B.Tech (I&EE) detail Syllabus for Admission Batch 2015-16

First Year Engineering

First Semester								
	Theory					Practical		
Code	**Course Name**	**Hours/ Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/Week L/T**	**Credit Practical**	**Marks**
BS	Mathematics-I	3-1	4	100	50	-	-	-
BS	Chemistry/ Physics	3-0	3	100	50	2	1	50
ES	Basics of Electronics / Basic Electrical Engineering	3-0	3	100	50	2	1	50
ES	Mechanics/ Thermodynamics	3-0	3	100	50			
ES	Programming in 'c"	3-0	3	100	50	2	2	50
HS	English Communication Skill	3-0	2	100	50	2	1	50
ES	Engineering Workshop/ Engineering Drawing					4	2	100
Total		16	18	600	300	18	7	300
Total Marks: 1200								
Total Credits: 25								

Second Semester								
	Theory					Practical		
Code	**Course Name**	**Hours/week L/T**	**Credit Theory**	**University marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
BS	Mathematics-II	3-1	4	100	50	-	-	-
BS	Chemistry/ Physics	3-0	3	100	50	2	1	50
ES	Basics of Electronics / Basic Electrical Engineering	3-0	3	100	50	2	1	50
ES	Mechanics/ Thermodynamics	3-1	3	100	50			
ES	Data Structure Using 'C"	3-0	3	100	50	2	2	50
HS	Business communication	3-0	2	100	50	2	1	50
ES	Engineering Workshop/ Engineering Drawing					4	2	100
MC	NSS/NCC	-	-	-	-			
Total		17	18	600	300	14	7	300
Total Marks: 1200								
Total Credits: 25								

Second Year Engineering

Third Semester

	Theory					Practical		
Code	**Course Name**	**Hours/ week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
PC	Analog Electronics Circuit	3-0	3	100	50	2	1	50
PC	Electrical & Electronics Measurement	3-0	3	100	50	2	1	50
PC	Energy Conversion Devices	3-0	3	100	50	2	1	50
PC	Network Theory	3-0	3	100	50	2	1	50
PC	Electromagnetic Field Theory	3-1	4	100	50			
HS	Engineering Economics/ Organizational Behavior	2-1	3	100	50			
Total		19	19	600	300	8	4	200
Total Marks: 1100								
Total Credits: 23								
Honours	Solid State Devices	4	4	100	50			
Minor Specialization								

Fourth Semester

	Theory					Practical		
Code	**Course Name**	**Hours/ week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
HS	Purely Applied Mathematics for Specific Branch of Engineering	3-0	3	100	50			
PC	Communication System Engg.	3-0	3	100	50	2	1	50
PC	Control System Engg.	3-0	3	100	50	2	1	50
PC	Digital Electronics	3-0	3	100	50	2	1	50
PC	Instrument Devices & System-I	3-0	3	100	50	2	1	50
HS	Engineering Economics/ Organizational Behavior	2-1	3	100	50			
	*Skill Project and Hands on					6	3	100
Total		18	18	600	300	14	7	300
Total Marks: 1200								
Total Credits: 25								
Honours	Analog Signal Processing	4	4	100	50			
Minor Specialization								

- ***College should conduct at least one NSDC program under this category.**

Third Year Engineering

Fifth Semester								
	Theory					Practical		
Code	Course Name	Hours/week L/T	Credit Theory	University Marks	Internal Evaluation	Hours/ week L/T	Credit Practical	Marks
PC	Instrument Devices & System-II	3-0	3	100	50	2	1	50
PC	Microprocessor & its Interfacing	3-0	3	100	50	2	1	50
PC	Digital Signal Processing	3-0	3	100	50	2	1	50
PE	Radar & TV Engineering/Fibre Optics Instrumentation/Optoelectronics Device & Instrumentation/Advanced Electronics Circuits	3-1	4	100	50			
OE	Numerical Methods/Computer Network & Data Communication	3-1	4	100	50			
PC	Advance Lab-I					8	4	200
Total		17	17	500	250	14	7	350
Total Marks: 1100								
Total Credits: 24								
Honours	Analytical Instrumentation	4	4	100	50			
Minor Specialization	Microprocessors and Interfacing							

Sixth Semester								
	Theory					Practical		
Code	Course Name	Hours/week L/T	Credit Theory	University Marks	Internal Evaluation	Hours/week L/T	Credit Practical	Marks
PC	Process Control	3-0	3	100	50	2	1	50
PC	Industrial Automation	3-0	3	100	50	2	1	50
PE	Intelligent & Virtual Instrumentation/Advanced Control System/Process Simulation & Modelling	3-1	4	100	50			
PE	Biomedical Instrumentation/Wireless & Sensor Network/Robotics & Robot Applications	3-1	4	100	50			
MC & GS	Environmental Science & Engineering	3-0	3	100	50			
OE	Industrial Lecture #					3	1	50
HS	Presentation Skill & Skill for Interview # #	2-0	1		50	4	2	100
MC	Yoga					2	1	50
Total		19	18	500	300	13	6	300
Total Marks: 1100								
Total Credits: 24								
Honours	Power Electronics	4	4	100	50			
Minor Specialization	Industrial Automation							

 # To be conducted by the Training & Placement department by inviting experts from the industry. No academician to be called. Record may be asked by the University for verification. Evaluation to be done by the TPO.# # To be conducted by the Training & Placement department of the College.

Final Year Engineering

Seventh Semester								
	Theory					Practical		
Code	Course Name	Hours/week L/T	Credit Theory	University Marks	Internal Evaluation	Hours/week L/T	Credit Practical	Marks
GS	Nano Science & Bio Technology	3-1	4	100	50			
PE	Microwave & Antenna Engg./ Microcontroller & its Application/Satellite Communication/Digital Image Processing	3-1	4	100	50			
PE	VLSI Design/MEMS/Renewable Energy Sorces/embedded Systems	3-1	4	100	50			
OE	Soft Computing */ Other subjects	3-1	4	100	50			
PC	Advance Lab-II/ Project					8	4	200
	Projects on Internet of Things					8	4	200
Total		16	16	400	200	16	8	400
Total Marks: 1000								
Total Credits: 24								
Honours	Advanced Process Control	4	4	100	50			
Minor Specialization								

*Student can choose from any department but subject must be running in that semester.

Eigth Semester						
	Training cum Project				Evaluation Scheme	
Code	Course Name	Hours/week L/T	Credit Theory	Total Marks		Marks
	Industrial Training cum Project/ Entrepreneurship Training cum Project / Stratup Training cum Project	30	20	1000	Evaluation by the Industry / Training Organisation	500
					Evaluation by the Institute (Report & Institute Viva)	500
Total		30	20	1000		1000
Total Marks:1000						
Total Credits:20						

Note- Minimum Pass Mark from Industry Evaluation is 300 (i.e. 60%).

Distribution of Credit Semester wise:

Semester	Credit
First	25
Second	25
Third	23
Fourth	25
Fifth	24
Sixth	24
Seventh	24
Eighth	20
Total	190

Internal Evaluation Scheme

Attendance & Class Interaction	**05**
Assignment	**05**
Surprise Test	**05**
Quiz	**05**
Class Test I & II	**30**
Total	**50**
Class Test Time(Hrs.): 1	

Pass Mark in Internal is 50% of total marks i.e. 25

External Evaluation Scheme

University Semester Examination of 3 Hours duration.
Pass mark will be 35% which means students have to score 35 out of 100.

Practical/Sessional Evaluation Scheme

Pass mark will be 50% which means students have to score 25 out of 50.
Evaluation Scheme

Attendance & Daily Performance	-10
Lab Record	- 10
Lab Quiz	- 05
Final Experiments & Viva	– 25
	Total=50

All Lab examinations are to be completed one week before the end semester examination and marks are to be displayed on the college notice board.

DETAIL SYLLABUS
FROM
III - VIII SEMESTER OF B.TECH. DEGREE PROGRAMME

for

ADMISSION BATCH 2015-16

BRANCH-INSTRUMENTATION AND ELECTRONICS ENGINEERING

Second Year Engineering

Third Semester

	Theory					Practical		
Code	**Course Name**	**Hours/ week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
PC	Analog Electronics Circuit	3-0	3	100	50	2	1	50
PC	Electrical & Electronics Measurement	3-0	3	100	50	2	1	50
PC	Energy Conversion Devices	3-0	3	100	50	2	1	50
PC	Network Theory	3-0	3	100	50	2	1	50
PC	Electromagnetic Field Theory	3-1	4	100	50			
HS	Engineering Economics/ Organizational Behavior	2-1	3	100	50			
Total		19	19	600	300	8	4	200
Total Marks: 1100								
Total Credits: 23								
Honours	Solid State Devices	4	4	100	50			
Minor Specialization								

3rd Semester

ANALOG ELECTRONICS CIRCUIT (3-0-2)

MODULE – I **(12 Hours)**

MOS Field-Effect Transistor: Principle and Operation of FETs and MOSFETs; P-Channel and N-Channel MOSFET; Complimentary MOS; V-I Characteristics of E- MOSFET and D-MOSFET; MOSFET as an Amplifier and as a Switch. (4 Hours)

Biasing of BJTs: Load lines (AC and DC); Operating Points; Fixed Bias and Self Bias, DC Bias with Voltage Feedback; Bias Stabilization; Examples. (4 Hours)

Biasing of FETs and MOSFETs: Fixed Bias Configuration and Self Bias Configuration, Voltage Divider Bias and Design (4 Hours)

MODULE – II **(12 Hours)**

Small Signal Analysis of BJTs: Small-Signal Equivalent-Circuit Models; Small Signal Analysis of CE, CC, CB amplifiers. Effects of R_S and R_L on CE amplifier operation, Emitter Follower; Cascade amplifier, Darlington Connection and Current Mirror Circuits.

Small Signal Analysis of FETs: Small-Signal Equivalent-Circuit Model, Small Signal Analysis of CS, CD, CG Amplifiers. Effects of R_{SIG} and R_L on CS Amplifier; Source Follower and Cascaded System. (6 Hours)

MODULE – III **(5 hours)**

High Frequency Response of FETs and BJTs: High Frequency equivalent models and frequency Response of BJTs and FETs; Frequency Response of CS Amplifier, Frequency Response of CE Amplifier. (5 Hours)

MODULE – IV (9 hours)

Feedback amplifier and Oscillators: Concepts of negative and positive feedback; Four Basic Feedback Topologies, Practical Feedback Circuits, Principle of Sinusoidal Oscillator, Wein-Bridge, Phase Shift and Crystal Oscillator Circuits. (4 Hours)

Operational Amplifier: Ideal Op-Amp, Differential Amplifier, Op-Amp Parameters, Non-inverting Configurations, Open-loop and Closed-loop Gains, Differentiator and Integrator, Instrumentation amplifier. (5Hours)

Additional Module (Terminal Examination-Internal) **(6 hours)**

Basic analysis of difference amplifier, Simulation of analog circuits i.e., different single and cascaded amplifier circuits, difference amplifier circuits and validating the theoretical parameters using PSpice and MULTISIM. Analysis op-amp IC circuits using LF411 and μA 741, Signal Generators using OPAMP: Square, triangle and ramp generator circuits using opamps - Effect of slew rate on waveform generation-introduction to analog simulation OPAMP as nonlinear element: comparator, Voltage controlled oscillator (VCO). Concept of Schmitt triggers circuit and sample/hold circuit using operational amplifier

Text Books

1. *Electronic Devices and Circuits theory, R.L. Boylestad and L. Nashelsky, Pearson Education, New Delhi , 9th/10th Edition,2013. (Selected portions of Chapter 4, 5, 6, 7, 8, 9, 10, 11, 12, and 14)*
2. *Milliman's Electronics Devices and Circuits, J. Milliman, C. Halkias, S. Jit., Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2nd Edition,2008.*

Reference Books

1. *Microelectronics Circuits, Adel Sedra and Kenneth C Smith, Oxford University Press, New Delhi, 5th Edition, International Student Edition,2009. (Selected portion of Chapter 2,4, 5, 6, 8, 13, and 14)*
2. *Electronic Devices and Circuits, Jimmie J. Cathey adapted by Ajay Kumar Singh, Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, (For Problem Solving)*
3. *Electronics Circuits Analysis and Design, Donald A. Neamen, Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition,2002.*
4. *Integrated Electronics: Analog and Digital Circuits and Systems, J. Milliman, C. Halkias, Tata McGraw Hill Publishing Company Ltd., New Delhi,2nd Edition.2004.*
5. *Microelectronic Circuits: Analysis and Design, M.H. Rashid, PWS Publishing Company, a division of Thomson Learning Inc. India Edition.*
6. *Electronic device and circuits, David A. Bell, Oxford University Press, 5thedition,2008.*
7. *Electronics devices and circuits, Anil.K.Maini, Wiley India Pvt.Ltd,2009*

ANALOG ELECTRONICS CIRCUIT LAB

List of Experiments

(At least 10 out of 12 experiments should be done)

1. *Design and simulate BJT bias circuit and compare the results.*
2. *Design and simulate JEET/MOSFET bias circuit and compare the results.*
3. *Design and simulate BJT common-emitter circuit and compare D.C and A.C performance:*
4. *Design and simulate JFET/MOSFET common-emitter circuit and compare D.C and A.C performance:*
5. *Determining the frequency response of a common-emitter amplifier: low frequency, high frequency and mid frequency response and compare with simulated results.*
6. *Differential amplifiers circuits: D.C bias and A.C operation without and with current source.*
7. *Study of Darlington connection and current mirror circuits.*
8. *OP-Amp Frequency Response and Compensation.*
9. *Application of Op-Amp as differentiator, integrator, square wave generator.*
10. *Obtain the band width of FET/ BJT using Square wave testing of an amplifier.*
11. *R.C phase shift oscillator/Wien-Bridge Oscillator using OP-Amp/Crystal Oscillator.*
12. *Class A and Class B Power Amplifier.*

3rd Semester

ELECTRICAL AND ELECTRONICS MEASUREMENT(3-0-2)

MODULE- I **[10 Hrs]**

University Portion (80%): (8 Hrs)

Measurement and Error: (2Hrs) Definition, Accuracy and Precision, Significant Figures, Types of Errors. **Text book-2-Ch-[1.1 to 1.4]**

Standards of Measurement: (1 Hrs) Classification of Standards, Electrical Standards, IEEE Standards. **Text Book-2- Ch-[3.1,3.4,3.6]**

Types of measuring instrument: (5 Hrs) Ammeter and Voltmeter: Derivation for Deflecting Torque of; PMMC, MI (attractionand repulsion types), Electro Dynamometer and Induction type Ammeters and Voltmeters. Energy meters and wattmeter.:Construction, Theory and Principle of operation of Electro-Dynamometer and Induction type wattmeter, compensation, creep, error, testing, Single Phase and Polyphase Induction type Watt-hour meters. Frequency Meters: Vibrating reed type, electrical resonance type, Power Factor Meters. **Text Book-1- Ch- [XVIII,XIX,XX,XXI,XXII]**

College/Institute Portion (20%): (2 Hrs)

Measuring instruments: Absolute and secondary instrument, indicating and recording instrument. **Text Book-1- Ch-XVII.**Or related advanced topics as decided by the concerned faculty teaching the subject.

MODULE-II **[10 Hrs]**

University Portion(80%): (8 Hrs)

Measurement of Resistance, Inductance and Capacitance: (8 Hrs)

Resistance: Measurement of Low Resistance by Kelvin's Double Bridge, Measurement of Medium Resistance, Measurement of High Resistance, Measurement of Resistance of Insulating Materials, Portable Resistance Testing set (Megohmmeter), Measurement of Insulation Resistance when Power is ON, Measurement of Resistance of Earth Connections.

Inductance: Measurement of Self Inductance by Ammeter and Voltmeter, and AC Bridges (Maxwell's, Hay's, & Anderson Bridge), Measurement of Mutual Inductance by Felici's Method, and as Self Inductance.

Capacitance: Measurement of Capacitance by Ammeter and Voltmeter, and AC Bridges (Owen's, Schering & Wien's Bridge), Screening of Bridge Components and Wagnor Earthing Device. **Text Book-1- Ch-[VI, VII]**

College/Institute Portion (20%): (2 Hrs)

Transducer: Strain Gauges, Thermistors, Thermocouples, Linear Variable Differential Transformer (LVDT), Capacitive Transducers, Peizo-Electric transducers, Optical Transducer, Torque meters, inductive torque transducers, electric tachometers, photo-electric tachometers, Hall Effect Transducer. (**Text Book-2- Ch-11.1 to 11.6).**Or related advanced topics as decided by the concerned faculty teaching the subject.

3rd Semester

MODULE- III **[10 Hrs]**

University Portion (80%): (8 Hrs)

Galvanometer: (5 Hrs) Construction, Theory and Principle of operation of D'Arsonval, Vibration (Moving Magnet & Moving Coil types), and Ballistic Galvanometer, Influence of Resistance on Damping, Logarithmic decrement, Calibration of Galvanometers, Galvanometer Constants, Measurement of Flux and Magnetic Field by using Galvanometers.

Potentiometer: (3 Hrs) Construction, Theory and Principle of operation of DC Potentiometers (Crompton, Vernier, Constant Resistance, & Deflection Potentiometer), and AC Potentiometers (Drysdale-Tinsley & Gall-Tinsley Potentiometer). **Text Book-1- Ch-[VIII,IX]**

College/Institute Portion (20%): (2 Hrs)

pH- Meter, volt ratio boxes and other auxiliary apparatus. **Text Book-1- Ch- VIII.**Or related advanced topics as decided by the concerned faculty teaching the subject.

MODULE- IV **[10 Hrs]**

University Portion(80%): (8 Hrs)

Current Transformer and Potential Transformer :(3 Hrs) Construction, Theory, Characteristics and Testing of CTs and PTs.

Electronic Instruments for Measuring Basic Parameters:(2 Hrs) Amplified DC Meters, AC Voltmeters using Rectifiers, True RMS Voltmeter, Considerations for choosing an Analog Voltmeter, Digital Voltmeters (Block Diagrams only), Q-meter

Oscilloscope:(3 Hrs) Block Diagrams, Delay Line, Multiple Trace, Oscilloscope Probes, Oscilloscope Techniques, Introduction to Analog and Digital Storage Oscilloscopes, Measurement of Frequency, Phase Angle, and Time Delay using Oscilloscope.

Text Book-2- Ch- [6.2 to 6.9, 7.2, 7.6, 7.7]

College/Institute Portion (20%): (2 Hrs)

[Wave analyser and Counter. (**Text Book-2- Ch- 9.2,9.3,9.4,10.1)].** Or related advanced topics as decided by the concerned faculty teaching the subject.

Text Book(s):

1. *Electrical Measurements and Measuring Instruments – Golding & Widdis – 5th Edition, Reem Publication.*
2. *Modern Electronic Instrumentation and Measurement Techniques – Helfrick & Cooper – Pearson Education.*

Reference Book(s):

1. *A Course in Electrical and Electronic Measurements and Instrumentation – A K Sawhney – Dhanpat Rai & Co.*
2. *Electronic Instrumentation – H C Kalsi – 2nd Edition, Tata McGraw Hill.*
3. *Electronic Measurement and Instrumentation – Oliver & Cage – Tata McGraw Hill.*

3rd Semester

ELECTRICAL AND ELECTRONICS MEASUREMENTLAB

Select any 8 experiments from the list of 10 experiments

1. *Measurement of Low Resistance by Kelvin's Double Bridge Method.*
2. *Measurement of Self Inductance and Capacitance using Bridges.*
3. *Study of Galvanometer and Determination of Sensitivity and Galvanometer Constants.*
4. *Calibration of Voltmeters and Ammeters using Potentiometers.*
5. *Testing of Energy meters (Single phase type).*
6. *Measurement of Iron Loss from B-H Curve by using CRO.*
7. *Measurement of R, L, and C using Q-meter.*
8. *Measurement of Power in a single phase circuit by using CTs and PTs.*
9. *Measurement of Power and Power Factor in a three phase AC circuit by two-wattmeter method.*
10. *Study of Spectrum Analyzers.*

ENERGY CONVERSION DEVICES (3-0-2)

University Level

MODULE-I **(12Hrs)**

GENERAL PRINCIPLES OF DC MACHINES: Constructional Features, Methods of Excitation, Expression for EMF Induced and Torque Developed in theArmature.
DC GENERATORS: No Load Characteristics for Separately Excited DC Generator and DC Shunt Generator, Conditions for Self Excitation, Critical Resistance and Critical Speed, Losses andEfficiency.
DC MOTORS: Speed~Armature Current, Torque~Armature Current and Speed~Torque Characteristic for (i) Separately Excited DC Motor, (ii) DC Shunt Motor, (iii) DC Series Motor, and (iv) DC Compound Motor, Speed control and Starting of DC shunt and DC series motors, Comparison Between Different types of DC Motors and theirApplication.

MODULE-II **(9 Hrs)**

TRANSFORMERS: Constructional Features, EMF Equation, Turns Ratio, And Determination of Parameters From Tests (Open Circuit Test and Short Circuit Test), Equivalent Circuit, Losses and Efficiency, Introduction to Three Phase Transformers: Three Single Phase

Transformers Connected as a Bank of Three PhaseTransformer, Introduction to Auto transformer

THREE PHASE SYNCHRONOUS MACHINES: Constructional Features, Principle of operation as Alternator and Synchronous Motor, Starting of SynchronousMotor.

MODULE-III **(9 Hrs)**

THREE PHASE INDUCTION MOTORS: Constructional Features of Squirrel Cage Rotor type and Slip Ring/Wound Rotor type of Induction Motors, Principle of Operation, Concept of Slip, Slip~Torque Characteristics, Starting of Squirrel Cage Rotor type and Slip Ring/Wound Rotor type of Induction Motors, Speed Control of InductionMotors
Principles of Single phase Induction motors, stepper motor, AC & DC servo motor and their application

Institution Level

Revolving Field Theory, Split Phase (capacitor start and run) and Shaded Pole Starting of Single Phase Induction Motors, Speed~Current, Torque~Current and Speed~Torque Characteristic for Single Phase AC Series Motor.

Text Book :

1. *Theory and Performance of AC Machines – M G Say – CBS Publication*
2. *The Performance and Design of DC Machines – A E Clayton*

Reference Book(s):

1. *ElectricMachines–DPKothari&IJNagrath–TataMcGrawHill.*
2. *Electrical Machinery – P S Bimbhra – Khanna Publishers.*
3. *Electric Machinery – Fitzgerald, Charles Kingsley Jr., S. D. Umans – Tata Mc GrawHill.*
4. *Electric Machinery And Transformers –Guru & Hiziroglu –Oxford UniversityPress.*

ENERGY CONVERSION DEVICES LAB

(Select any 8 experiments from the list of 10 experiments)

1. *Determination of critical resistance and critical speed from no load test of a DC shuntgenerator.*
2. *Plotting of Magnetization characteristics of a separately excited DC generator.*
3. *Starting of DC shunt motors by 3-point/ 4-pointstarter.*
4. *Speed control of DC shunt motor by armature control and flux controlmethod.*
5. *Determination of Efficiency by Open Circuit and Short Circuit test on single phase transformer.*
6. *Polarity test and Parallel operation of two single phasetransformers.*
7. *Load test of three phase inductionmotors.*
8. *Speed control of induction motor using frequency control.*
9. *Calculation of slip and efficiency of three phase squirrel cage induction motor at fullload.*
10. *Starting of single phase inductionmotors*

3rd Semester

NETWORK THEORY(3-0-2)

MODULE- I (10 Hrs)

Network Topology: Graph of a network; Concept of tree; Incidence matrix; Tie-setmatrix; Cut-set matrix; Formulation and solution of network equilibrium equations on loop and node basis.

Network Theorems & Coupled Circuits: Substitution theorem; Reciprocity theorem; Maximum power transfer theorem; Tellegen's theorem; Millman's theorem; Compensation theorem; Coupled Circuits; Dot Convention for representing coupled circuits; Coefficient of coupling.

MODULE- II (08 Hrs)

Laplace Transform & Its Application: Introduction to Laplace Transform, Laplace transform of some basic functions, Laplace transform of periodic functions, Inverse Laplace transform, Application of Laplace transform: Circuit Analysis (Steady State and Transient).

MODULE- III (08 Hrs)

Two Port Network Functions & Responses: z, y, ABCD and **h**-parameters; Reciprocity and Symmetry; Interrelation of two-port parameters, Interconnection of two-port networks; Network Functions; Significance of Poles and Zeros, Restriction on location of Poles and Zeros, Time domain behaviour from Pole-Zero plots.

MODULE- IV (08 Hrs)

Fourier Series and Fourier Transform: Fourier series, Fourier analysis and evaluation of coefficients; Steady state response of network to periodic signals; Fourier transform and convergence; Fourier transform of some functions; Brief idea about network filters (Low pass, High pass, Band pass and Band elimination) and their frequency response.

Additonal Module (Terminal Examination-Internal) (08 hours)

Network Synthesis: On network synthesis.

Text Book(s)

1. *Network Analysis, M E Van Valkenburg, PHI, third edition.*
2. *Fundamentals of Electric Circuits, Charles K Alexander & Mathew N.O. Sadiku, Tata McGraw Hill, fifth edition.*

Reference Book(s)

1. *Network Theory, Smarajit Ghosh, PHI, first edition(2005)*
2. *Network Theory, P K Satpathy, P Kabisatpathy, S P Ghosh and A K Chakraborty Tata McGraw Hill, New Delhi.*
3. *Fundamentals of Network analysis and Synthesis, K.M.Soni, S.K.Kataria and Sons (2010) ninth edition*
4. *Network Analysis and Synthesis, Franklin F. Kuo ,Wiley Student Edition, second edition 2006*

3rd Semester

NETWORK THEORY LAB

List of Experiments
(At least 8 out of 10 experiments should be done)

1. *Verification of Network Theorems (Superposition, Thevenin, Norton, Maximum Power Transfer).*
2. *Study of DC and AC Transients.*
3. *Determination of circuit parameters: Open Circuit and Short Circuit parameters.*
4. *Determination of circuit parameters: Hybrid and Transmission parameters.*
5. *Frequency response of Low pass and High Pass Filters.*
6. *Frequency response of Band pass and Band Elimination Filters.*
7. *Determination of self inductance, mutual inductance and coupling coefficient of a single phase two winding transformer representing a coupled circuit.*
8. *Study of resonance in R-L-C series circuit.*
9. *Study of resonance in R-L-C parallel circuit.*
10. *Spectral analysis of a non-sinusoidal waveform.*

ELECTROMAGNETIC FIELD THEORY(3-1-0)

MODULE – I (13 Hours)

1. Vectors and Fields: Cartesian Coordinate System, Cylindrical and Spherical coordinate system, Vector Algebra, Scalar and Vector Fields, gradient, divergence, curl operations, The Laplacian, Divergence Theorem, Stoke's Theorem ,Useful vector identities and their derivations. (selected portions from 1.01 to 1.05 of TB-1)

2.: Electric and Magnetic fields: Field due to a line/sheet/volume charge, Biot _Savart Law,Gauss's Law for Electric Field and Magnetic Field, Fields of electric and magnetic dipoles, Applications of electrostatics and magnetostatics, Faraday's Law, Ampere's Circuital Law. (portions 3.4.to 3.6, 4.4.3,4.6, 4.8,4.9, 8.3 to 8.8 and 9.2 of TB-2)

3. Maxwell's Equations: Divergence and Differential Form, Line Integral, Surface Integral and Integral form, Faradays Law, Ampere's Circuital Law, Gauss's Law for Electric Field and Magnetic Field. (portions 4.01 to 4.03 of TB-1)

MODULE – II (13 Hours) (Portions 5.01 to 5.13 of TB-1)

4. Wave Propagation in Free Space: The electromagnetic wave equation and its solution, Uniform Plane Waves, Direction cosines, Concept on TEM mode, Poynting Vector and Power density

5. Wave Propagation in Material Media: Conductors and Dielectrics, Magnetic Materials, Wave Equation and Solution, Uniform Plane Waves in Dielectrics and Conductors, Polarization, Boundary Conditions, Reflection and Transmission of Uniform Plane Waves at the boundary of two media for normal and oblique incidence, Brewster's angle.

MODULE – III (10 Hours)

6. Transmission Line Analysis: Transmission lines, Circuit representation of a parallel plane transmission line, Parallel plane transmission lines with loss, E and H about long parallel cylindrical conductors of arbitrary cross section, Transmission line theory, UHF lines as circuit elements (portions 7.10 to 7.16 of TB-1)

7. Wave Guide Principles: Rectangular guides, TM waves in rectangular guides, TE waves in rectangular guides, Impossibility of TEM wave in wave guides, wave impedance and characteristic impedances, Attenuation factor and Q of wave guides, Dielectric Slab Guide ,(portions 8.01 to 8.04, 8.08,8.10,8.11 of TB-1).

Text Book(s):

1. *Electromagnetic Waves and Radiating Systems, 2nd Edition, E.C. Jordan and K.G. Balmain, Pearson Education, New Delhi.*
2. *Engineering Electromagnetic, 2nd Edition, Nathan Ida, Springer*
3. *Electromagnetic, 2nd Edition, Joseph A. Edminister, adapted by Vishnu Priye, Tata McGraw Hill Publishing Company Ltd., New Delhi. (For Problem Solving)*

Reference Book(s):

1. *Fundamentals of Electromagnetic for Engineering, First Impression – 2009, N. N. Rao, Pearson Education, New Delhi.*
2. *Engineering Electromagnetic, 7th Edition, William H. Hyat, Tata McGraw Hill Publishing Company Ltd., New Delhi.*
3. *Elements of Electromagnetic, Mathew N.O. Sadiku, Oxford University Press, New Delhi.*
4. *Electromagnetic Field Theory Fundamentals, B.S. Guru and H.R. Hiziroglu, PWS Publishing Company, a division of Thomson Learning Inc*

3rd Semester

ENGINEERING ECONOMICS

Theory L/T (Hours per week):2/1, Credit: 3

Module I (12 hours)

Engineering Economics- Nature, Scope, Basic problems of an economy, Micro Economics and Macro Economics.

Demand- Meaning of demand, Demand function, Law of Demand and its exceptions, Determinants of demand, Elasticity of demand & its measurement (Simple numerical problems to be solved), Supply-Meaning of supply, Law of supply and its exception, Determinants of supply, Elasticity of supply, Determination of market equilibrium (Simple numerical problems to be solved).

Production-Production function, Laws of returns: Law of variable proportion, Law of returns to scale

Module II (12 hours)

Cost and revenue concepts, Basic understanding of different market structures, Determination of equilibrium price under perfect competition (Simple numerical problems to be solved), Break Even Analysis-linear approach (Simple numerical problems to be solved).

Banking -Commercial bank, Functions of commercial bank, Central bank, Functions of Central Bank.

Inflation-Meaning of inflation, types, causes, measures to control inflation.

National Income-Definition, Concepts of national income, Method of measuring national income.

Module III (12 hours)

Time value of money- Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence.

Evaluation of engineering projects-Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects .

Depreciation- Depreciation of capital assert, Causes of depreciation, Methods of calculating depreciation (Straight line method, Declining balance method), After tax comparison of project.

Text Books

1. *Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India*
2. *Principles of Economics, Deviga Vengedasalam; Karunagaran Madhavan, Oxford University Press.*
3. *Engineering Economy by William G.Sullivan, Elin M.Wicks, C. Patric Koelling, Pearson*
4. *R.Paneer Seelvan, " Engineering Economics", PHI*
5. *Ahuja,H.L., "Principles of Micro Economics" , S.Chand & Company Ltd*
6. *Jhingan,M.L., "Macro Economic Theory"*
7. *Macro Economics by S.P.Gupta, TMH*

3rd Semester

ORGANIZATIONAL BEHAVIOUR

Credit- 3 Class Hours - 40

Objectives:

1. To develop an understanding of the behavior of individuals and groups inside organizations
2. To enhance skills in understanding and appreciating individuals, interpersonal, and group process for increased effectiveness both within and outside of organizations.
3. To develop theoretical and practical insights and problem-solving capabilities for effectively managing the organizational processes.

Unit	Contents	Class Hours
01	Fundamentals of OB: Definition, scope and importance of OB, Relationship between OB and the individual, Evolution of OB, Theoretical framework (cognitive), behavioristic and social cognitive), Limitations of OB.	6
02	Attitude: Importance of attitude in an organization, Right Attitude, Components of attitude, Relationship between behavior and attitude, Developing Emotional intelligence at the workplace, Job attitude, Barriers to changing attitudes. Personality and values: Definition and importance of Personality for performance, The Myers-Briggs Type Indicator and The Big Five personality model, Significant personality traits suitable to the workplace (personality and job – fit theory), Personality Tests and their practical applications. Perception: Meaning and concept of perception, Factors influencing perception, Selective perception, Attribution theory, Perceptual process, Social perception (stereotyping and halo effect). Motivation: Definition & Concept of Motive & Motivation, The Content Theories of Motivation (Maslow's Need Hierarchy & Herzberg's Two Factor model Theory), The Process Theories (Vroom's expectancy Theory & Porter Lawler model), Contemporary Theories – Equity Theory of Work Motivation.	10
03	Foundations of Group Behavior: The Meaning of Group & Group behavior & Group Dynamics, Types of Groups, The Five – Stage Model of Group Development. Managing Teams: Why Work Teams, Work Teams in Organization, Developing Work Teams, Team Effectiveness & Team Building. Leadership: Concept of Leadership, Styles of Leadership, Trait Approach Contingency Leadership Approach, Contemporary leadership, Meaning	9

	and significance of contemporary leadership, Concept of transformations leadership, Contemporary theories of leadership, Success stories of today's Global and Indian leaders.	
04	Organizational Culture : Meaning & Definition of Organizational Culture, creating & Sustaining Organizational Culture, Types of Culture (Strong vs. Weak Culture, Soft Vs. Hard Culture & Formal vs. Informal Culture), Creating Positive Organizational Culture, Concept of Workplace Spirituality.	8
05	Organizational Change: Meaning, Definition & Nature of Organizational Change, Types of Organizational Change, Forces that acts as stimulants to change. Implementing Organizational Change : How to overcome the Resistance to Change, Approaches to managing Organizational Change, Kurt Lewin's-Three step model, Seven Stage model of Change & Kotter's Eight-Step plan for Implementing Change, Leading the Change Process, Facilitating Change, Dealing with Individual & Group Resistance, Intervention Strategies for Facilitating Organizational Change, Methods of Implementing Organizational Change, Developing a Learning Organization.	7

Reference Books

1. *Understanding Organizational Behaviour, Parek, Oxford*
2. *Organizational Behaviour, Robbins, Judge, Sanghi, Pearson.*
3. *Organizational Behaviour, K. Awathappa,HPH.*
4. *Organizational Behaviour, VSP Rao, Excel*
5. *Introduction to Organizational Behaviour, Moorhead, Griffin, Cengage.*
6. *Organizational Behaviour, Hitt, Miller, Colella, Wiley*

3rd Semester

HONOURS SUBJECT
SOLID STATE DEVICES (4-0-0)

80% University Level:

Module-I **(11 hours)**

Introduction to Quantum Mechanics: Principles of Quantum Mechanics , Energy Quanta, Schrodinger's Wave Equation, Applications of Schrodinger's Wave Equation, Extensions of the Wave Theory to Atoms

Introduction to the Quantum Theory of Solids: Allowed and Forbidden Energy Bands, Electrical Conduction in Solids, Extension to Three Dimensions, Density of States Function, Statistical Mechanics: The Fermi–Dirac Probability Function, The Distribution Function and the Fermi Energy

The Semiconductor in Equilibrium: Charge Carriers in Semiconductors, Dopant Atoms and Energy Levels: Qualitative Description, Ionization Energy, The Extrinsic Semiconductor: Equilibrium Distribution of Electrons and Holes, The n_0p_0 Product, The Fermi–Dirac Integral, Degenerate and Non degenerate Semiconductors, Statistics of Donors and Acceptors, Charge Neutrality, Position of Fermi Energy **Level.**

Module-II **(12 hours)**

Carrier Transport Phenomena: Carrier Drift:Drift Current Density, Mobility Effects, Conductivity, Velocity Saturation, Carrier Diffusion, Graded Impurity Distribution, The Hall Effect

Non-equilibrium Excess Carriers in Semiconductors: The Semiconductor in Equilibrium, Excess Carrier Generation and Recombination, Characteristics of Excess Carriers, Continuity Equations, Time-Dependent Diffusion Equations, Ambipolar Transport Quasi-Fermi Energy Levels, Excess Carrier Lifetime, Surface Effects

The pn Junction: Basic Structure of the pn Junction, Zero Applied Bias: Built-in Potential Barrier, Electric Field, Space Charge Width, Reverse Applied Bias:Space Charge Width and Electric Field , Junction Capacitance, One-Sided Junctions ,Junction Breakdown, Non uniformly Doped Junctions: Linearly Graded Junctions

The pn Junction Diode: pn Junction Current, Small-Signal Model of the pn Junction, Diode current equation, Junction breakdown, Charge Storage and Diode Transients: The Turn-off Transient, The Turn-on Transient.

Metal–Semiconductor and Semiconductor Hetero junctions: The Schottky Barrier Diode, Metal–Semiconductor Ohmic Contacts, Hetero-junctions

Module-III **(10 hours)**

The Bipolar Transistor:The Bipolar Transistor Action, Minority Carrier Distribution, Transistor Currents and Low-Frequency Common-Base Current Gain, Nonideal Effects, Equivalent Circuit Models, Frequency Limitations, Large-Signal Switching

3rd Semester

The Junction Field-Effect Transistor: JFET Concepts: Basic pn JFET Operation, Basic MESFET Operation, The Device Characteristics, Nonideal Effects, Equivalent Circuit and Frequency Limitations.
Metal–Oxide–Semiconductor Field-Effect Transistor: The Two-Terminal MOS Structure: Energy-Band Diagrams, Depletion Layer Thickness, Surface Charge Density, Work Function Differences, Flat-Band Voltage, Threshold Voltage, Capacitance–Voltage Characteristics, The Basic MOSFET Operation, Frequency Limitations, The CMOS Technology, Nonideal Effects, MOSFET Scaling, Threshold Voltage Modifications.

20% Institution Level: 9 hours

Optoelectronics and High Frequency, High Power, Nanoelectronic Semiconductor Devices: Optical Devices:Photon Absorption Coefficient, Electron–Hole Pair Generation Rate, Solar Cells, The pn Junction Solar Cell, Conversion Efficiency and Solar Concentration, Photodetectors: Photodiode, PIN Photodiode, Avalanche Photodiode, Light Emitting Diodes, Laser Diodes.
The Tunnel Diode, The IMPATT Diode, The Gunn Diode, The p-n-p-n Diode, SCR, Nanoelectronics Devices.

Text Books:

1. *Solid State Electronic Devices, 7th Edition, Ben. G. Streetman and Sanjay Banarjee, Pearson Education, New Delhi.*
2. *Semiconductor Physics and Devices, 4th Edition, Donald A. Neamen and Dhrubes Biswas, Tata McGraw Hill Publishing Company Limited, New Delhi.*

Reference Books:

1. *Solid State Devices and Materials, R.K.Singh & D.S.Chauhan, Wiley India.*
2. *Fundamentals of Semiconductor Devices, M.K. Achuthan and K.N. Bhatt, Tata McGraw Hill Publishing Company Limited, New Delhi.*
3. *Principle of Semiconductor Devices, 2nd Edition, Sima Dimitrijev, Oxford University Press, New Delhi.*
4. *Semiconductor Device Modeling With SPICE, 2nd Edition, Giuseppe Massobrio and Paolo Antognetti, Tata McGraw Hill Publishing Company Limited, New Delhi.*
5. *Physics of Semiconductor Devices, 3rd Edition, S.M. Sze and Kwok K. Ng, Wiley India Pvt. Limited, New Delhi.*
6. *Solid State Electronics Devices, D.K. Bhattacharya and Rajnish Sharma, Oxford University Press, New Delhi.*

Fourth Semester								
	Theory					Practical		
Code	**Course Name**	**Hours/ week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
HS	Purely Applied Mathematics for Specific Branch of Engineering	3-0	3	100	50			
PC	Communication System Engg.	3-0	3	100	50	2	1	50
PC	Control System Engg.	3-0	3	100	50	2	1	50
PC	Digital Electronics	3-0	3	100	50	2	1	50
PC	Instrument Devices & System-I	3-0	3	100	50	2	1	50
HS	Engineering Economics/ Organizational Behavior	2-1	3	100	50			
	*Skill Project and Hands on					6	3	100
Total		18	18	600	300	14	7	300
Total Marks: 1200								
Total Credits: 25								
Honours	Analog Signal Processing	4	4	100	50			
Minor Specialization								

4th Semester

COMMUNICATION SYSTEM ENGINEERING (3-0-0)

University level 80%

MODULE-I (12 Hrs)

INTRODUCTION: Signals and their classifications, Elements of a Communication System, Transmission of message signals, limitations and resources of Communication Systems
FREQUENCY ANALYSIS OF SIGNALS AND SYSTEMS: Fourier series, Fourier Transforms, Properties of Fourier transform, Dirac Delta function, Fourier transforms of Periodic signals, Energy Spectral Density, Power Spectral Density, Correlation of Energy Signals, Correlation of Power Signals

MODULE-II (15 Hrs)

ANALOG SIGNAL TRANSMISSION AND RECEPTION: Introduction to modulation, Amplitude Modulation (AM), Angle Modulation, Radio and Television broadcasting

MODULE-III (11 hrs)

ANALOG PULSE MODULATION SYSTEMS:
Modulators and demodulators for pulse amplitude modulation, pulse Time Modulation, pulse position modulation

College Level (20%)

PULSE CODE MODULATION: Sampling Theorem, PCM system, Companding, Time Division Multiplexing of PCM signals, Line codes, Bandwidth of PCM system, Delta Modulation (DM), Limitations of DM, Adaptive Delta Modulation, Comparison between PCM and DM, Deltaor Differential PCM (DPCM)

Text Book:

1. *Simon Haykin, An Introduction to Analog and Digital Communications, John Wiley and Sons*
2. *B.P. Lathi, Modern Digital and Analog Communication Systems, Oxford*

1. *Reference Book:*
2. *Taub, Schilling, Saha, Taub, " Principles of Communication Systems", TMH*
3. *A.B. Carlson and P.B.Crilly, " Communication Systems An Introduction to Signals and Noise in Electrical Communication", 5th Edn., TMH*

4th Semester

CONTROL SYSTEM ENGINEERING (3-0-0)

University level 80%

Module-I: (12 Hours)

Introduction: definition, control system, open loop, close loop, automatic control, modern control, properties of transfer function

Mathematical Modeling: translational, rotational systems and their electrical analogy, mechanical coupling, liquid level systems, servo motors, sensors, magnetic amplifiers, stepper motor, synchros, block diagram, signal flow graph, gain formula.

Feedback characteristics of Control Systems: Feedback and non-feedback systems, Reduction of parameter variations, Control over system dynamics, Effect of disturbance signal by use of feedback, Linearizing effect of feedback, Regenerative feedback, Sensitivity of control system, parameter variation and disturbance ofsignal.

Module-II: (12 Hours)

Time Domain Analysis: typical test signals, transient analysis of second order systems, overshoot, damping, settling time and rise time, Analysis of multi-order control system with dominant poles, steady state error analysis, error confidents, generalised error series, transient analysis with derivative control, integral control and proportional control, rate feedback control, Routh Hurwitz stability criteria.

Root Locus Technique: Basic conditions for root loci, rules for construction, stability and conditional stability on root locus.

Module-III: (12 Hours)

Frequency Response Analysis: Polar plot, Bode plot, frequency domain behaviour of control, gain margin and phase margin, Wpand Mp for second order system, stability criteria.

Nyquist Criteria: Stability criteria, conformal mapping, Cauchy's theorem, Nyquist stability criteria, conditionally stable system.

State variable Technique: state variable for continuous system, transfer function to state variable, state variable to transfer function, state transition matrix, time domain solution of single input single output system.

College Level (20%)

Derivation of Transfer Function for State Model. Diagonalization: Eigenvalues and Eigenvectors, Generalized Eigenvectors. Solution of State Equations: Properties of the State Transition Matrix,
Time domain solutions of multi-input and multi-output systems

Text Book:

1. *I J Nagrath and M Gopal, Control system engineering; New Age International Publisher2010.*

Reference Books:

2. *K Ogata, Modern Control Engineering, PHI, 5th edition*
3. *R C Dorf and R H Bishop, Modern Control Systems; Pearson Education;2009*
4. *B C Kuo, Automatic Control System; PHI; 7th Edition*

4th Semester

DIGITAL ELECTRONICS

University level 80%

MODULE – I (12 Hours)

1. Number System: Introduction to various number systems and their Conversion. Arithmetic Operation using 1's and 2`s Compliments, Signed Binary and Floating Point Number Representation Introduction to Binary codes and their applications. (5 Hours)
2. Boolean Algebra and Logic Gates: Boolean algebra and identities, Complete Logic set, logic gates and truth tables. Universal logic gates, Algebraic Reduction and realization using logic gates (3 Hours)
3. Combinational Logic Design: Specifying the Problem, Canonical Logic Forms, Extracting Canonical Forms, EX-OR Equivalence Operations, Logic Array, K-Maps: Two, Three and Four variable K-maps, NAND and NOR Logic Implementations. (4 Hours)

MODULE – II (14 Hours)

4. Logic Components: Concept of Digital Components, Binary Adders, Subtraction and Multiplication, An Equality Detector and comparator, Line Decoder, encoders, Multiplexers and De-multiplexers. (5 Hours)
5. Synchronous Sequential logic Design: sequential circuits, storage elements: Latches (SR, D), Storage elements: Flip-Flops inclusion of Master-Slave, characteristics equation and state diagram of each FFs and Conversion of Flip-Flops. Analysis of Clocked Sequential circuits and Mealy and Moore Models of Finite State Machines (6 Hours)
6. Binary Counters : Introduction, Principle and design of synchronous and asynchronous counters, Design of MOD-N counters, Ring counters. Decade counters, State Diagram of binary counters (4 hour)

MODULE – III (12 hours)

7. Shift resistors: Principle of 4-bit shift resistors. Shifting principle, Timing Diagram, SISO, SIPO ,PISO and PIPO resistors. (4 hour)
8. Memory and Programmable Logic: Types of Memories, Memory Decoding, error detection and correction), RAM and ROMs. Programmable Logic Array, Programmable Array Logic, Sequential Programmable Devices. (5 Hours)
9. IC Logic Families: Properties DTL, RTL, TTL, I^2L and CMOS and its gate level implementation. A/D converters and D/A converters (4 Hours)

College Level (20%)

Basic hardware description language: Introduction to Verilog/VHDL programming language, Verilog/VHDL program of logic gates, adders, Substractors, Multiplexers, Comparators, Decoders flip-flops, counters, Shift resistors.

Text book

1. *Digital Design, 3rd Edition, Moris M. Mano, Pearson Education.*
2. *Fundamentals of digital circuits, 8th edition, A. Anand Kumar, PHI*
3. *Digital Fundamentals, 5th Edition, T.L. Floyd and R.P. Jain, Pearson Education, New Delhi.*

Reference Book

1. *Digital Systems – Principles and Applications, 10th Edition, Ronald J. Tocci, Neal S. Widemer and Gregory L. Moss, Pearson Education.*
2. *A First Course in Digital System Design: An Integrated Approach, India Edition, John P. Uyemura, PWS Publishing Company, a division of Thomson Learning Inc.*
3. *Digital Systems – Principles and Applications, 10th Edition, Ronald J. Tocci, Neal S. Widemer and Gregory L. Moss, Pearson Education.*
4. *Digital Design, Robert K. Dueck, CENGAGE Learning.: 1. Digital Principles and Applications, 6th Edition, Donald P. Leach, Albert Paul Malvino and GoutamSaha,*

4th Semester

Instrumentation Devices & Systems–I (3-1-0)

University level 80%

Module –1 10 lectures

Elements of a general measurement system; Static Characteristics: systematic characteristics, statistical characteristics, calibration; Dynamic characteristics of measurement systems: transfer functions of typical sensing elements, step and frequency response of first and second order elements, and dynamic error in measurement systems. Techniques for dynamic compensation, loading effect, signal and noise in measurement system. (Bentley & A. K. Ghosh: Selected portions of Chapters 1 to 4)

Module-2 15 lectures

Sensing elements: Transducers and sensors, Resistive sensing elements: potentiometers, Resistance Temperature Detector (RTD), thermistors, strain gages. Capacitive sensing elements: variable separation, area and dielectric; Inductive sensing elements: variable reluctance, LVDT and RVDT displacement sensors; Electromagnetic sensing elements velocity sensors; ultrasonic, radar, nucleonic type sensing elements, thermoelectric sensing elements: thermocouple laws, characteristics, installation problems, cold junction compensation. IC temperature sensor Elastic sensing elements: Bourdon tube, bellows, and diaphragms for pressure sensing, force and torque measurement.(Bentley: Sections 8.1 to 8.6; Ghosh: Section 10.3 to 10.4).

Module-3: (8 lectures)

Signal Conditioning Elements: Deflection bridges: design of resistive and reactive bridges, push-pull configuration for improvement of linearity and sensitivity Amplifiers: Operational amplifiers-ideal and non-ideal performances, inverting, noninverting and differential amplifiers, instrumentation amplifier, and filters. A.C. carrier systems, phase sensitive demodulators and its applications in instrumentation.

signal processing elements: A/D conversion: sampling, quantization,encoding,typical converter(Bentley: Sections 9.1 to 9.3; Gosh: Sections 15.1 and 15.2)

College level 20%

Industrial application of active and passive capacitive, inductive and resistive transducers: Taking at least two Case study of each category (illustrating with diagram)

Text Books:

1. *Principles of Measurement Systems- J.P. Bentley (3/e), Pearson Education, New Delhi, 2007.*
2. *Measurement Systems Application and Design- E.O. Doeblin (4/e), McGraw-Hill, International, NY.*
3. *Introduction to Measurement and Instrumentation- A.K. Ghosh(3/e), PHI Learning, New Delhi, 2009.*
4. *Transducers and Instrumentation- D.V.S. Murthy (2/e), PHI Learning, New Delhi, 2009.*

Reference Books:

1. *Instrumentation for Engineering Measurements- J.W. Dally, W.F. Riley and K.G. McConnel (2/e), John Wiley, NY, 2003.*
2. *Industrial Instrumentation- T.R. Padmanabhan, Springer, London, 2000.*

4th Semester

ANALOG SIGNAL PROCESSING (Honours)

(Syllabus at university level)

Module – I (10 lectures)

Introduction: Review of Operational Amplifier Fundamentals, Current-to-Voltage Converters, Voltage-to-Current Converter, Current Amplifiers, Difference Amplifiers, Instrumentation Amplifiers, Instrumentation amplifiers and its applications, Transducer Bridge Amplifiers. Bandwidth, slew rate and frequency response. Op-amp applications: DC and AC amplifiers.

Module – II 12 lectures

Liner Analog Functions: Addition, Subtraction, Differentiation, Integration, Impedance Transformation and AC/DC Signal Conversion: Signal Rectification, Peak and Valley Detection, rms to dc Conversion, Amplitude Demodulation Other Nonlinear Analog Functions: Voltage Comparison, Voltage Limiting (Clipping), Logarithmic Amplifiers, Analog Multipliers, Analog Dividers.

Module - III 13 lectures

Analog Filters: Introduction to filtering and filter design, components for filter implementation, active low-pass, high-pass, band-pass, band-reject and all-pass filters – design and realization, Switch capacitance filter.
Interference and Noise: Sources of signal coupling, Grounding and shielding techniques, Isolation amplifiers, Noise fundamentals, Noise modelling for electronic components and Circuits.

(Syllabus at college level)

Signal Generators: Square, triangle and ramp generator circuits using opamps - Effect of slew rate on waveform generation- monostable circuits- Principles of VCO circuits. Comparator Circuits: Zero Crossing Detector- Regenerative comparator circuits Active filters –Types- Characteristics- Frequency Response of different types of filters-
Use μ741 and LF411 IC in instrumentation System, Simulation of Ist and 2^{nd} order filter using PSpice and MULTISIM and compare their performance parameter using MATLAB simulations. Simulation of noise of analog circuits.

Text Books:

1. *Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, 3rd*
1. *Edn., Tata McGraw Hill Education Pvt. LTd., New Delhi, 2002, ISBN: 0-07-232084-2.*
2. *Ramon Pallas-Areny, John G. Webster, Analog Signal Processing, John Wiley& Sons,*
3. *1999, ISBN: 9814-12-696-9.*

Reference Books:

1. *R. Schaumann and M. E. Valkenberg, Design of Analog Filters, Oxford University Press,*
1. *2001, ISBN: 0-19-568087-1.*
2. *Don Meador, Analog Signal Processing With Laplace Transform and Active Filter Design, Thomson Learning.*
3. *Ashok Ambardar, Analog and Digital Signal Processing, 2nd Edn., Michigan Technological*
4. *University Published by Nelson Engineering, 1999.*
5. *A.S. Sedra and K.C. Smith, Microelectronic Circuits, Oxford University Press, New Delhi*
6. *J.N. Jacob, Application & Design with Analog Integrated Circuits, PHI Pub, New Delhi.*
7. *D. Patranabis, Electronic Instrumentation, PHI Pub, New Delhi*

4th Semester

COMMUNICATION SYSTEM ENGINEERING LAB

List of Experiments (10 Experiments to be conducted)

1. Analyze and plot the spectrum of following signals with aid of spectrum analyzer : sine wave , square wave , triangular wave, sawtooth wave of frequencies 1 KHz , 10 KHz , 50 KHz ,100 KHz , 1 MHz .
2. Study and design of AM Modulator and demodulator (Full AM , SSB, DSB- SC, SSB-SC)
3. Study of FM modulation and Demodulation techniques.
4. Observe the process of PAM ,its quantization and determination of noise.
5. Multiplex 2-4 PAM / PPM and PWM signals.
6. Study the functioning of PCM and Delta modulator.
7. Show the AM waveform of a sinusoidal signal in time domain and analyze its freq spectrum using MATLAB/SCILAB. Repeat the same for square , triangular and for other waveforms.
8. Show the FM waveform of a sinusoidal signal in time domain and analyze its freq spectrum using MATLAB/SCILAB. Repeat the same for square , triangular and for other waveforms.
9. Using LABVIEW software simulate AM modulation and demodulation system.
10. Using LABVIEW software simulate FM modulation and demodulation system.
11. Design a receiver to demodulate and receive the signal from an AM radio station.
12. Design a receiver to demodulate and receive the signal from an FM radio station

4th Semester

CONTROL SYSTEMS LAB

1. Simulation of a typical second order system and determination of step response and evaluation of time- domainspecifications
    (a) To design a passive RC lead compensating network for the given specifications, viz., the maximum phase lead and the frequency at which it occurs and to obtain its frequencyresponse.
    (b) To determine experimentally the transfer function of the lead compensatingnetwork.
    (a) To design RC lag compensating network for the given specifications., viz.,themaximumphase lag and the frequency at which it occurs, and to obtain its frequencyresponse.
    (b) To determine experimentally the transfer function of the lag compensatingnetwork.
2. Experiment to draw the frequency response characteristic of a given lag- lead compensating network.
3. To study the effect of P, PI, PD and PID controller on the step response of a feedback control system (using control engineering trainer/process control simulator). Verify the same by simulation.
    (a) Experiment to draw the speed – torque characteristic of a two - phase A.C.servomotor.
    (b) Experiment to draw speed torque characteristic of a D.C.servomotor.
4. To determine the frequency response of a second -order system and evaluation of frequency domainspecifications.
5. Simulate a D. C. position control system using MATLAB/SCILAB and obtain its stepresponse.
6. Obtain the phase margin and gain margin for a given transfer function by drawing bode plots. Verify the same using (i) MATLAB/SCILAB and (ii) The rltool command of MATLAB or equivalent inSCILAB.
    (a) To draw the root loci for a given transfer function and verification of breakaway point and imaginary axis crossover point using (i) MATLAB/SCILAB (ii) The rltool command of MATLAB or equivalent in SCILAB (b) To draw the Nyquist plot for a given transfer function using MATLAB/SCILAB

4th Semester

DIGITAL ELECTRONICS LAB

(Atleast 10 experiments should be done, Experiment No. 1 and 2 are compulsory and out of the balance 8 experiments atleast 3 experiments has to be implemented through both Verilog/VHDL and hardware implementation as per choice of the student totaling to 6 and the rest 2 can be either through Verilog/VHDL or hardware implementation.)

1. Digital Logic Gates: Investigate logic behavior of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert and Buffer gates, use of Universal NANDGate.
2. Gate-level minimization: Two level and multi level implementation of Booleanfunctions.
3. Combinational Circuits: design, assemble and test: adders and subtractors, code converters, gray code to binary and 7 segmentdisplay.
4. Design, implement and test a given design example with (i) NAND Gates only (ii) NOR Gates only and (iii) using minimum number ofGates.
5. Design with multiplexers andde-multiplexers.
6. Flip-Flop: assemble, test and investigate operation of SR, D & J-Kflip-flops.
7. Shift Registers: Design and investigate the operation of all types of shift registers with parallelload.
8. Counters: Design, assemble and test various ripple and synchronous counters - decimal counter, Binary counter with parallelload.
9. Memory Unit: Investigate the behaviour of RAM unit and its storage capacity – 16 X 4 RAM: testing, simulating and memoryexpansion.
10. Clock-pulse generator: design, implement andtest.
11. Parallel adder and accumulator: design, implement andtest.
12. Binary Multiplier: design and implement a circuit that multiplies 4-bit unsigned numbers to produce a 8-bitproduct.
13. Verilog/VHDL simulation and implementation of Experiments listed at Sl. No. 3
14. to 12

4th Semester

Instrumentation Devices and Systems-I Lab

(Total 10 experiments to be performed)

1. Characteristics of RTD andThermistor
2. Temperature sensing using semiconductor type temperaturesensor
3. Load cell using straingage
4. LVDT and its signalconditioning
5. Pressure measurement using Bourdon tube and diaphragm typesensor
6. Temperature measurement usingthermocouple
7. Flow measuringtransducers
8. Capacitive and Inductive typetransducers
9. Speed measurement using optical and variable reluctance typetransducers
10. Active 2^{nd}order low passfilter
11. Instrumentationamplifier
12. Phase sensitivedetector

Fifth Semester								
	Theory					Practical		
Code	Course Name	Hours/ week L/T	Credit Theory	University Marks	Internal Evaluation	Hours/ week L/T	Credit Practical	Marks
PC	Instrument Devices & System-II	3-0	3	100	50	2	1	50
PC	Microprocessor & its Interfacing	3-0	3	100	50	2	1	50
PC	Digital Signal Processing	3-0	3	100	50	2	1	50
PE	Radar & TV Engineering/Fibre Optics Instrumentation/Optoelectronics Device & Instrumentation/Advanced Electronics Circuits	3-1	4	100	50			
OE	Numerical Methods/Computer Network & Data Communication	3-1	4	100	50			
PC	Advance Lab-I					8	4	200
Total		17	17	500	250	14	7	350
Total Marks: 1100								
Total Credits: 24								
Honours	Analytical Instrumentation	4	4	100	50			
Minor Specialization	Microprocessors and Interfacing							

5th Semester

INSTRUMENTATION DEVICES AND SYSTEMS–II (3-0-0)

University Level

Module –1 (10 Hrs)

Pressure measurement: Manometer for use of pressure measurement, Hall effect transducer, Low pressure measurements.
Flow Measurement: Basics of flow measurement; differential pressure flow meters- Pitot tube, Orifice plate, Venturi tube; Rotameter, turbine type flow meter, electromagnetic flow meter. Doppler shift flow meter. (Bentley: Sections 12.1 to 12.3.2 and 12.5.1)
Temperature measurement: Temperature scale, Change in dimensions-Bimetals, liquid-in-glass thermometers, Filled system thermometers.

Module-2: (10 Hrs)

Miscellaneous Measurements:
Level measurements using floats, hydrostatic pressure gage and capacitive type; principles of ultrasonic and gamma ray type level indicators. Humidity sensor: capacitive type. pH and liquid conductivity measurements: basic principles, Bolometer and Viscosity Measurement. (Ghosh: Sections 12.1, 12.3.3, 12.4, 13.3 and 13.5; Bentley: Section 8.9)
Acceleration Measurement: Piezoelectric transducers: basic principle, equivalent circuit, frequency response, charge amplifier; acceleration measurement: basic principle and frequency response; piezoelectric accelerometer. (Bentley: Section 8.7, Ghosh: Section 9.1)

Module-3: (12 Hrs)

Optical sensing:
LED and photo resistors and photodiodes; Radiation pyrometer: Planck's law, Stefan Boltzmann's law, broad band and narrow band pyrometer; optical fibre and fibre optic sensing. (Johnson: Chapter 6, Bentley: Sections 15.2, 15.3.2, 15.5, 15.6)
Programmable Logic Controllers:
Discrete state process control and its characteristics; input and output devices; Event sequence description with examples; Relay ladder logic and its construction; Programmable Logic Controllers (PLCs): functional description, PLC software functions; programs examples. (Johnson: Chapter 8)

College Level

Data transmission: Basic idea about Time division Multiplexing (TDM), Frequency division Multiplexing (FDM), Wavelength division Multiplexing (WDM). Parallel and serial data transmission system, Data Acquisition and Display: Basic principle of Digital display System and data acquisition system, Case study of DAS.

Text Books:

1. *Measurement Systems Application and Design- E.O. Doeblin (4/e), McGraw-Hill,*
2. *International, NY.*
3. *Principles of Measurement Systems- J.P. Bentley (3/e), Pearson Education, N Delhi,*
4. *Introduction to Measurement and Instrumentation- A.K. Ghosh(3/e), PHI Learning.*
5. *Process Control Instrumentation Technology- C.D. Johnson (8/e), PHI Learning,*

Reference Books:

1. *Transducers and Instrumentation- D.V.S. Murthy (2/e), PHI Learning, New Delhi, 2009.*
2. *2 Industrial instrumentation, D patronabis,----------*
3. *Modern Control Technology Components and Systems- C.T. Kilian (3/e), Clengage Learning, New Delhi, 2006.*

5th Semester

MICROPROCESSOR &ITS INTERFACING (3-0-0)

80% of syllabus covers module I and Module II

Module –I : (13 hours)

Introduction to the general concept of Microprocessor organization, architectural advancements of microprocessor, evolution of microprocessors and its applications, introduction to 8085 microprocessor, block diagram as well as its pin description, addressing modes of 8085,instruction sets and its data formats, timing diagram of 8085 instructions.

Module –II : (12 hours)

Assembly language programs of 8085 , memory and I/O interfacing, memory address decoding, data transfer schemes, interrupts of 8085 , 8255 PPI, 8253 timer,serial communication interface 8251, DMA controller 8257.
Introduction to 8051 Micro-controller; Basic features, Timing Diagram, Instructions
20% of syllabus covers module III

Module –III : (7 hours)

Introduction to 8086 Microprocessor, Its block diagram and pin description, memory segmentation, 8086 memory addressing, timing diagram of memory read and write bus cycle, bus controller 8288.

Text Books :

1. *Microprocessor Architecture Programming and Applications with 8085/8080A By R.S.Gaonker (Willey Eastern India Ltd)*
2. *Microprocessors and interfacing by Douglas V Hall; Mc Graw Hill publication.*
3. *Microprocessors and interfacing by N.Senthil Kumar, M. Saravanan, S. Jeevanathan, S.K Shah; Oxford Publication*
4. *Microprocessors and Microcontrollers Architecture, Programming and system Design by Krishna kant; PHI .*

Reference Books :

1. *Microprocessors and Microcontrollers bySoumitra Kumar Mandal ; Mc Graw Hill Publication.*

5th Semester

DIGITAL SIGNAL PROCESSING (3-0-0)

University level

Module–I(10hours)

Discrete Time System

Basic Discrete Time Signals and their classifications, Discrete times systems and their classifications, Stability of discrete time system, Analysis and response (convolution sum) of discrete - time linear LTI system, Recursive and Non-recursive discrete time system, impulse response of LTI system, Correlation of discrete time Signal

The Z-Transform and Its Application to the Analysis of LTI Systems:

The Z-Transform: The Direct Z-Transform, The Inverse Z-Transform; Properties of the Z-Transform; Inversion of the Z-Transforms: The Inversion of the Z-Transform by Power Series Expansion, The Inversion of the Z-Transform by Partial-Fraction Expansion; Analysis of Linear Time-Invariant Systems in the z-Domain: Response of Systems with rational System Functions, Transient and Steady-State Responses, Causality and Stability, Pole-ZeroCancellations.

Module–II (15hours)

The Discrete Fourier Transform: Its Properties and Applications

Frequency Domain Sampling: Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, The Discrete Fourier Transform, The DFT as a Linear Transformation, Relationship of the DFT to other Transforms; Properties of the DFT: Periodicity, Linearity, and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties; Linear Filtering Methods Based on the DFT: Use of the DFT in Linear Filtering, Filtering of Long Data Sequences; Frequency Analysis of Signals using the DFT; The Discrete Cosine Transform: Forward DCT, Inverse DCT, DCT as an Orthogonal Transform.

Efficient Computation of the DFT: Fast Fourier Transform Algorithms

Efficient Computation of the DFT: FFT Algorithms: Direct Computation of the DFT, Radix-2 FFT Algorithms: Decimation-In-Time (DIT), Decimation-In-Time (DIF); Applications of FFT Algorithms: Efficient Computation of the DFT of two Real Sequences, Efficient Computation of the DFT a 2N-Point Real Sequence, Use of the FFT Algorithm in Linear Filtering and Correlation.

5th Semester

Module–III **(10hours)**

Structure and implementation of FIR and IIR filter:
Structure for the Realization of Discrete-Time Systems, Structure for FIR Systems: Direct-Form Structure, Cascade-Form Structures, Frequency-Sampling Structures; Structure for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures.

Design of Digital Filters:
General Considerations: Causality and Its Implications, Characteristics of Practical Frequency-Selective Filters; Design of FIR Filters: Symmetric and Antisymmetric FIR Filters, Design of Linear-Phase FIR Filters by using Windows, Design of Linear-Phase FIR Filters by the Frequency-Sampling Method;
Design of IIR Filters from Analog Filters: IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation.
Basic adaptive filter: System modeling and Identifications using adaptive filter

College Level (20%)

MatLab realization of DFT, FFT, Z-transform, IIR and FIR and adaptive filter realization as mentioned in Text Book-3

Text Books

1. *Digital Signal Processing – Principles, Algorithms and Applications by J. G. Proakis and D. G. Manolakis, 4th Edition,Pearson.*
2. *Digital Signal Processing – S. Salivahan, A. Vallavraj and C. Gnanapriya, Tata McGrawHill.*
3. *Digital Signal Processing: a Computer-Based Approach – Sanjit K. Mitra, Tata McGraw Hill.*

Reference Book :

1. *Digital Signal Processing: Tarun Kumar Rawat, Oxford university Press*
2. *Digital Signal Processing: T.J.Cavicchi, Wieley Student Edition*
3. *Digital Signal Processing – Manson H. Hayes (Schaum's Outlines) Adapted by Subrata Bhattacharya, Tata McGraw Hill.*
4. *Digital Signal Processing: Dr. Shalia D. Apte, 2nd edition Willey Publication*
5. *Adaptive signal processing, B. Widrow and S. D. Stearns, Pearson Education*

5th Semester

RADAR AND TV ENGINEERING(3-1-0)

University level (80%)

MODULE I (14 hours)

Basic Television System: Frequency band for TV transmission and reception, basics of audio and video signals, persistence of vision and flicker, aspect ratio, progressive and interlaced scanning, Kell factor, horizontal and vertical resolution, bandwidth requirement of typical video signals, horizontal and vertical synchronizing and blanking signals, composite video signal, photometric quantities, TV pick up tubes, vidicon, CCD and CMOS cameras, transmission and reception of sound and video signals, block schematic of TV transmitter and receiver.

MODULE II (10 hours)

Mixing of colours and colour perception, bandwidth of typical colour signals, colour signal transmission, NTSC and PAL systems, colour TV transmitter and receiver block schematics,

MODULE III (14 hours)

RADAR SYSTEMS:Radar frequencies and application, basics of radar, the simple form of the radar equation, block schematic of radar transmitter and receiver
Radar equation: Radar cross section, PRF, Detection of signal in noise, receiver noise and SNR, probability of false alarm and miss detection, integration of radar pulses
MTI radars: Introduction, delay line cancellers
Tracking by radar, monopulse tracking, conical scan and sequential lobing

(At college level) (6 hours)

Digital TV signal, digitized video parameters, digital TV transmitter and receiver
Doppler filter banks, limitations of MTI, staggered PRF (At college level)

Text Books:

1. *A.M. Dhake, "Television and Video Engineering", 2nd Edn., TMH*
2. *Merril I. Skolnik, " Introduction to Radar Systems", 3rd Edn, TMH*

Reference Books:

1. *R.R. Gulati , "Modern Television Practice-Principles, Technology and Servicing", TMH*
2. *C. Toomay, "Principles of Radar", PHI, 2nd Edn, 2004*

5th Semester

FIBRE OPTICS INSTRUMENTATION (FOR HONORS) (3-1-0)

Institution Level(80%)

Module I(14 Hrs)

Optical Sources:

Light emitting diodes (LED), Materials for LED, Types of LEDs, Quantum efficiency, Light Intensity, Modulation capability, Output Power, LED drive circuits
Laser Diode: Laser fundamentals, Absorption and emission of radiation, conditions for amplification by stimulated emission, threshold condition for laser oscillation, resonant frequencies, quantum efficiency, semiconductor laser, modulation of laser diode, radiation pattern, optical transmitters, laser drivers

Optical Detectors:

PIN photodetector, impulse response and frequency response, avalanche Photodiode (APD), photodiode sensitivity, photodetector Noise, noise Sources, signal-to-noise ratio in a photodetector, speed of Response, photomultiplier tubes, Phototransistor, solar cells

Module II (12 Hrs)

Optical Fibre:

Fibre materials, modes in step index fibre (TE and TM modes only), numerical aperture in graded index ((GI)) fibres modes in GI fibre
Power launching and coupling:
Source-to-fibre power launching, power launching calculation, equilibrium numerical aperture, lensing schemes for coupling improvement

Module III (14 Hrs)

Fibre Sensors:

Classification of sensors, intensity modulated sensors, macrobend, micro bending, diffraction grating based IM Sensors, displacement sensors, Moire fringe modulation sensors for displacement measurement, hybrid pressure sensor, liquid level detector, flow sensor, acoustic wave sensor, temperature sensor, phase modulated sensor, interferometric sensors fibre based Fabrey-Parot interferometric sensors, Sagnac effect based optical gyroscope, phase and polarization modulation based fibre sensors, stress sensor, current sensor, magnetic field sensor, acceleration sensor, humidity sensor, pH

sensor, laser Doppler velocimeter, optical time domain reflectometrey, optical frequency domain reflectometrey, distributed fibre optic sensors

Optical Fibre Measurements and Optical Components: (At college level)

Classification of Optical Couplers, biconically tapered directional coupler, offset butt joint directional coupler, beam splitting directional coupler, star couplers, T-couplers, calculations on couplers, Splicers, power loss in joining technique, optical fibre connectors, polarizer, fibre polarizers, Optocouplers

Fiber attenuation measurement, total fiber attenuation, fiber absorption loss measurement, fiber scattering loss measurement, fiber refractive index profile measurement, interferometric methods, near field scanning method, refracted near field method, fibre cutoff wavelength measurement, fibre numerical aperture measurement, fibre diameter (core and outer diameter) measurements

Text Books:

1. *John M. Senior, Optical Fibre Communications, Principles and Practice, 3rdEdn, Pearson, 2010*
2. *Gerd Keiser, Optical Fiber Communications, 2ndEdn., McGraw Hill, Inc.*
3. *R.P.Khare, " Fiber Optics and OptoElectronics, Oxford University Press,2015*

Reference Books:

1. *ArunaTripathy, " OptoElectronics and Systems", Studium Press, New Delhi, 2016*

5th Semester

OPTOELECTRONICS DEVICES & INSTRUMENTATION (3-1-0)

Institution Level(80%)

Module –1 (14 Hrs)

Wave Optics: Wave Polarization, Transmission of light through slab, Numerical aperture, Wave propagation in cylindrical waveguides, Modes in step and graded index fibers, single mode and multimode fibres

Module –2 (10 Hrs)

Optical Components: Sources: LED, Lasers-fundamentals, conditions for oscillations, construction and principle of operation of semiconductor lasers, pulsed and continuous type lasers (Chapter 4 of TB-1, 11.2-11.4 of TB-1, Chapter 4, 4.2-4.9 of TB-2)
Fiber optic components: (at college level) couplers, splicer, polarizer, power coupled to a fibre (Chapter 9 9.2-9.12 of TB-2) Detectors: photodiodes- PIN and APD. (Chapter 12, 12.1-12.4 of TB-1)

Module –3 (12 Hrs)

Optoelectronic Instrumentation:
Modulation techniques: intensity, polarization, interference, electro-optic, electromagnetic; Sensing techniques for displacement, pressure, acceleration, flow, current and voltage measurement, Fiber optic gyroscope, Distributed fiber optic sensors- OTDR and OFDR principles. (Chapter 11, 11.2-11.3.5, 11.3.9, 11.4-11.6 and 11.9 of TB-2)

College Level(20%)

Interference, diffraction (Chapter 2, 2.1-2.5, Chapter 3, 3.5-3.8, Chapter 5, 5.1-5.3, Chapter 6, 6.1-6.4, Chapter 8, 8.2-8.6 of TB-2)
Fiber losses and dispersion characteristics (at college level)
(Chapter 3, 3.4-3.6 of TB-1, Chapter 4, 4.2-4.3 of TB-1/ Chapter 7, 7.2-7.5 of TB-2)

Text Books:

1. *.A. Ghatak and K. Tyagrajan: Introduction to Fiber Optics: Cambridge University Press, New Delhi, 2004. (Chapter 2, Sections 7.2-7.3, Chapter 3, Sections 4.3,8.2, 17.2, 17.8, Section 11.3, 11.6, Chapter 12, Chapter 18)*
2. *A. Tripathy, Opto-Electronics and Systems: Studium Press, New Delhi, 2016*

Reference Books:

1. *R.P.Khare: Fibre Optics & Optoelectronics, Oxford University Press, New Delhi, 2010.*
2. *John M. Senior, Optical Fibre Communications, Principles and Practice, 3rdEdn, Pearson, 2010*
3. *J.P. Bentley- Principles of Measurement Systems (3/e), Pearson Education, New Delhi, 2007.*
4. *J. Wilson and J.F.B. Hawkes: Optoelectronics: An Introduction (2/e), PHI, New Delhi, 2001. (Chapter 1, Sections 3.1-3.2; 8.1-8.2, Sections 8.3-8.4, 8.5, Sections 4.6, 5.1-5.6, 5.10.2, 7.2, Sections 3.4, 3.7, 3.8, Chapter 10)*

5th Semester

ADVANCED ELECTRONICS CIRCUITS(3-1-0)

University Level(80%)

MODULE-I (10Hours)

1: Active Filters :Active Filters, Frequency response of Major Active filters, First order low-pass Butterworth filter: Filter Design, Frequency Scaling, Second-order low- pass Butterworth filter: First-order high-pass Butterworth filter, Second-order high- pass Butterworth filter, Band-pass filters: Wide band-pass Filter, Narrow Band-Pass Filter, Band-reject filters: Wide Band-Reject Filter, Narrow Band-Reject Filter, All- Pass filter.
2: Oscillators: Oscillators: Oscillator Principles, Oscillator Types, Quadrature Oscillator, Sawtooth wave generator, Voltage-controlled oscillator.
3: Comparators: Comparators: basic comparator, zero-crossing detector, Schmitt trigger, comparator characteristics, limitations of Op-Amp as comparators, voltage limiters.

MODULE-II (12Hours)

4: BistableMultivibrator: BistableMultivibrator, fixed-bias bistablemultivibrator, Loading, self-biased transistor binary, commutating capacitors, Triggering the binary, Unsymmetrical Triggering of the bistablemultivibrator, Triggering Unsymmetrically through a Unilateral Device, Symmetrical Triggering, Triggering of a Bistable Multi Symmetrically without the Use of Auxiliary Diodes, Schmitt Trigger Circuit (Emitter-coupled BistableMultivibrator).
5: Monostable and AstableMultivibrator: MonostableMultivibrator, Gate Width of a Collector-Coupled MonostableMultivibrator, Waveforms of the Collector-Coupled MonostableMultivibrator, Emitter-Coupled MonostableMultivibrator, Triggering of theMonostableMultivibrator. Astable Collector-Coupled Multivibrator, Emitter- coupled astablemultivibrator.

MODULE-III **(**13Hours**)**

6: Negative Resistance Switching Devices: Voltage Controllable Negative resistance devices, Tunnel Diode operation and characteristics, MonostableAstable, Bistable circuits using tunnel diode, Voltage controlled Negative Resistance Switching Circuits.
7: Voltage and Current Time Base Generators: Time-Base Generators, General features of a Time-base signal, Methods of generating a voltage time-base waveform, Exponential sweep circuit, Miller and bootstrap time base generators- Basic principles, Transistor miller time base generator, Transistor bootstrap time base generator, Current Time-Base Generators, A Simple Current sweep, Linearity Correction through adjustment of driving waveform, Transistor current time base generator.

8: Specialized IC Applications: IC 555 Timer: IC 555 Timer as a MonostableMultivibrator and its applications, IC 555 Timer as AstableMultivibrator and its applications. Phase Locked Loop: Operating principle of PLL, Phase detectors, Exclusive-OR phase detector, Monolithic phase detector, Instrumentation Amplifier and its applications.

College Level (20%)

Wideband amplifiers: Wideband amplifiers: The Hybrid-π , High-frequency, Small- signal, Common-emitter Model, Voltage regulators: Fixed and adjustable type ,Switched capacitor: Principle, theory and application

Text Books:

1. *Pulse, Digital and switching Waveforms, Second Edition - Jacob Millman, Herbert Tauband Mothiki S Prakash Rao (TMH Publication).*
2. *OP-Amps and Linear Integrated Circuits- Ramakant A. Gayakwad (PHI Publication).*
3. Pulse,Switching, and Digital Circuits, David A. Bell, Oxford University Press
4. *Pulse & Digital Circuits by K.Venkata Rao, K Rama Sudha& G Manmadha Rao, Pearson Education, 2010. (Selectedportions)*

Reference Books:

1. *OP-Amps and Linear Integrated Circuits - Robert F. Coughlin, Frederick F. Driscoll (Pearson Education Publication).*
2. *Pulse and Digital Circuits by A. Anand Kumar,PHI*

5th Semester

NUMERICAL METHODS(3-1-0)

("will be uploaded soon")

5th Semester

COMPUTER NETWORK & DATA COMMUNICATION (3-0-0)

Module–I **12Hrs**

Overview of Data Communications and Networking.
Physical Layer : Analog and Digital, Analog Signals, Digital Signals, Analog versus Digital, Data Rate Limits, Transmission Impairment, More about signals.
Digital Transmission: Line coding, Block coding, Sampling, Transmission mode.
Analog Transmission: Modulation of Digital Data; Telephone modems, modulation of Analog signals. Multiplexing : FDM , WDM , TDM ,
Transmission Media: Guided Media, Unguided media (wireless)
Circuit switching and Telephone Network: Circuit switching, Telephone network.

Module–II **12Hrs**

Data Link Layer
Error Detection and correction: Types of Errors, Detection, Error Correction Data Link Control and Protocols:
Flow and Error Control, Stop-and-wait ARQ. Go-Back-N ARQ, Selective Repeat ARQ, HDLC. Point-to –Point Access: PPP
Point –to- Point Protocol, PPP Stack, Multiple Access
Random Access, Controlled Access, Channelization. Local area Network: Ethernet.
Traditional Ethernet, Fast Ethernet, Gigabit Ethernet. Token bus, token ring Wireless LANs: IEEE 802.11, Bluetooth virtual circuits: Frame Relay and ATM.

Module–III 12Hrs

Network Layer:
Host to Host Delivery: Internetworking, addressing and Routing Network Layer Protocols: ARP, IPV4, ICMP, IPV6 ad ICMPV6
Transport Layer: Process to Process Delivery: UDP; TCP congestion control and Quality of service.
Application Layer :
Client Server Model, Socket Interface, Domain Name System (DNS): Electronic Mail (SMTP) and file transfer (FTP) HTTP and WWW.

Text Books:

1. *Data Communications and Networking: Behrouz A. Forouzan, Tata McGraw-Hill, 4 Ed*
2. Data Communication and Networks, Bhushan Trivedi, Oxford University Press
3. *Computer Networks: A. S. Tannenbum, D. Wetherall, Prentice Hall, Imprint of Pearson 5th Ed*

Reference Book: .

1. *Computer Networks: A system Approach:Larry L, Peterson and Bruce S. Davie,Elsevier, 4 Ed*
2. *Computer Networks: Natalia Olifer, Victor Olifer, WilleyIndia*
3. *Data and Computer Communications: William Stallings, Prentice Hall, Imprint of Pearson,9*
4. *Data communication & Computer Networks: Gupta, Prentice Hall ofIndia*
5. *Network for Computer Scientists & Engineers: Zheng, Oxford UniversityPress*
6. *Data Communications and Networking: White, CengageLearning*

5th Semester

ANALYTICAL INSTRUMENTATION (3-1-0)

(Honour)

University Level(80%)

Module I: (12 Hours)

Fundamentals of Analytical Instruments: Elements of an Analytical Instrument, Intelligent Analytical Instrumentation Systems, PC-based Analytical Instruments. Spectrophotometers: Ultraviolet and Visible Absorption Spectroscopy, Calorimeters, Photometers, Different types of Spectrophotometers, Sources of Errors and Calibration, Infrared Spectrophotometers – Basic Components and Types, Sample Handling Techniques, Flame Photometers – Principle, Constructional Details, Types and accessories, Atomic Absorption Spectrophotometers and their instrumentation.
(1.1, 1.5, 1.6, 2.4, 2.5, 2.6, 2.7, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.5, 5.1 and 5.2)

Module II: (14 hours)

Chromatography: Gas Chromatograph – Basic Parts of a Gas Chromatograph, Methods of Measurement of Peak Areas, Liquid Chromatograph – Types, High Pressure Liquid Chromatograph.
pH meters and Ion Analyzers: Principle of pH Measurement, Electrodes for pH Measurement, pH Meters, Ion Analyzers, Blood pH Measurement.
Gas Analyzers: Measurement of Blood $pCO_2$and pO_2, Industrial Gas Analyzers – Types, Paramagnetic Gas Analyzer, Infrared Gas Analyzers, Industrial gas Analyzers Based on Other
Methods. (16.1, 16.3, 16.4, 16.5, 17.1, 17.2, 17.3, 21.2, 21.3, 21.4, 21.6, 22.2, 22.3, 22.4, 23.1, 23.2, 23.3, 23.5)

Module III: (12 Hours)

Principles of Nuclear Magnetic Resonance: Nuclear Magnetic Resonance (NMR) Spectroscopy – Principle, Types and Construction details of NMR Spectrometers.
Radiochemical Instruments: Fundamentals of Radiochemical Methods, Radiation Detectors, Liquid Scintillation Counters, Gamma Spectroscopy.
X-Ray Spectrometers: Instrumentation for X-Ray Spectrometry, X-Ray Diffractometers, X-Ray Absorption Meters, Electron Probe Micro analyzer.
(10.1, 10.2, 10.3, 10.4, 13.1, 13.2, 13.3, 13.5, 14.2, 14.3, 14.4, 14.6)

At college Level

Use of PC based analytical Instrument in Industry, Industrial application of spectrometer, photometer, NMR spectrometer, Chromatograph and their case study.
Technical speciation of various analytical Instruments as used in Industry.

TEXT BOOK:

1. *Handbook of Analytical Instruments – by R.S. Khandpur, TMH Education Pvt. Ltd.*

REFERENCE BOOKS:

2. *Instrumental Methods of Analysis – by Willard H.H., Merrit L.L., Dean J.A.. and Seattle F.L., CBS Publishing and Distributors, 6/e, 1999*
3. *Instrument Technology – by Jones B.E., Butterworth Scientific Publ., London, 1987. Mechanical and Industrial Measurements by Jain R.K., Khanna Publishing,N Delhi, 2/e, 1992.*
4. *Principles of Instrumental Analysis – by Skoog D.A. and West D.M., Holt Sounder Publication, Philadelphia, 1985.*
5. *Instrumental Analysis – by Mann C.K., Vickerks T.J. &Gullick W.H., Harper and Row*
6. *Publishers, New York, 1974.*
7. *Jone's instrument Technology (vol. 2 and 3) - B.E. Noltingk, Butterworth-Heinmann, N Delhi.*
8. *Instrumental Methods of Chemical Analysis - E.W. Ewing, McGraw-Hill.*
9. *Instrumentation, Measurement and Analysis - B.C. Nakra and K.K. Chowdhurry, TMH.*
10. *Measurement and Instrumentation: Trends and Applications - M.K. Ghosh, S.Sen and S. Mukhopadhyay (ed.), Ane Books, New Delhi, 2008.*

5th Semester

Minor:

Microprocessors and Interfacing

(same as Professional core)

5th Semester

INSTRUMENTATION DEVICES AND SYSTEMS-II LAB(0-0-2)

1. Temperature measurement system with thermocouple providing cold junction compensation.
2. Design of a microcontroller based storage & display device.
3. LVDT and its signal conditioningcircuit.
4. Orifice type flow meter, with diaphragm type differential pressure transducer with capacitive sensingscheme.
5. Study of piezoelectricaccelerometerwithchargeamplifierconfiguration.
6. Study of active low pass, high pass & band passfilters.
7. Study of RLL for a PLC based sequential controlscheme.
8. Study of PID controller.
9. 9.Design of a stepper motor drive.
10. DesignofRegulatedpowersupplyunit(includingheatsickdesign)

5th Semester

Microprocessor Lab

8085 Microprocessor

1. Write a program for addition of two 8 –bit and 16 bit numbers.
1. 2 .write a program for addition of series of numbers.
2. Subtraction of two 8 bit and 16 bit numbers.
3. Write a program for finding the larger between two numbers.
4. Write a program to find the smallest from an array of numbers.
5. Arrange a series of numbers in ascending order.
6. Multiplication and division of two 8 bit numbers
7. . Demonstrate the generation of square wave using PPI
8. Write a program to interface ADC and DAC with 8085.
9. Write a program to interface stepper motor with 8085.
10. Write a program to interface traffic light control with 8085.

5th Semester

Digital Signal Processing Lab

1. Familiarization with the architecture of a standard DSP kit (Preferably TMS 320C6XXX DSP kit of TexasInstruments)
2. Generation of various types of waveforms (sine, cosine, square, triangular etc.) using MATLAB and DSPkit.
3. Linear convolution of sequences (without using the inbuilt conv. function in MATLAB) and verification of linear convolution using DSPkit.
4. Circular convolution of two sequences and comparison of the result with the result obtained from linear convolution using MATLAB and DSPkit.
    (i) Computation of autocorrelation of a sequence, cross correlation of two sequences usingMATLAB.
    (ii) Computation of the power spectral density of a sequence using MATLAB also implementing the same in a DSP kit.
5. Finding the convolution of a periodic sequence using DFT and IDFT inMATLAB.
    (i) Implementation of FFT algorithm by decimation in time and decimation in frequency usingMATLAB.
    (ii) Finding the FFT of a given 1-D signal using DSP kit and plotting the same.
6. Design and implementation of FIR (lowpass and highpass) Filters using windowing techniques (rectangular window, triangular window and Kaiser window) in MATLAB and DSPkit.
7. Design and implementation of IIR (lowpass and highpass) Filters (Butterworth and Chebyshev) in MATLAB and DSPkit.
11. (i) Convolution of long duration sequences using overlap add, overlap XXXXX using MATLAB.
8. (ii) Implementation of noise cancellation using adaptive filters on a DSP kit.

Reference Books:

9. *Digital Signal Processing: A MATLAB-Based Approach – Vinay K. Ingle and John G. Proakis, CengageLearning.*
10. *Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling and Sandra L. Harris, CengageLearning.*

5th Semester

Advance Lab-I (Simulation Lab)

(5 Experiments has to be done)

Tools used: MatLab, Multisim, Xilinx/Vivado, Labview.

1. Design, realization & Simulation of 1st order LPF, HPF. Compare the results with realized filter.
2. Design, realization & Simulation of 2nd order LPF, HPF. Compare the results with realized filter.
3. Design and simulation of a simple R-L-C circuit and find its settling time, overshoot and steady state error.
4. Design, realization & Simulation of PLL and find its operating frequency.
5. Simulation of PID controller using Ziegler-Nichols and Cohen-Coon technique.
6. Design, realization & Simulation of Flip Flop and counters using Xilinx/Vivado .

Sixth Semester								
	Theory					Practical		
Code	Course Name	Hours/week L/T	Credit Theory	University Marks	Internal Evaluation	Hours/week L/T	Credit Practical	Marks
PC	Process Control	3-0	3	100	50	2	1	50
PC	Industrial Automation	3-0	3	100	50	2	1	50
PE	Intelligent & Virtual Instrumentation/Advanced Control System/Process Simulation & Modelling	3-1	4	100	50			
PE	Biomedical Instrumentation/Wireless & Sensor Network/Robotics & Robot Applications	3-1	4	100	50			
MC & GS	Environmental Science & Engineering	3-0	3	100	50			
OE	Industrial Lecture #					3	1	50
HS	Presentation Skill & Skill for Interview # #	2-0	1		50	4	2	100
MC	Yoga					2	1	50
Total		19	18	500	300	13	6	300
Total Marks: 1100								
Total Credits: 24								
Honours	Power Electronics	4	4	100	50			
Minor Specialization	Industrial Automation							

6th Semester

PROCESS CONTROL (3-0-0)

University: 80%:

Module-I (10 Hrs)

Analog Signal Conditioning Introduction, Principles of Analog Signal Conditioning, Signal-Level Changes, Linearization, Conversions, Zero adjustment, Span adjustment, Level changing, AC/DC Power supply, Filtering and Impedance Matching, Passive Circuits, Divider Circuit, Bridge Circuits, RC Filters, Operational Amplifiers, Op Amp Characteristics, Op Amp Specifications, Op Amp Circuits in Instrumentation, Voltage Follower, inverting Amplifier, Non- inverting Amplifier, Differential Amplifier, Active Filters, Protection Voltage-to –Current Converter, Current-to-Voltage Converter, Integrator, Linearization.

Digital Signal Conditioning

Introduction, Review of Digital Fundamentals, Digital Information, Fractional Binary Numbers, Boolean Algebra, Digital Electronics, Programmable Logic Controllers, Busses and Tri-State Buffers, Converters, Comparators, Digital-to-Analog Converters (DCA), Analog-to-Digital Converters (ADCs), Sample and Hold, Multiplexer and De-multiplexer, decoder and encoder, Pulse modulations, Digital recorder.

Module-2 (20 Hrs)

Thermal Sensors

Definition of Temperature, Metal Resistance versus Temperature Device, Thermistors, Thermocouples, Other Thermal Sensors, Design Consideration.

Mechanical Sensors Displacement, Position Sensors, Strain Sensors, Motion Sensors, Pressure Sensors, Flow Sensors. Optical Sensors

Photodetectors, Pyrometry, LASER Principles, Applications.

Final Control

Final Control Operation, Signal Conversions, Switching and Control Devices, Actuators, control Elements.

Discrete-State Process Control

Characteristics of the System, Relay Controllers and Ladder diagrams, PLCs.

Module-3 (10 Hrs)

Controller Principles, Process Characteristics, Control System Parameters, Discontinuous and Continuous Controller Modes, Composite Control Modes.

Analog Controllers:

Electronic controllers, pneumatic controllers, design consideration. Cascade, Feed forward, and Ratio Control, Cascade Control, Feed forward Control, Feed forward-feedback Control Configuration, Ratio Control.

Selective and Adaptive Control Systems

Selective Control, Adaptive Control, Adaptive Control Configuration.

College / Institute Portion

Design Guide lines for analog signal conditioning

TEXT BOOK:

1. *1.-PROCESS CONTROL INSTRUMENTATION TECHNOLOGY BY-Curtis D.Johnson.PHI Publication.*
2. *2-PROCESS CONTROL PRINCIPLES AND APPLICATIONS BY- Surekha Bhanot. Oxford Publication*

Reference:-

3. *1.Process control Systems and Instrumentation By-Terry Bartelt , Cengage Learning Publication*

6th Semester

INDUSTRIAL AUTOMATION(3-0-0)

(Prerequisite: Control System Engineering – I)

University level: 80%

ModuleI: (12Hours)

Process Control: Introduction: Process Definition, Feedback Control, PID Control, Multivariable Control. (Chapter 1 of Text Book 1)
PID Controller Tuning: Introduction, Zeigler-Nichols Tuning Method (Based on Ultimate Gain and Period, and Process Reaction Curve), Digital PID Controllers. (Chapter 13 of Text Book 2)

ModuleII: (15Hours)

Special Control Structures: Cascade Control, Feedforward Control, Feedforward- Feedback Control Configuration, Ratio Control, Selective Control, Adaptive Control, Adaptive Control Configuration. (Chapter 10 and 11 of Text book 3)
Actuators: Introduction, Pneumatic Actuation, Hydraulic Actuation, Electric Actuation, Motor Actuators and Control Valves. (Chapter 8 of Text Book 1

ModuleIII: (10Hours)

Industrial Automation: Programmable Logic Controllers: Introduction, Principles of operation, Architecture, Programming (Programming Languages, Ladder Diagram, Boolean Mnemonics) (Chapter 5 of Text Book 1)
Distributed Control: Distributed vs. Centralized, Advantages, Functional Requirements, System Architecture, Distributed Control Systems (DCS), Communication options in DCS. (Chapter 6 of Text Book 1)
Real-time Programming: Multi-tasking, Task Management, Inter-task Communication, Real-time Operating System. (Chapter 9 of Text Book 1)

20% Course (Institute Level):

Architecture of industrial automation systems, measurement of system characteristics, time delay systems and inverse delay systems.

Text Books:

1. *KrishnaKant,"Computer-BasedIndustrialControl",PHI,2009.*
2. *M. Gopal, "Digital Control and State Variable Methods" Tata McGraw Hill,2003.*
3. *SurekhaBhanot, Process Control: Principles and Applications, Oxford university Press,2010*

Reference Books:

1. *Smith Carlos and Corripio, "Principles and Practice of Automatic Process Control", John Wiley & Sons,2006.*
2. *Jon Stenerson, "Industrial Automation and Process Control", Prentice Hall,2003.*
3. *C. Johnson, "Process Control Instrumentation Technology", PHI, NewDelhi*
4. *D.R.Coughnowr,"ProcessSystemanalysisandControl",McGrawHill.*

6th Semester

INTELLIGENT & VIRTUAL INSTRUMENTATION(3-1-0)

University level: 80%

MODULE: I (Basic Concepts for Intelligent Instrumentation) 12 hours

Background of Instrumentation: Introduction, Classification of Classical Sensors and Transducers, Self-Generating Transducers, Variable Parameter Transducers, Radioactive Transducer, Semiconductor Sensors, Array-Based Sensors, Biosensors.
Intelligent Sensors: Introduction, Classification, Smart Sensors, Cogent Sensors, Soft or Virtual Sensors, Self-Adaptive Sensors, Self-Validating Sensors, VLSI Sensors, Temperature Compensating Intelligent Sensors.

MODULE: II (Virtual Instrumentation) 10 hours

Introduction to Virtual Instrumentation: Computers in instrumentation, What is Virtual instrumentation (VI), History of VI, LabVIEW and VI, Conventional and graphical programming, Distributed systems.
Basics of LabVIEW: Components of LabVIEW, Owned and free labels, Tools and other palettes, Arranging objects, pop-up menu, Colour coding, Code debugging, Context sensitive help, Creating sub-Vis.
FOR and WHILE Loops: The FOR loop, The WHILE loop, Additional loop problem, Loop behaviour and interloop communication, Local variables, Global variables, Shift registers, Feedback, Autoindexing, Loop timong, Timed loop.
Other Structures: Sequence structures, Case structures, Formula node, Event structure.
Arrays and Clusters: Arrays, Clusters, inter-conversion of arrays and clusters.
Graphs and Charts: Waveform chart, Resetting plots, Waveform graph, Use of cursors, X-Y graph.
File Input/Output: File formats, File I/O functions, Path functions, Sample VIs to demonstrate file WRITE and READ, Generatinf file names automatically.
String Handling: String functions, LabVIEW string formats, Examples, Some more functions, Parsing of strings.

MODULE: III (Data Acquisition and Interfacing in Virtual Instrumentation) 10 hours

Basics of Data Acquisition: Classification of signals, Read-world signals, Analog interfacing, Connecting the signal to the board, Guidelines, Practical versus ideal interfacing, Bridge signal sources.
Data Acquisition with LabVIEW DAQmx and DAQ Vis: Measurement and automation explorer, The waveform data type, Working in DAQmx, Working in NI-DAQ (Legacy DAQ), Use of simple VIs, Intermediate VIs.
Interfacing with Assistants: DAQ assistant, Analysis assistant, Instrument assistant.

6th Semester

20% Course (Institute Level)

Sensors with Artificial Intelligence: Introduction, Sensors with Artificial Intelligence
State Machines: What is a state machine? , A simple state machine, Event structures, the full state machine, Notes and comments.
Interfacing Instruments: GPIB and RS232: RS232C versus GPIB, Handshaking, GPIB interfacing, RS232C/RS485 interfacing, Standard commands for programmable instruments, VISA, Instrument interfacing and Lab VIEW.

Textbooks:

1. *M. Bhuyan, Intelligent Instrumentation Principles and Applications, CRC Press 2011,ISBN-13: 978-1-4200-8954-7*
2. *Sanjay Gupta and Joseph John, **Virtual Instrumentation Using LabVIEW**, 2nd Edn., Tata McGraw-Hill, 2010, **ISBN-10:** 0-07-070028**-1**, **ISBN-13:** 978-0-07-070028-4.*
3. *Jerome Jovitha, **Virtual Instrumentation Using Labview**, PHI Learning,, 2010, **ISBN-10:** 8120340302, **ISBN-13:** 9788120340305, 978-8120340305.*

Recommended Reading:

1. *J.S.R. Jang, C.T. Sun, E. Mizutani, Neuro Fuzzy and Soft Computing, PHI.*
2. *Ham & I. Kostanic, Principles of Neuro Computing for Science & Engineering, TMH.*
3. *V.keeman, Learning and Soft Computing, Pearson Education, New Delhi.*
4. *Gary W. Johnson & Richard Jeninngs, LabVIEW Graphical Programming, 4th Edn., TMH.*
5. *J. Travis and J. Kring, LabVIEW for Everyone, 3rd Edn., Prentice Hall, 2006.*
6. *Peter A. Blume, The LabVIEW Style Book, Prentice Hall, 2007.*

6th Semester

ADVANCED CONTROL SYSTEMS (3-1-0)

University level: 80%

Module-I: ***(15Hours)***

Discrete - Time Control Systems: Introduction: Discrete Time Control Systems and Continuous Time Control Systems, SamplingProcess.
Digital Control Systems: Sample and Hold, Analog to digital conversion, Digital to analog conversion.
The Z-transform: Discrete-Time Signals, The Z-transform, Z-transform of Elementary functions, Important properties and Theorms of the Z-transform. The inverse Z-transform, Z-Transform method for solving Difference Equations.
Z-Plane Analysis of Discrete Time Control Systems: Impulse sampling & Data Hold, Reconstruction of Original signals from sampled signals: Sampling theorem, folding, aliasing. Pulse Transfer function: Starred Laplace Transform of the signal involving Both ordinary and starred Laplace Transforms; General procedures for obtaining pulse Transfer functions, Pulse Transfer function of open loop and closed loop systems.

Module -II : (15 Hours)

State Variable Analysis & Design: Introduction: Concepts of State, State Variables and State Model (of continuous time systems): State Model of Linear Systems, State Model for Single-Input-Single-Output Linear Systems, Linearization of the State Equation. State Models for Linear Continuous – Time Systems: State-Space Representation Using Physical Variables, State – space Representation Using Phase Variables, Phase variable formulations for transfer function with poles and zeros, State – space Representation using Canonical Variables, Derivation of Transfer Function for State Model. Solution of State Equations: Properties of the State Transition Matrix, Computation of State Transition Matrix, Computation by Techniques Based on the Cayley- Hamilton Theorem. Concepts of Controllability and Observability: Controllability, Observability, Effect of Pole-zero Cancellation in Transfer Function. Pole Placement by State Feedback, Observer Systems. State Variables and LinearDiscrete

Module -III : (12 Hours)

Nonlinear Systems : Introduction : Behaviour of Non linear Systems, Investigation of nonlinear systems.
Common Physical Non Linearities: Saturation, Friction, Backlash, Relay, Multivariable Nonlinearity.
The Phase Plane Method: Basic Concepts, Singular Points: Nodal Point, Saddle Point, Focus Point, Centre or Vortex Point, Stability of Non Linear Systems: Limit Cycles, Construction of Phase Trajectories: Construction by Analytical Method, Construction by Graphical Methods.
The Describing Function Method: Basic Concepts: Derivation of Describing Functions:

Dead- zone and Saturation, Relay with Dead-zone and Hysteresis, Backlash. Stability Analysis by Describing Function Method: Relay with Dead Zone, Relay with Hysteresis, Stability Analysis by Gain-phase Plots. Jump Resonance.

20% Course (Institute Level)

Liapunov's Stability Analysis: Introduction, Liapunov's Stability Criterion: Basic Stability Theorems, Liapunov Functions, Instability. Direct Method of Liapunov& the Linear System: Methods of constructing Liapunov functions for Non linear Systems.
Stability analysis of closed loop systems in the z-plane: Stability analysis by use of the Bilinear Transformation and Routh stability criterion. – Time Systems: State Models from Linear Difference Equations/z-transfer Functions, Solution of State Equations (Discrete Case).

Text Books:

1. *Discrete-TimeControlSystem,byK.Ogata,2ndedition(2009),PHI.*
2. *Control Systems Engineering, by I.J. Nagrath and M.Gopal., 5th Edition (2007 / 2009), New Age International (P) Ltd.Publishers.*

Reference Books:

1. *Design of Feedback Control Systems by Stefani, Shahian, Savant, Hostetter, Fourth Edition (2009), Oxford UniversityPress.*
2. *Modern Control Systems by K.Ogata, 5th Edition (2010),PHI.*
3. *Modern Control Systems by Richard C. Dorf. And Robert, H.Bishop, 11th Edition (2008), Pearson Education Inc.Publication.*
4. *Control Systems (Principles & Design) by M.Gopal, 3rd Edition (2008), TMH Publishing CompanyLtd.*
5. *ControlSystemsEngineeringbyNormanS.Nise,4th Edition(2008),WileyIndia(P)Ltd.*

6th Semester

PROCESS SIMULATION AND MODELLING (3-1-0)

University level: 80%

Module-I: ***(15Hours)***

Introduction:
Introduction to process control, control objectives and benefits, Dynamic behavior of process control systems: Dynamic behavior of first second order system, series and parallel structures of simple system, Recycle structures, staged processes.
Concepts of system modeling: Definition, principles of system modeling, modeling procedure, need of modeling, for engineering and non –engineering systems, Classification of modeling, fundamentals of chemical process dynamics, continuity equation, equation of motion, transport equation, equation of state, equilibrium, chemical kinetics, Input-output model and its transfer function,Dynamicmodelingoftankreactorsystem. Vaporizer flashes drum, batch reactor, Binary distillation column, and boiler.

Module -II: (13Hours)

Computational methods for solving algebraic & differential equations:
Solution of algebraic equation: Interval Halving, Newton Raphson method
Solution of differential equation: Runge-Kutta method, Euler method,
Empirical model Identification: Empirical model building procedure, process reaction curve method, statistical model Identification.
Intelligent controllers: Adaptive control system (Self tuning regulator & Model reference adaptive controller), inferential control systems

Module -III: (10Hours)

Optimization: Optimization techniques and application, Single and multivariable optimization, line programming, Sequential quadratic programming & reduced gradient optimization technique & application
Simulation:
Basicprinciplesofsimulation,useofsystemsimulation,toolsformodeling&simulation, types of system simulation.

20% Course (Institute Level)

Adam-Bash forth method, Introduction to geometric programming and dynamic programming. Predictive controller. Analog & digital simulation techniques, formulation of model for dynamic system, process simulation, control system simulation.
Optimal controller using Kalman filter,

Text books:

1. *Processcontrol:ThomasE.Marlin,McGrawHillPublication.*
2. *Chemicalprocesscontrol:Geoyestephanppolous,PHIprivateLimited*
3. *Processmodeling,simulationandcontrolforchemicalEngineersWilliamL.Luyben, MC-GrawHillPrivateLtd.*
4. *ComputerbasedIndustrialcontrol-KrishnaKnt.*
5. *Chemicalprocesssimulation–AsgharHussain.*
6. *Reference Books:*
7. *Systemsimulation–GeoffreyGorden*
8. *Systemsimulationwithdigitalcomputer–NarsingDeo*
9. *Introductiontosimulation–JamesPayne(MN)*
10. *Simulationmodeling&analysis–LawKelton(MN)*

6th Semester

BIOMEDICAL INSTRUMENTATION (3-1-0)

University level: 80%

Module I (13 Hours)

Introduction to Bioengineering, Biochemical Engineering, Biomedical Engineering, Sources of Biomedical Signals, Basic medical Instrumentation system, Performance requirements of medical Instrumentation system, use of microprocessors in medical instruments, PC based medical Instruments, general constraints in design of medical Instrumentation system & Regulation of Medical devices.

Bioelectrical Signals & Electrodes: Origin of Bioelectric Signals, Electrocardiogram, Electroencephalogram, Electromyogram, Electrode-Tissue Interface, Polarization, Skin Contact Impedance, Motion Artifacts.

Module -II (14 Hours)

Electrodes for ECG: Limb Electrode, Floating Electrodes, Prejelled disposable Electrodes, Electrodes for EEG, Electrodes for EMG.

Physiological Transducers: Introduction to Transducers, Classification of Transducers, Performance characteristics of Transducers, Displacement, Position and flow and pressure Transducers.

Strain gauge pressure transducers, Thermocouples, Electrical Resistance Thermometer, The mister, Photovoltaic transducers, Photo emissive Cells & Biosensors or Biochemical sensor

Module –III (13 Hours)

Recording Systems: Basic Recording systems, General considerations for Signal conditioners, Preamplifiers, Differential Amplifier, Isolation Amplifier, Electrostatic and Electromagnetic Coupling to AC Signals, Proper Grounding (Common Impedance Coupling)

20% Course (Institute Level)

Transformation techniques in biomedical signals ie. Laplace transform, Z-transform, DFT, DTFT, STFT, Wavelet transform, Effects of noise in biomedical instruments- filtering in biomedical instruments.

Text Books:-

1. *Hand Book of Biomedical Instrumentation-2nd Ed by R.S.Khandpur, Tata McGraw Hill, 2003*
2. *Introduction to Biomedical Engineering by Michael M. Domach, Pearson Education Inc,-2004*

Reference Books:

(1) Introduction to Biomedical equipment technology, 4e. By JOSEPH.J.CAAR & JOHN M.BROWN (Pearson education publication)

(2) Medical Instrumentation-application & design. 3e – By JOHN.G.WEBSTER John Wiley & sons publications

6th Semester

WIRELESS & SENSOR NETWORK (3-1-0)

University level: 80%

MODULE -I (12Hrs)

Sensor Network Concept: Introduction, Networked wireless sensor devices, Advantages of Sensor networks, Applications, Key design challenges.
Network deployment: Structured versus randomized deployment, Network topology, Connectivity, Connectivity using power control, Coverage metrics, and Mobile deployment.
Localization and Tracking: Issues and approaches, Coarse-grained and Fine-grained node localization. Problem formulations: Sensing model, collaborative localization.

MODULE -II (14 Hrs)

Tracking multiple objects: State space decomposition. Synchronization: Issues and Traditional approaches. Communication Protocols for Senor Networks: Application layer protocols for WSN, Transport Layer, Network Layer, Data Link Layer, and Physical Layer, Time synchronization. Wireless Characteristics: Link quality.

MODULE -III (10 Hrs)

Medium-access and sleep scheduling: Traditional MAC protocols, Energy efficiency in MAC protocols, Asynchronous sleep techniques, Sleep-scheduled techniques.
Energy-efficient and robust routing: Overview, Lifetime-maximizing energy-aware routing techniques, Geographic routing.

20% Course (Institute Level)

Sensor network Databases: Data-centric routing, Data-gathering with compression, Querying, the database perspective on sensor networks. Security for WSN- WSN threats, WSN operational paradigms and their corresponding vulnerabilities.

Text Books:

1. *Networking Wireless Sensors: BhaskarKrismachari, Cambridge University Press*

References Books:

1. *Wireless Sensor Networks: Edited by C.S Raghavendra, Krishna M, Sivalingam, Taieb Znati, Springer.*
2. *Wireless Sensor Networks: An Information Processing Approach- by Feng Zhao, Leonidas Guibas, Morgan Kaufmann Series in Networking 2004.*
3. *Wireless Sensor Networks: Technology, Protocols, and Applications: KazemSohraby,* Daniel Minoli, TaiebZnati, Wiley Inter Science.

6th Semester

ROBOTICS & ROBOT APPLICATIONS (3-1-0)

University level: 80%

Module – I (12 hrs)

Fundamentals of Robotics: Evolution of robots and robotics, Definition of industrial robot, Laws of Robotics, Classification, Robot Anatomy, Work volume and work envelope, Human arm characteristics, Design and control issues, Manipulation and control, Resolution; accuracy and repeatability, Robot configuration, Economic and social issues, Present and futureapplication.Mathematicalmodeling of a robot: Mapping between frames, Description of objects in space, Transformation ofvectors. Direct Kinematic model: Mechanical Structure and notations, Description of links and joints, Kinematic modeling of the manipulator, Denavit-Hartenberg Notation, Kinematic relationship between adjacent links, Manipulator Transformation matrix.

Module – II (12 hrs)

Inverse Kinematics: Manipulator workspace, Solvable of inverse kinematic model, Manipulator
Jacobian, Jacobian inverse, Jacobian singularity, Staticanalysis. Dynamic modelling Lagrangianmechanics,2D-Dynamic model, Lagrange-Euler formulation, Newton-Eulerformulation. Robot Sensors: Internal and external sensors, force sensors, Thermocouples, Performance characteristic of arobot.

Module – III(12 hrs)

Robot Actuators: Hydraulic and pneumatic actuators, Electrical actuators, Brushless permanent magnet DC motor, Servomotor, Stepper motor, Micro actuator, Micro gripper, Micro motor, Driveselection. Trajectory Planning: Definition and planning tasks, Joint space planning, Cartesian space planning. Applications of Robotics: Capabilities of robots, Material handling, Machine loading and unloading, Robot assembly, Inspection, Welding, Obstacleavoidance.

Text Books:

4. *RoboticsandControl,R.K.MittalandI.J.Nagrath,TataMcGrawHill*

2. *Introduction to Robotics: Mechanics and control, John J Craig,PHI*
5. *RoboticsTechnologyandFlexibleAutomation,S.R.DebandS.Deb,TataMcGrawHill*

Reference Books:

6. *Introduction to Robotics, S. K. Saha, Tata McGrawHill*
7. *Robotics:Control,Sensing,VisionandIntelligence,K.S.Fu,R.C.GonzalezandC.S.G.Lee,TMH*
8. *Robotics, AppuuKuttan K.K., I.K.international*
9. *RobotDynamicsandControl,M.W.SpongandM.Vidyasagar,WileyIndia.*
10. *IndustrialRoboticsTechnology,programmingandapplication,M.P.Groover,McGrawHill*

6th Semester

POWER ELECTRONICS (3-1-0)

(Major)

University(80%)

Module-1 12Lecturers

Power semiconductor devices: Switching and V-I characteristic of devices Thyristor family: SCR, TRIAC,GTO,RCT,MCT, and Transistor Family: BJT, IGBT, andMOSFET

Triggering Methods: SCR: UJT and R-C triggering scheme, Power Transistor: MOSFET Gate drive, BJT base drive, IGBT gate drive, Isolation of gate and base drive.

Protection of Devices: SCR: Over voltage, over current, dv/dt, di/dt, Gate Protection. Transistor: protection of power BJT, IGBT and power MOSFET, dv/dt&di/dtlimitation.

Module-2 **12Lectures**

AC to DC converter: Un controlled Diode rectifier : Single phase half wave and full wave rectifiers with R-L and R-L-E load ,3 phase bridge rectifier with R-L and R-L-E load

Controlled rectifiers : Principle of phase controlled converter operation, single phase full converter with R-L and R-L-E load,3 phase full converter with R-L and R-L-E load ,single phase semi converter with R-L and R-L-E load, 3 phase semi convertewith R-L and R-L-E load.

Single phase PWM rectifier, Three phase PWM rectifier.

AC –AC converter : AC voltage controller: Single phase bi-directional controllers with R and R-L load, single phase cycloconverters, ac-voltage controllers with PWM control.

Module3 **12Lectures**

DC to DC converter: Classification: First quadrant, second quardrant, first and second quardrant, third and fourth quardrant, fourth quardrant converter. Switching mode regulators: Buck regulators, Boost regulators, Buck-Boost regulators, Cuk regulators, Isolated Types: Fly Back Converters, Forward converters, Push Pull Converters, Bridge Converter.

DC to AC converter: Inverters: PWM inverters, Single phase Bridge Inverters, 3-Phase Inverters-180 deg. conduction, 120 deg. conduction. voltage control of 3-Phase Inverters: Sinusoidal PWM , space vector modulation, Current Source Inverter, Soft-switching, Zero Current Switching resonant inverters, Zero Voltage Switching resonant inverter.

(20%) Institute level

UPS, SMPS, Battery Chargers, Electronic Ballast, Importance of dc/ac drive Basic operation of a chopper-fed dc motor drive.

Text Books:

1. *Power Electronics: Circuits, Devices and Applications by M H Rashid, 3rd Edition, Pearson*

Reference Books:

2. *PowerConverterCircuits by W Shepherd and L Zhang, CRC,TaylorandFrancis, Special IndianEdition*
3. *Power Electronics: Converters , Applications, and Design by Mohan, Undeland and Robbins, Wiley StudentEdition.*

6th Semester

INDUSTRIAL AUTOMATION LAB

1. Architecture of Industrial Automation Systems,
2. Measurement Systems Characteristics,
3. Motion Sensing
4. Signal Conditioning,
5. Flow Measurement,
6. PID Control Tuning,
7. Time Delay Systems and Inverse Response Systems,
8. Hydraulic Control Systems,
9. DC Motor Drives,
10. Step Motor Drives

6th Semester

PROCESS CONTROL LAB

1. To study the characteristics of P/I & I/P converter;
2. Determination of the different types of valve characteristics & calculate the gain at various condition;
3. Study and synthesis of Hydraulic & Pneumatic systems using Trainers;
4. Experiments on Air velocity sensor and its associate signal conditioner circuit;
5. Performance analysis on ON-OFF/P/ PI/PD/PID controllers on Co-Current and Counter Current Heat Exchanger Process;
6. Phase- Plane analysis on Relay Control system;
7. Study of Linear System Simulator;
8. Study of Compensation Design Network

Seventh Semester								
	Theory					Practical		
Code	**Course Name**	**Hours/week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/week L/T**	**Credit Practical**	**Marks**
GS	Nano Science & Bio Technology	3-1	4	100	50			
PE	Microwave & Antenna Engg./ Microcontroller & its Application/Satellite Communication/Digital Image Processing	3-1	4	100	50			
PE	VLSI Design/MEMS/Renewable Energy Sorces/embedded Systems	3-1	4	100	50			
OE	Soft Computing */ Other subjects	3-1	4	100	50			
PC	Advance Lab-II/ Project					8	4	200
	Projects on Internet of Things					8	4	200
Total		16	16	400	200	16	8	400
Total Marks: 1000								
Total Credits: 24								
Honours	Advanced Process Control	4	4	100	50			
Minor Specialization								

7th Semester

NANO SCIENCE & BIO TECHNOLOGY

"will be uploaded soon"

7th Semester

MICROWAVE AND ANTENNA ENGINEERING (3-1-0)

University Level(80%)

MODULE I (14 Hrs)

Transmission lines: The lumped element circuit model for a transmission line, wave propagation, field analysis of two wire and coaxial transmission lines, characteristic impedance, terminated transmission line, reflection coefficient, voltage standing wave ratio, scattering matrix, signal flow graph, Smith chart, transmission line problem solutions with Smith chart, single stub and double stub matching
Rectangular and cylindrical waveguide: wave propagation, modes in waveguides, power flow , attenuation due to conductor and dielectric losses

MODULE II (12 Hrs)

Microwave Devices and components
Reflex klystron: velocity modulation, electronic admittance, output power and frequency
Magnetron: Principle of operation, rotating field, π mode of operation, frequency of oscillation, the ordinary (O-type) TWT-principle of operation as an amplifier

MODULE III (12 Hrs)

Antenna and parameters: Radiation pattern, beam solid angle, directivity, gain, input impedance, polarization, bandwidth, reciprocity, equivalence of radiation and receive patterns, equivalence of impedances, effective aperture, vector effective length, short dipole, radiation resistance and directivity, half-wave dipole, monopole, small loop antenna

College Level (20%)

Power Dividers and Couplers:
Basic properties, basic T-junction power divider, waveguide directional couplers, fixed and precision variable attenuator, ferrite isolator, rectangular cavity resonator, resonant frequencies of cavity supporting dominant mode only, dielectric resonator, strip line and micro strip

TEXT BOOKS:

1. *David M.Pozar, " Microwave Engineering", Wiley, 4thEdn., 2013*
2. *A.R. Harish and M.Sachidananda, " Antennas and Wave Propagation", Oxford University Press 2007*

REFERENCE BOOK:

1. *Sushrut Das, " Microwave Engineering", Oxford University Press 2014*

7th Semester

MICROCONTROLLERS & ITS APPLICATIONS (3-1-0)

BPUT Level(80%)

Module-I:(12 hrs)

Microcontrollers and Embedded processors, Microcontroller's Architecture, Pin diagram of 8051 and basic features like Timing diagram, 8051 data types and directives, PSW register, Register bank and stack. Memory organization. Addressing modes, Arithemetic, logic instructions and their classification, Assembly language programming, Difference among various microcontrollers 8031, 8051and 8052, 8051,89c51,89s52,89s52.

Module- 2: (15 Hours)

Input/ Output Port Programming: Introduction to Port programming as Input Port and Output Port (Assembly Language Programming)
Timer Port Programming: Introduction to timers, Programming 8051 timers, Counter programming. Programming timers 0 and 1 in 8051
Serial Port Programming : Serial Communication -Hardware Description- Logical Level Converter- MAX232 ,Implementation with Real time application -Parallel communication - Parallel port basics -Pin details- Interfacing with Microcontroller-PC to MC communication. Serial port programming
Interrupts Programming : Definition for Interrupt -Interrupt types -Handling interrupts - Polling sequences-Interrupt sequences-External interrupts-Internal interrupts-Programming for interrupt based applications-Problems at interrupts-Debugging
ADC and DAC: - Basic principle , Their pin diagram; ADC(0804/0808/0809), DAC-0800 -

Module-3: (13 hours)

Applications:

Peripheral Devices Interfacing: Different peripheral device -Difference types of display units -7 Segments & its types, Principle of Operation-Common Anode mode-Common Cathode mode, 16x2 LCD -Applications- Hardware interfaces-Interfacing Circuits for LCD & LED, Switch: types of switch, Programming Seven Segment Display, LCD, LED, Switch with 8051 Microcontroller.
Keyboard Interfacing: Applications using keyboard interfacing with 8051 Microcontroller, Introduction to 8255 and 8255 interfacing with 8051.
Motor Interfacing: Motors used for Robotics controls -Stepper Motor & Stepper driver circuit -Stepper motor Bidirectional controlling of DC motor -Method to change polarity-Sample programs -Different sensors- Applications.

Institution Level: 20%

(Transformation from assembly language programming to C-Language for various internal/external peripheral devices)

Text Book:

1. *The 8051 Microcontroller and Embedded Systems using assembly and C by M.A. Mazidi, J.G. Mazidi, Pearson.*
2. *8051 Microcontrollers- MCS 51 Family its Variants, Satish Shah, Oxford University Press*
3. *Microcontrollers [Theory and applications] by Ajay V Deshmukh; Mc Graw Hill publication.*

Reference Books :

1. *Microprocessors and Microcontrollers Architecture, Programming and system Design by Krishna kant; PHI .*
2. *Microprocessors and Microcontrollers by NagoorKani, 2nd edition, McGraw Hill Publication.*

7th Semester

SATELLITE COMMUNICATION(3-1-0)

University level: 80%

Module – I (12 Hours)

Introduction to state of satellite communication: Orbital mechanics and parameters, look angle determination, Launches and Lunch vehicle, Orbital effects in communication system performance. Attitude and orbit control system(AOCS), TT&C , Description of spacecraft System – Transponders,
Equipment reliability and space qualification.
Satellite Link Design: Basics of transmission theory, system noise temperature and G/T ratio, Uplink and Downlink design, design of satellite links for specified (C/N) performance.

Module – II(10 Hours)

Analog telephone and television transmission: Energy dispersal, digital transmission Multiple Access: Multiplexing techniques for satellite links, Comprehensive study on FDMA, TDMA and CDMA. Spread Spectrum Transmission and Reception. Estimating Channel requirements, SPADE, Random access

Module – III (12 Hours)

Earth station Technology: Earth station design, Design of large antennas – Cassegrain antennas, optimizing gain of large antenna, antenna temperature, feed system for large cassegrain antennas,
Design of small earth station antennas: Front fed paraboloid reflector antennas, offset fed antennas, beam steering, Global Beam Antenna, equipment for earth station.

20% Course (Institute Level):

Application of Satellite communication: Network distribution and direct broad casting TV, fundamentals of mobile communication satellite. Propagation on satellite: Earth paths and influence on link design: Quantifying attenuation and depolarization, hydrometric & non hydrometric effects, ionosphere effects, rain and ice effects .Satellite Antennas: Types of antenna and relationships, Basic Antennas Theory – linear, rectangular & circular aperture. Gain, pointing loss,

Text Books:

1. *Satellite Communication by T. Pratt, C. Bostian. 2nd Edition, John Wiley Co.*

Reference Books:

1. *Digital Communication with Satellite and Fiber Optic Application, HarlodKolimbins, PHI*
2. *Satellite Communication by Robert M. Gagliardi, CBS Publisher*
3. *R N Mutagi, Satelite Communication, Oxford University Press*

7th Semester

DIGITAL IMAGE PROCESSING (3-1-0)

University level: 80%

Module: 1 (12 hours)

Introduction: Digital Image fundamentals: Image sensing and acquisition, Image sampling and quantization, relationship between pixels, Intensity transformations and spatial filtering, some basic intensity transformation functions, Histogram processing, spatial filters for smoothing and sharpening (Chapt: 2 & 3 of Text book 1)

Module: 2 (12 hours)

Filtering in the Frequency Domain: preliminary concepts, 2D DFT and its properties, basic filtering in the frequency domain, image smoothing and sharpening (Chapt: 4 of Text book 1)
Image Restoration and Reconstruction: Image restoration/degradation model, noise models, restoration in the presence of noise only, estimating the degradation function (Chapt: 5 of Text Book 1)

Module: 3 (12 hours)

Color Image Processing: color models, Color transformation (Chapt: 6 of Text book 1). Wavelets and Multi-resolution Processing: multiresolution expansions, wavelet transforms in one and two dimension (Chapt: 7 of Text book 1)
Image Compression: Fundamentals, Error-free compression: variable length coding, LZW coding. Lossy compression: lossy predictive coding (Chapt: 8 of Text book 1)
Morphological Image Processing: Erosion and Dilation, opening and closing (Chapt: 9 of Text book 1)

20% Course (Institute Level):

Image enhancement using Arithmetic/Logic operation, correspondence between filtering in the spatial and frequency domain, Bit-plane coding, loss less predictive coding, wavelet coding, some basic morphological algorithms.

Text Books:

1. R.C. Gonzalez, R.E. Woods, *Digital Image Processing*, 3rd Edition, Pearson Education
2. R C Gonzalez, Woods and Eddins, *Digital Image Processing using Matlab*, 2nd Edition, Tata McGraw Hill

Reference Books:

1. *S.Sridhar, Digital Image Processing, Oxford University Press, 2011*

7th Semester

VLSI DESIGN(3-1-0)

80% University Level:

Module – I **2+2+4+3= 11 Hours**

Introduction: Historical Perspective, VLSI Design Methodologies, VLSI Design Flow,Design Hierarchy, Concept of Regularity, Modularity and Locality,
Fabrication of MOSFETs: Introduction, Fabrication Processes Flow – Basic Concepts,The CMOS n-Well Process, Layout Design Rules, Stick Diagrams, Full-Customs MaskLayout Design.
MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor (MOSFET), MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects, MOSFET Capacitance.
MOS Inverters – Static Characteristics: Introduction, Resistive-Load Inverters, Inverters with n-Type MOSFET Load, CMOS Inverter.
(Chapter 1 to 5 of Text Book 1 and for Stick Diagram Text Book 2)

Module – II **4+3+4= 11 Hours**

MOS Inverters – Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definitions, Calculation of Delay-Times, Inverter Design with Delay Constraints, , Switching Power Dissipation of CMOS Inverters.
Combinational MOS Logic Circuits: Introduction, MOS Logic Circuits with Depletion NMOS Loads, CMOS Logic Circuits, Complex Logic Circuits, CMOS Transmission Gates (Pass Gates).
Sequential MOS Logic Circuits: Introduction, Behaviour of Bistable Elements, SR Latch Circuits, Clocked Latch and Flip-Flop Circuits, CMOS D-Latch and Edge-Triggered Flip Flop.
(Chapter 6 to 8 of Text Book 1)

Module – III **4+4+2= 10 Hours**

Dynamic Logic Circuits: Introduction, Basic Principles ofPass TransistorCircuits,Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS Circuits.
Semiconductor Memories: Introduction,Dynamic Random Access Memory (DRAM),StaticRandom Access Memory(SRAM), Non-volatileMemory, Flash Memory.
Design for Testability: Introduction,Fault Types and Models, Ad Hoc Testable.Design Techniques, Scan-Based Techniques, Built-In Self-Test (BIST) Techniques,
(Chapter ,9,10,11& 15 of Text Book

20% Institution Level: **8 Hours**

VLSI Design Styles, Computer-Aided Design Technology, The CMOS p-Well Process.
Modelling of MOS transistors using SPICE: Basic concepts, The LEVEL 1 model equations, The LEVEL 2model equations, The LEVEL 3 model equations.
Low power CMOS logic circuits: Estimation of Interconnect Parasitics, Calculation of Interconnect Delay of CMOS .Over view of power consumption, Low power design through voltage scaling, Estimation and optimization of switching activity, reduction of switched capacitance.

Text Books:

1. *Sung-Mo Kang and Yusuf Leblebici, CMOS Digital Integrated Circuits: Analysis and Design, 3rd Edn., Tata McGraw-Hill Publishing Company Limited, 2003.*
2. *K. Eshraghian and N.H.E. Weste, Principles of CMOS VLSI Design – a Systems Perspective, 2nd Edn., Addison Wesley, 1993.*
3. *Debaprasad Das, VLSI Design, Oxford University Press, New Delhi, 2010.*

Reference Books:

1. *Wayne Wolf, Modern VLSI Design System – on – Chip Design, 3rd Edn., PHI.*
2. *Jan M. Rabaey, AnanthaChandrakasan, Borivoje Nikolic, Digital Integrated Circuits – A Design Perspective, 2nd Edn., PHI.*
3. *John P. Uyemura, CMOS Logic Circuit Design, Springer (Kluwer Academic Publishers), 2001.*
4. *Ken Martin, Digital Integrated Circuit Design, Oxford University Press, 2000.*

MICRO-ELECTRO-MECHANICAL SYSTEMS (MEMS) (3-1-0)

Module-I (14 Lectures)

Overview of MEMS and Microsystems.(Chapter 1 of Text Book 1)
Micromachining Techniques:Silicon as material for micromachining, Photolithography, thin film deposition, doping,wet and dry etching, surface and bulk micromachining, Wafer bonding,LIGA packaging. (Chapter 3 and Section 8.2 of Text Book 1, Chapter 2 of Text Book 2)

Module II (10 lectures)

Microsystem Modeling and Design:Mechanics of deformable bodies, Energy method, Estimation of stiffness and damping for different micro-structures, Modeling of electromechanical systems, Pull-in voltage. (Section 4.1 to 4.3 and 6.2.2 of Text Book 1, Section 3.4 of Text Book 2)

Module III (15 Lectures)

MEMS Applications:Mechanical sensors and actuators: Piezoresistive pressure sensors, MEMS capacitive accelerometer, Gyroscopes, (Section 8.3 of Text Book 1 and Section 5.3 and 5.11 of Text Book 2)
Optical:Micro-lens, Micro-mirror, Optical switch(Section 7.5 to 7.7 of Text Book 2) Radio frequency MEMS:Inductor, Varactor, Filter, Resonator. (Section 9.3 to 9.7 of Text Book 2)
Microfluidics:Capillary action, Micropumping, Electrowetting, Lab-on-a-chip. (Section 10.1 to 10.8 of Text Book 2)

20% Institution Level:

Piezoelectric actuators, pressure measurement by microphone , MOEMS,MEMS switch,

Text Books:

1. G.K. Ananthsuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat and V.K. Atre: Micro and Smart Systems, Wiley India, New Delhi, 2010.
2. N.P. Mahalik: MEMS, Tata McGraw-Hill, New Delhi, 2007.

Reference Book:

1. *T. Hsu: MEMS and Microsystems: Design and Manufacture, Tata McGraw-Hill, New Delhi, 2002.*
2. *Gabriel M.Rebeiz: RF MEMS Theory,design&Technology,Wiley India Education,2010.*

RENEWABLE ENERGY SYSTEMS

Module I **[15 Hours]**

University Portion (80%): (13 Hours)

Introduction: Conventional energy Sources and its Impacts, Non conventional energy– seasonal variations and availability, Renewable energy – sources and features, Distributed energy systems and dispersed generation (DG) (Textbook-1, Chapter-1.10, 1.13, 1.14)
Solar Energy: Solar processes and spectral composition of solar radiation. Solar Thermal system- Solar collectors, Types and performance characteristics, Applications- Solar water heating systems (active & passive) , Solar space heating & cooling systems , Solar desalination systems, Solar cooker. Solar photovoltaic system-Operating principle, Photovoltaic cell concepts, Cell, module, array, Losses in Solar Cell, Effects of Shadowing-Partial and Complete Shadowing, Series and parallel connections, Cell mismatching, Maximum power point tracking, Applications-Battery charging, Pumping, Lighting, Peltier cooling. Modeling of PV cell. (Textbook-1, Chapter- 4.1, 4.2, 4.5, 4.10, 4.11, 5, 6)

College/Institute Portion (20%):(2 Hours)

Classification of energy Sources, Extra-terrestrial and terrestrial Radiation, Azimuth angle, Zenith angle, Hour angle, Irradiance, Solar constant Or related advanced topics as decided by the concerned faculty teaching the subject.

Module II **[10 Hours]**

University Portion (80%): (8 Hours)

Wind Energy: Wind energy, Wind energy conversion; Wind power density, efficiency limit for wind energy conversion, types of converters, aerodynamics of wind rotors, power ~ speed and torque ~ speed characteristics of wind turbines, wind turbine control systems; conversion to electrical power: induction and synchronous generators, grid connected and self excited induction generator operation, constant voltage and constant frequency generation with power electronic control, single and double output systems, reactive power compensation, Characteristics of wind power plant, Concept of DFIG. (Textbook-2, Chapter-1.2, 1.4, 1.5, 1.6, 1.7, 1.8, 1.10, 1.11, 1.12, 3, 5)

College/Institute Portion (20%):(2 Hours)

Velocity at different heights, Basics of Fluid Mechanics (Textbook-1, Chapter-7.1, 7.2, 7.5) Or related advanced topics as decided by the concerned faculty teaching the subject.

Module III **[9 Hours]**

University Portion (80%):(9 Hours)

Biomass Power: Principles of biomass conversion, Combustion and fermentation, Anaerobic digestion, Types of biogas digester, Wood gassifier, Pyrolysis, Applications. Bio gas, Wood stoves, Bio diesel, Combustion engine, Application.
(Textbook-1, Chapter-8)

College/Institute Portion (20%): (2 Hours)

Urban Waste to Energy Conversion, Fuel cell. (Textbook-1, Chapter-8.6) Or related advanced topics as decided by the concerned faculty teaching the subject.

Module IV **[6 Hours]**

University Portion (80%): (4 Hours)

Hybrid Systems: Need for Hybrid Systems, Range and type of Hybrid systems, Case studies of Diesel-PV, Wind-PV, Microhydel-PV, Biomass-Diesel systems, electric and hybrid electric vehicles.
(Textbook-2, Chapter-7)

College/Institute Portion (20%):(2 Hours)

Small hydro Resources, Magnetohydrodynamics power conversion (Textbook-1, Chapter-11.4,12.2) Or related advanced topics as decided by the concerned faculty teaching the subject.

Text Books:

1. *B.H.Khan, Non-Conventional Energy Resources, Tata McGrawHill, 2009*
2. *S. N. Bhadra, D. Kastha, S. Banerjee, Wind Electrical Systems, Oxford Univ. Press, New Delhi, 2005.*
3. *Renewable Energy- Power for a Sustainable Future, Godfrey Boyle, Oxford University Press*

Reference Books:

1. *S. A. Abbasi, N. Abbasi, Renewable Energy Sources and Their Environmental Impact, Prentice Hall of India, New Delhi, 2006*

7th Semester

EMBEDDED SYSTEMS (3-1-0)

University Level: 80%

MODULE – I 10 Hours

Embedded System: Understanding the Basic Concepts:
Introduction to Embedded System: Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification of Embedded Systems, Major Application Areas of Embedded Systems, Purpose of Embedded Systems, 'Smart' running shoes from Adidas – The Innovative bonding of Life Style with Embedded Technology.
The Typical Embedded System: Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System Components, PCB and Passive Components.
Characteristics and Quality Attributes of Embedded System: Characteristics of Embedded System, Quality Attributes of Embedded System.
Embedded Systems – Application and Domain Specific: Washing Machine – Application Specific Embedded System, Automotive – Domain Specific Example for Embedded System.
Hardware Software Co-Design and Program Modeling: Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modeling Language (UML), Hardware Software Trade-offs.

MODULE – II 12 Hours

Design and Development of Embedded Product:
Embedded Hardware Design and Development: Analog Electronic Components, Digital Electronic Components, VLSI and Integrated Circuit Design, Electronic Design Automation (EDA) Tools.
Embedded Firmware Design and Development: Embedded firmware Design Approaches, Embedded firmware Development Languages, Programming in Embedded 'C'.
Real Time Operating System (RTOS) based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling: Putting them altogether, Task Communication, Task Synchronisation, Device Drivers, How to choose an RTOS.

MODULE – III 14 Hours

Design and Development of Embedded Systems:
An Introduction to Embedded System Design with VxWorks and MicroC/OS-II (□COS-II) RTOS: VxWorks, MicroC/OS-II (□COS-II).
Integration and Testing of Embedded Hardware and Firmware: Integration of Hardware & Firmware, Board Power up.
The Embedded System Development Environment: Integrated Development Environment

(IDE), Types of files generated on cross-compilation, Disassembler/Decompiler, Simulators, Emulators & Debugging, Target Hardware Debugging, Boundary Scan.
Product Enclosure Design & Development: Product Enclosure Design Tools, Product Enclosure Development Techniques

College Level-20%

Embedded Product Development Life Cycle (EDLC): Definition and Objectives of EDLC, Different Phases of EDLC, EDLC Approaches (Modeling the EDLC).
Trends in the Embedded Industry: Processor Trends in Embedded System, Embedded OS Trends, Development Language Trends, Open standards, Frameworks and Alliances, Bottlenecks.

Text Book:

1. Shibu K.V., *Introduction to Embedded Systems*, Tata McGraw Hill Education Private Limited, New Delhi, 2009.

Reference Book:

2. *J.K.Peckol, Embedded Systems, A Contemporary Design Tool, Wiley Student edition,*
3. *Peter Marwedel, Embedded System Design, Springer, 2006 http://ls12-www.cs.uni- dortmund.de/~marwedel/kluwer-es-book/*
4. *Wayne Wolf, Computers as Components, Morgan Kaufmann,*
5. *2001 http://www.ee.princeton.edu/~wolf/embedded-book*
6. *Michael Barr, Programming Embedded Systems in C and C++, O'Reilly, 1999.*
7. *David E. Simon, An Embedded Software Primer, Addison Wesley, 1999.*
8. *Jack Ganssle, The Art of Designing Embedded Systems, Newnes, 2000.*
9. *K. Short, Embedded Microprocessor System Design, Prentice Hall, 1998.*
10. *C. Baron, J. Geffroy and G. Motet, Embedded System Applications, Kluwer, 1997.*
11. *Raj Kamal, Embedded Systems – Architecture, Programming and Design,*
12. *Tata McGraw Hill Publishing Company Limited, New Delhi*

7th Semester

ADVANCED PROCESS CONTROL (3-1-0)

(HONORS)

University Level: 80%

MODULE – I (10 Hours)

Basics of process control scheme:
Introduction to Feedback control:Concept of feedback control,Types of feedback controllers, measuring sensors,Transmission lines. Ch-13 of text book-1
Adaptive and Interferential control systems: Adaptive control, Interferential control. (Ch-22 of text book-1)

MODULE – II (12 Hours)

Advance control in process: Cascade control, selective control, Split-Range control. (Ch-20 of text book-1)
Synthesis of Alternative control configurations for Multiple-Input, Multiple-Output processes: Design questions for MIMO control systems, Degree of freedom and the number of controller and manipulated variables, Generation of alternative loop configurations, Extension to systems with interacting units.(Ch-23 of text book-1)

MODULE – III (13 Hours)

Computer based control:
SCADA system: SCADA systems , Definition of SCADA, Basic elements of SCADA systems-Field data interface devices, Communications network , Central host computer, operator workstations and software components, SCADA architecture: Monolithic SCADA systems, distributed SCADA systems, Networked SCADA systems.).CH-10 of text book-2.
Data Acquisition systems: Data Acquisition systems with basic Architecture, Basic data Acquisition systems, data logger. Various elements /subsystems of DAS: Sensors and transmitter, cables and wiring, signal conditioning, hardware elements of DAS, software elements of DAS, multi channel DAS. CH-8 of text book-2.
Computer-Based controller: H/W configuration, multiple loop controllers, Data logging, Supervisory control, Direct control. ch-11 of text book-3

College Level: 20%

Intelligent control and artificial intelligence: Introduction, features of intelligent control, AI technology in intelligent control. Expert system: Introduction, feature and capability ,advantage and disadvantage also structure of expert system.

Text Book:

1. *George Stephanopoulos, Chemical process control, PHI Learning Private Limited, New Delhi, 2009.*
2. *K. Padma Raju and Y.J Ready., Instrumentation and control system, Tata McGraw Hill Education Private Limited, New Delhi.*
3. *Cotis D. Jonson.,Process control Instrumentation, 8thEdn., PHI.*

Reference Book:

1. *SurekhaBhanot.Process control principles and application,Oxforg University Press.*

7th Semester

SOFT COMPUTING

MODULE – I (8 hours)

Basic tools of soft Computing: Fuzzy logic, Neural Networks and Evolutionary Computing, Approximations of Multivariate functions, Non – linear Error surface and optimization.

MODULE – II (8 hours)

Fuzzy Logic Systems: Basics of fuzzy logic theory, Crisp and fuzzy sets; Basic set operations; Fuzzy relations, Composition of Fuzzy relations, Fuzzy inference, Zadeh's compositional rule of inference; Defuzzificaiton ; Fuzzy logic control; Mamdani and Takagi and Sugeno architectures. Applications to pattern recognition.

MODULE—III (16 hrs)

Neural networks: Single layer networks, Perceptron; Activation functions; Adalinc- its training and capabilities, weights learning, Multilayer perceptrons; error back propagation, generalized delta rule; Radial basis function networks and least square training algorithm, Kohenen self – organizing map and learning vector quantization networks; Recurrent neural networks, Simulated annealing neural networks; Adaptive neuro-fuzzy information; systems (ANFIS),

MODULE—IV (08 hrs)

Evolutionary Computing: Genetic algorithms: Basic concepts, encoding, fitness function, reproduction. Differences of GA and traditional optimization methods. Basic genetic, basic evolutionary programming concepts Applications, hybrid evolutionary algorithms.

ADDITIONAL MODULE (Terminal Examination-Internal)

Applications to Different Engineering problems.

Text Books

1) *F. O. Karry and C. de Silva, "Soft Computing and Intelligent Systems Design – Theory, Tools and Applications". Pearson Education. (Printed in India).*

Reference Books

2) J. S. R. Jang. C. T. SUN and E. Mizutani, "Neuro-fuzzy and soft-computing". PHI Pvt. Ltd., New Delhi.
3) Fredric M. Ham and Ivica Kostanic, "Principle of Neuro Computing for Science and Engineering", Tata McGraw Hill.
4) S. Haykins, "Neural networks: a comprehensive foundation". Pearson Education, India.
5) V. Keeman, "Learning and Soft computing", Pearson Education, India.
6) R. C. Eberhart and Y. Shi, "Computational Intelligence Concepts to Implementation". Morgan Kaufmann Publishers (Indian Reprint).