedded system by M. A. Mazidi, J. Mazidi.

ESL412.S Embedded system design

Unit-1 Introduction to embedded system, Processor in the system, software embedded into system, embedded system on chip.
Devices and device drivers: I/O devices, timer and counting devices, I/O buses, ISA, PCI, parallel and serial port device drivers, interrupt servicing mechanisms.

Unit-2 Software and programming concept: processor and memory selection for embedded systems, embedded programming in C++, multiple processes and application, sharing data by multiple tasks and routines, inter process communications.

Unit-3 OS services, I/O subsystems, network OS, RTOS and embedded system OS, need for a well tested and debugged RTOS.

Unit-4 Hardware and Software co-design: embedded system design and co-design issues, design cycle in the development phase for an embedded system, use of software tools. Case study of an embedded system for a smart card.

BOOKS & REFERENCES:

1. Embedded system architecture, programming and design, Raj Kamal, TMH
2. Hardware and software co-design of embedded systems, Ralf Niemann, Kluwer Academic.
3. Embedded Real Time System Programming, S. V. Iyer and Pankaj Gupta, TMH.

ESL413.S MICROPROCESSOR BASED BIOMEDICAL INSTRUMENTATION

Microprocessor Based Instrumentation:
Unit-1: General interfacing Technique, Input signals, output signals, GPIB (IEEE 488 family) bus interfacing system, RS232 family interfacing system.
Unit-2: Data acquisition systems, Interfacing of: Higher order Data converter, stepper motors and control, DC motor and control, elevator and traffic control systems.
Biomedical Instruments:
Unit-3: Biomedical signals and electrodes, Recording Systems.
Unit-4: ECG, Computer aided ECG analysis, Electroencephalograph, Introduction to biomedical telemetry.

BOOKS & REFERENCES:

4. Microprocessor Architecture, Programming and Applications – R. S. Gaonkar
5. Microprocessor and Digital Systems – D. Hall
6. Microprocessor – S. I. Ahson
7. Handbook of Biomedical Instrumentation – R. S. Khandpur
8. Biomedical Instrumentation – L. Cromwell

ESL414.S PROCESS & INTELLIGENT CONTROL SYSTEMS

Process Controller:
Unit-1: On-Off controller, P, PI, PD & PID controllers, microprocessor based PID Controller, microprocessor based temperature, pressure and flow control systems.
Intelligent Control System:
Unit-2: Introduction, Artificial Neural Network – Feedforward network, transfer functions, back propagation learning, Unsupervised network, static & dynamic networks, ANN based control, predictive control structure, Neuro PID controller. Knowledge Based Systems.
Unit-3: Fuzzy Logic – Linguistic variables, Fuzzy sets, Membership Functions, Fuzzification, Logical operator, Rule Base inference mechanism, Defuzzification, Introduction to Fuzzy control – Case study on Inverted Pendulum, Fuzzy tuning of PID Controller, Relationship between Fuzzy Systems & Neural Network.

BOOKS & REFERENCES:

1. Microprocessor Architecture, Programming and Applications – R. S. Gaonkar
2. Microprocessor and Digital Systems – D. Hall
3. Microprocessor – S. I. Ahson
4. An introduction to neural network – S. Hykins
5. Fuzzy Control – K. M. Passino

ESL415.S RADAR AND SATELLITE COMMUNICATION

RADAR System Concepts:
Unit-1: Radar Performance factors; Pulsed System – Basic pulsed radar system, antennas & scanning, display methods.
Unit-2: MTI Radar; Radar Beacons; CW Doppler Radar, Frequency modulated CW Radar.

Introduction to Satellite Communication:
Unit-3: Satellite orbit & position; Up-Down & Cross Links; Assignable Frequencies; Inside the Satellite - Transponder, Antenna System, Power package; Station keeping – Aligning the satellite dish, ground station, forms of modulation, free path space losses.
Unit-4: Satellite Parameters & Configurations; Capacity allocation: Frequency Division & Time Division.

BOOKS & REFERENCES:

1. Electronic Communication Systems – George Kennedy
2. Electronic Communications – R. E. Schoenback

ESL416.S WIRELESS AND COMPUTER COMMUNICATION

Unit-1: Communication Networks: LAN, MAN & WAN; Switching Techniques – Circuit switching, Packet switching; ATM.
Unit-2: Protocols & TCP/IP: Requirements, TCP/IP Architecture, OSI Architecture, Internetworking.
Wireless Communication:
Unit-3: Introduction to wireless communication system; Modern Wireless Communication Systems – 2G, 3G & Bluetooth; Cellular Concept – Frequency reuse, Channel Assignment, Handoff, Interference & system capacity, trunking, improving coverage & capacity.
Unit-4: Mobile Radio Propagation – Large Scale Path Loss, Small Scale Fading & Multipath; Multiple Access Techniques – FDMA, TDMA, Spreadspectrum, SDMA, Packet Radio, Capacity of Cellular Systems.

BOOKS & REFERENCES:

1. Wireless Communications principles & practices – T. S. Rapaport
2. Wireless Communications & Networks – W. Stallings

ESL417.S FIBRE OPTICS

Unit-1: Fiber propagation using ray model, material dispersion, the combined effect of material dispersion and multipath dispersion. Root mean square pulse width and frequency response attenuation mechanism.

Unit-2: Electromagnetic wave propagation in step index fiber Modes and rays, wave propagation modes in an ideal step index fiber. Weakly guiding solutions. Simple model fibers.
Unit-3: Electro magnetic wave propagation, in graded index fibers, Modes in graded index fibers. The equivalency of WKB approximation and the ray model. Inter mode dispersion in graded index fibers, Intra mode dispersion in graded index fibers, total dispersion in graded index fibers, mode coupling.

BOOKS

1. Optical communication system by John Gower. (PHI PVT. LTD. New Delhi: 1989)
2. Optical Fibre communication By G. Kaiser. (McGraw-Hill intcmational-1991)
3. Opto-electronics and Fiber Optics Communication; C. K. Sarkar and P. C. Sarkar (New Age)

ESL418.S Optical Communication: Devices & Systems

Unit-1: Modulation: Electro optic effect, E. O. retardation, A. M. phase modulation. Transverse electro optic modulator, acoustic optic effect and magneto optic effect.
Unit-2: Semiconductor p-i-n photo diode detectors, Quantum efficiency, material and designs for p-i-n diode. impulse and frequency response of a p-i-n photo diode. noise in p-i-n photo diode. Avalanche photo diode detectors. The multiplication process, APD design, APD band width, APD noise.
Unit-3: The receiver amplifier: Sources of receiving noise, voltage amplifier circuit the transimpedance, feed back amplifiers, switches and couplers

BOOKS

1. Optical communication system by John Gower. (PHI PVT. LTD. New Delhi: 1989)
2. Optical Fibre communication By G. Kaiser. (McGraw-hill intcmational-1991)
3. Opto-electronics and Fiber Optics Communication; C. K. Sarkar and D. C. Sarkar (New Age)

ESD401.C Project

The student and supervisor shall decide upon the topic, prepare a plan of work. The student shall make an open presentation in the Department. Following the presentation, the work-plan shall be approved by a committee of faculties, present on the day at the time of presentation, Chaired by the Head of the Department. The student shall carry out the project for the whole semester and on completion of the project submit a project report along with the Evaluation Report (Template of the Thesis and Format of the Report shall be provided by the HoD, Electronic Science Department of Berhampur University) duly signed by the supervisor to the Department. The student shall thereafter make the final presentation (open in nature) in the Department.

ESD402.C Seminar

The student may decide upon a topic in consultation with one or more faculties. Then the student shall submit a report and make an open presentation in the Department.

ESD403.C Grand Viva Voce
Student shall be evaluated, for his/her overall knowledge of the subject through Viva-Voce.