COURSE STRUCTURE FOR UG ENGINEERING
UNDER DIBRUGARH UNIVERSITY

INSTRUMENTATION ENGINEERING

SEMESTER I

Sl No.	Course Code	Course Title	L	T	P	Contact hrs/wk	Credit
01	HS101	Sociology	2	0	0	2	2
02	HS102	Business Communications	2	0	0	2	2
03	MA101	Mathematics I	3	1	0	4	4
04	PH101	Applied Physics I	3	0	0	3	3
05	PH102	Applied Physics Laboratory I	0	0	2	2	1
06	CH101	Engineering Chemistry I	3	0	0	3	3
07	CH102	Engineering Chemistry Laboratory I	0	0	2	2	1
08	CE101	Engineering Graphics	2	0	2	4	3
09	EE101	Basic Electrical Engineering	3	1	0	4	4
10	EE102	Basic Electrical Engineering Laboratory	0	0	2	2	1
11	ME101	Engineering Workshop I	0	0	2	2	1
						30	**25**

SEMESTER II

Sl No.	Course Code	Course Title	L	T	P	Contact hrs/wk	Credit
01	HS103	Economics for Engineers	2	0	0	2	2
02	HS104	Presentation Skills	2	0	0	2	2
03	MA102	Mathematics II	3	1	0	4	4
04	PH103	Applied Physics II	3	0	0	3	3
05	PH104	Applied Physics Laboratory II	0	0	2	2	1
06	CH103	Engineering Chemistry II	3	0	0	3	3
07	CH104	Engineering Chemistry Laboratory II	0	0	2	2	1
08	CS101	Computer Programming	2	0	2	4	3
09	CS102	Computer Programming Laboratory	3	1	0	4	4
10	ME102	Engineering Mechanics	0	0	2	2	1
11	ME103	Engineering Mechanics Laboratory	0	0	2	2	1
12	ME104	Engineering Workshop II	0	0	2	2	1
						30	**25**
13	AC101	Environmental studies	0	0	0	3	0

SEMESTER III

Sl no	Course Code	Course Title	L	T	P	Contact hrs/week	Credit
01	MA301	Mathematics III	3	1	0	4	4
02	PH301	Electrical Engineering Materials	3	0	0	3	3
03	IN301	Basic Electronics	3	1	0	4	4
04	IN302	Electrical Circuit Theory	3	0	0	3	3
05	IN303	Transducers	3	1	0	4	4
06	IN304	Object Oriented Programming and Data Structure	3	0	0	3	3
07	IN305	Object Oriented Programming Lab (C & C++)	0	0	2	2	1
08	IN306	Instrumentation Laboratory -I	0	0	2	2	1
09	IN307	Basic Electronics Laboratory	0	0	2	2	1
		TOTAL				**27**	**24**
10	AC301	Language Laboratory	0	0	4	4	0

SEMESTER IV

Sl no	Course Code	Course Title	L	T	P	Contact hrs/week	Credit
01	MA401	Mathematics IV	3	1	0	4	4
02	IN401	Automatic Control Theory-I	3	0	0	3	3
03	IN402	Digital Systems & Logic Design	3	0	0	3	3
04	IN403	Analog Integrated Circuits	3	1	0	4	4
05	IN404	Electrical Machines & Applications	3	0	0	3	3
06	IN405	Industrial Instrumentation	3	1	0	4	4
07	IN406	DSLD Laboratory	0	0	2	2	1
08	IN407	Analog Integrated Circuits Lab	0	0	2	2	1
09	IN408	Electrical Machines &Applications Laboratory	0	0	2	2	1
		TOTAL				**27**	**24**
10	AC401	Language Laboratory	0	0	4	4	0

SEMESTER V

Sl no	Course Code	Course Title	L	T	P	Contact hrs/week	Credit
01	MA501	Mathematics V	3	1	0	4	4
02	IN501	Automatic Control Theory-II	2	1	0	3	3
03	IN502	Microprocessor & Microcontroller	3	1	0	4	4
04	IN503	Power Electronics & Drives	3	0	0	3	3
05	IN504	Digital Signal Processing	3	0	0	3	3
06	IN505	Electrical Measuring Instruments & Measurement--I	3	0	0	3	3
07	IN506	Microprocessor Laboratory	0	0	2	2	1
08	IN507	Object Oriented Programming Lab with JAVA	0	0	2	2	1
09	IN508	Control & DSP Laboratory	0	0	2	2	1
		TOTAL				**26**	**23**

SEMESTER VI

Sl no	Course Code	Course Title	L	T	P	Contact hrs/week	Credit
01	HS601	Introduction to Accountancy & Management	3	0	0	3	3
02	IN601	Principles of Communication Engineering	3	1	0	4	4
03	IN602	Process Dynamics & Control	3	1	0	4	4
04	IN603	Electrical Measuring Instruments & Measurement--II	3	0	0	3	3
05	IN604	Instrumentation System Design & Drawing	0	0	6	6	3
06	IN605	Instrumentation Laboratory- II	0	0	2	2	1
07	IN606	Mini Project	0	0	4	4	2
08		**Elective-I (Open)**	3	0	0	3	3
		TOTAL				**29**	**23**

List of Elective I (Open)

1. EE608 Computer Organization
2. EE610 Basic Thermal Science
3. IN607 Fluid Power & Control
4. IN608 Electro Magnetic Field Theory
5. IN609 Renewable Energy Sources

SEMESTER VII

Sl no	Course Code	Course Title	L	T	P	Contact hrs/week	Credit
01	IN701	Analytical Instruments	3	0	0	3	3
02	IN702	Advanced Process Dynamics & Control	3	0	0	3	3
03	IN703	Seminar Presentation	0	0	2	2	1
04	IN704	Project--I	0	0	12	12	6
05		**Elective--II**	3	0	0	3	3
06		**Elective—III**	3	0	0	3	3
07		**Elective—IV(Open)**	3	0	0	3	3
		TOTAL				**29**	**22**
08	AC701	Industrial Training	0	0	0	0	0

List of Elective – II, III

1. EE705 VLSI Circuits Design
2. EE706 Speech Processing
3. EE708 Advances in Tele-communication Engineering
4. EE715 Advance Control System
5. IN705 Biomedical Instrumentation
6. IN706 MEMS & NEMS
7. IN707 Ultrasonic & High Frequency Instrumentation
8. IN708 Advance Microprocessor and Microcontroller

Elective-IV (Open)

1. EE707 Digital Image Processing
2. EE709 Optimization Techniques
3. EE710 Operating System Design
4. IN709 Data Communication & Networks
5.

SEMESTER VIII

Sl no	Course Code	Course Title	L	T	P	Contact hrs/week	Credit
01	IN801	Instrumentation System Installation & Professional Practice	3	0	0	3	3
02	IN802	Project--II	0	0	20	20	10
03		***Elective—V***	3	0	0	3	3
04		***Elective--VI***	3	0	0	3	3
05		***Elective--VII***	3	0	0	3	3
		TOTAL				**32**	**22**

List of Elective – V, VI & VII

1. IN803 Power Plant Instrumentation
2. IN804 Optoelectronics & Optical Communication Engineering
3. IN805 Environmental Instrumentation and Safety
4. IN806 Advance Sensors
5. IN807 Industrial Automation and Robotics
6. IN808 Multisensor Data Fusion
7. IN809 Intelligent Instrumentation
8. EE805 Adaptive Signal Processing
9. EE806 Computer Vision
10. EE807 Computer Graphics
11. EE808 Intelligent Control System
12. EE809 Discrete Time Control System

SYLLABUS

SEMESTER III

Sl no	Course Code	Course Title	L	T	P	Contact hrs/week	Credit
01	MA301	Mathematics III	3	1	0	4	4
02	PH301	Electrical Engineering Materials	3	0	0	3	3
03	IN301	Basic Electronics	3	1	0	4	4
04	IN302	Electrical Circuit Theory	3	0	0	3	3
05	IN303	Transducers	3	1	0	4	4
06	IN304	Object Oriented Programming and Data Structure	3	0	0	3	3
07	IN305	Object Oriented Programming Lab (C & C++)	0	0	2	2	1
08	IN306	Instrumentation Laboratory -I	0	0	2	2	1
09	IN307	Basic Electronics Laboratory	0	0	2	2	1
		TOTAL				**27**	**24**
10	AC301	Language Laboratory	0	0	4	4	0

3rd Semester BE (E, IN)

Syllabus for **Electrical Engineering Materials (PH301)**

L-3 T-0 P-0 C-3

Md No.	Contents	%Marks
1.	**Crystal Structure:** Unit cell and Bravais lattice; Bravais lattice in tow-dimensional and three-dimensional crystal structures; Direction and planes in a crystal lattice: Miller indices; Crystal structures of solids - LCC, FCC, BCC, simple cubic and diamond structures; X-ray diffraction and Bragg's law.	10
2.	**Conductor Materials:** Free electron theory of metals-conductivity, drift velocity, relaxation time, collision time and mean free path; Fermi-Dirac distribution; Temperature and impurity effect; Frequency effect; Effect of magnetic fields-Hall effect and megnetoresistance; Heat developed in current carrying conductors; Thermal conductivity; Conductor materials-choice of conductor materials, high conductive materials, materials of high resistivity, materials for fuse and soldiers, materials for lamp filaments, thermoionic materials.	15
3.	**Magnetic Materials:** Magnetic parameters-permeability and magnetic susceptibility; Magnetic dipole moment and angular momentum; Classification of magnetic materials; Diamagnetism; Paramagnetism; Ferromagnetism and Curie-Weiss law; Ferrimagnetism; Magnetic domain; Magnetic anisotrophy and magnetostriction; Ferrimagnetic materials; Powder Magnet; Magnetic memories – Magnetic Bubbles, Hard Disks.	15
4.	**Dielectric Materials:** Dielectric parameters-Dielectric constant, dipole moment, polarization and polarizability, Clausius-Mosotti equation; Mechanism of polarization-electronic polarization, ionic polarization and dipolar polarization; Frequency dependence of polarizability; Dielectric losses; Ferroelectric materials their properties and classification; Piezoelectricity; Mechanism of dielectric breakdown of gases; Liquids and solids; Factors influencing dielectric strength; Insulating materials; Properties of common insulating materials used in electrical apparatus like mica, asbestos, glass, bakelite, porcelain, rubber, paper, cotton, silk fibre, wood, plastics, PVC resins, varnishes, insulating oil and liquids, gaseous insulator etc.	15
5.	**Introduction to Nanoelectronic materials**: Principle of operation and Construction of Single Electron devices and applications; Photonoic Crystals and Quantum dot devices; Concept of Spintronics - Giant Magneto-Resistance (GMR), Tunnelling Magneto-Resistance (TMR), Magnetic Random Access Memory (MRAM); Concept of Quantum Computers.	15
6.	**Introduction to Polymer Electronic materials**: Conductive polymers;	15

Principle of operation and fabrication of Organic Light Emitting Diode (OLED) – Small Molecule OLED and Polymer OLED; Organic Field Effect Transistors (OFET) - Small Molecule OFET and Polymer OFET; Organic Solar Cells. ,

7. **Superconductivity**: Transition temperature Tc – Critical field Hc- Isotope, pressure, magnetic field effects on Tc – Meissner effect – type I and type II super conductors – London equation – thermodynamics of superconductors – free energy – entropy – specific heat – BCS theory – Superconducting energy gap – DC and AC Josephson effects – Quantization of flux – Quantum interference. 15

   High temperature superconductors – copper free oxide superconductors – preparation of Cuprates – Modern theories of HTSc – Qualitative ideas of RVB theory – application of superconductors – High field magnets, motors, generators – Magnetic Levitation and transportation – Nuclear magnetic resonance imaging – energy storage – superconducting power transmission - devises based on Josephson's effect – SQUID – memory elements – Signal Processing.

Text Books:

1. Electrical and Electronics Engineering Materials 2013 – J. B. Gupta, S. K. Kataria & Sons
2. Electrical Engineering Materials 1970 - A. J. Dekker, Prentice Hall of India
3. Solid State Physics 2000 - A J Dekkar, Macmillan Publishers India
4. Science of Engineering Materials and Carbon Nanotubes 3rd Ed 2010 - C. M. Srivastava and C. Srinivasan, New Age International
5. An Introduction to Electrical Engineering Materials 4th Ed 2006 - C. S. Indulkar and S. Thiruvengadam, S. Chand & Company, India.
6. Electrical Engineering Materials 2001 - N Alagappan and N Kumar, McGraw Hill
7. Electrical Engineering Materials - G. P. Chalotra and B. K. Bhatt, Khanna Publishers
8. Electrical Engineering Materials 2nd Ed 2015 - R. K. Rajput, Laxmi Publications, India
9. Material Science for Electrical & Electronics Engineers 2000 - Ian P. Hones, Oxford University Press
10. A Course in Electrical Engineering Materials 3rd Ed 2011 – S. P. Seth, Dhanpat Rai Publications
11. Nanotechnology for Electronic Materials and Devices 2007 – Edited by A. Korkin, E. Gusev, J.K. Labanowski, S. Luryi, Springer
12. Nanotechnology and Nanoelectronics Materials, Devices, Measurement Techniques 2005 - Edited by W. Fahrner, Springer
13. Quantum Electronics 3rd Ed 2012 - Amnon Yariv, Wiley India
14. Modern Quantum Chemistry: Introduction to Advanced Electronic Structure Theory 1996 - Attila Szabo and Neil S. Ostlund, Dover Publications
15. Quantum Computing Explained 2016 - David McMahon, Wiley
16. Organic Electronics Materials and Devices 2015 - Edited by Shuichiro Ogawa, Springer
17. Superconductivity 2nd Ed 2013 - S. L. Kakani and Shubhra Kakani, New Age International
18. Super conductivity 1992 - Mical. Cesnot, World University.
19. Electronic Engineering Materials and Devices, J. Allison, Tata Mc Graw Hill, 1985, 5th Edition.

3rd Semester BE (IN)

Syllabus for **Basic Electronics (IN301)**

L-3 T-1 P-0 C-4

Md No	Contents	%Marks
1.	**Diode Circuits**: Piece-wise linear static model and dynamic incremental model; Practical circuits employing diode; Voltage multiplier, Clipper and Clamper; Power rectifying circuits; Power (C, L, LC and π) filters.	20
2.	**Bipolar Junction Transistor (BJT)**: Basic construction and the physical behaviour of the device; Low level injection condition; Forward active region (FAR) and the study of the flow of carriers through the BJT; Control valve action; Volt-amp curves; Base width modulation and early effect; Static circuit models; Ebers – Moll equations for the current of BJT forward bias conditions; A simple amplifier circuit; Bias stability, compensation and biasing methods; The common base (CB), common emitter (CE) and common collector (CC) configurations.	15
3.	**Small signal operation of BJT amplifier**: Incremental models for the BJT; Hybrid-Π model; Analysis of amplifiers with the help of incremental models; Simplified low frequency operation; Gains, input and output impedances of the amplifiers; Some ideas about high frequency analysis such as Miller effect and Dominant pole approximation; Determination of the Hybrid-Π parameters; Details about Two port Π- and h-parameter analysis; Multiple stage BJT amplifiers: PNP and NPN combinations; Voltage and current biasing methods; Gains; Frequency response of the amplifiers.	15
	Feedback Amplifiers: Negative feedback amplifier; Current-Series and Shunt Feedback Amplifiers; Voltage-Series and Shunt Feedback Amplifiers.	10
	Transistor Oscillators: Positive feedback and Barkhausen criterion for sustained oscillations; Classification of oscillators, Tuned collector oscillator; Hartley oscillator; Colpitt's oscillator, RC oscillators, Crystal oscillator.	10
4.	**Field Effect Transistor (FET)**: Construction and characteristics of Junction FET (JFET); Principle of operation; Characteristic parameters of JFET; Effect of temperature on JFET parameters; Biasing of JFETs; Common drain (CD), Common source (CS) and Common gate (CG) configurations; Frequency response of JFET amplifiers; Metal oxide semiconductor FET (MOSFET); Enhancement MOSFET (EMOSFET) and Depletion MOSFET (DMOSFET); Differences between JFETs and MOSFETs; Biasing of EMOSFET and DMOSFET; Applications of MOSFETs; Complementary MOSFET (CMOS); Multistage FET Amplifiers.	20
5.	**High Input Impedance and Power Amplifier:** Need for High input impedance amplifier, Emitter follower; Darlington amplifier; Tuned amplifier; Class-A, Class-B, Class-AB and Class-C amplifiers; Distortions in power amplifiers.	10

Text Books:

1. Integrated Electronics Analog and Digital Circuits and Systems 1991 – J. Millman and C.

C. Halkias, TMH
2. Microelectronics 2nd Ed 2001- Jacob Millman and Arvin Grabel, TMH
3. Electronic Devices and Circuits 5th Ed 2008 – David A. Bell. Oxford University Press
4. Electronic Principles 8th Ed 2015– Alvert Paul Malvino and David J. Bates, McGraw Hill
5. Electronic Devices and Circuit Theory 11th Ed 2013 – Robert L. Boylestad and Louis Nashelsky, Pearson Education
6. Electronic Principles: Physics, Models and Circuits 1970 – Paul E. Gray and Campbell L. Searls, John Wiley & Sons
7. Electronic Devices and Circuits: An Introduction 1979 – Allen Mottershead, PHI

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3rd Semester BE (IN)

Syllabus for **Electrical Circuit Theory (IN302)**

L-3 T-0 P-0 C-3

Md No	Contents	%Marks
1	**Sinusoidal Steady State Analysis**: Phasor representation of sinusoidal functions; Frequency domain diagram; Phasor diagram; Node and Loop analysis methods; Steady state response using network theorems – Thevenin's, Norton's, Superposition, Reciprocity and Maximum power transfer theorems; Magnetically coupled circuits; Duality of networks.	20
2	**Resonance circuits**: Resonance in series and parallel R-L-C circuits; Resonant frequency; Selectivity; Bandwidth; Q-factor and their relationship for series & parallel resonance circuits.	10
3	**Circuit Transients**: Concept of circuit transient; Transient response & steady state response; Laplace Transform method and solution of network problems due sudden application of step, sinusoidal and exponential forcing functions.	10
4	**Network Functions**: Driving point impedance and admittance; Transfer functions; Poles & zeroes of network functions.	15
5	**Two port networks**: Impedance; Admittance; Transmission (T) and hybrid (h) parameters of two port network; Condition for reciprocity & symmetry; Relation between the parameter sets; Equivalent T & π section representation.	15
6	**Non-sinusoidal periodic waves**: Periodic waves; Fourier analysis of non-sinusoidal periodic waves; Waveform symmetry; Frequency spectrum; Average value; Root mean square (RMS) value; Average power of non-sinusoidal periodic functions.	20
7	**Graph Theory**: Graph of a network and its parts; Oriented graph; Tree; Co-tree; Loops; Tie-set; Cut-set matrix; Incidence matrices; Network equilibrium equations.	10

Text Books:

1. Electric Circuits - Schaum's Outlines on Theory and Problems 6th Ed/ 2012 - Joseph A. Edminister, McGraw Hill
2. Engineering Circuit Analysis 6th Ed - William H. Hayt, Jr., Jack E. Kemmerly, Steven M. Durbin (McGraw-Hill, 2002).
3. Circuits and Networks: Circuits & Networks: Analysis, Design and Synthesis 2010 - M. S. Sukhija, T. K. Nagsarkar, Oxford University Press
4. Fundamentals of Electric Circuit Theory 2011 - B. Chattopadhyay, P. C. Rakshit, S. Chand & Co. Publication.

5. A Text Book of Electrical Technology Vol I – B. L. Theraja, A. K. Theraja (S. Chand & Co.)
6. Network and Systems 2nd Ed 2009 - D. Roy Choudhury, New Age Science
7. Network Analysis and Synthesis 3rd Ed 2007 - C. L. Wadhwa, New Age International
8. Fundamentals of Electric Circuits 5th Ed 2013 - Charles K. Alexander and Matthew N.O. Sadiku, McGraw Hill
9. Circuits & Networks: Analysis & Synthesis 5th Ed 2015 – A. Sudhakar and Shyammohan S. Palli, McGraw Hill
10. Circuit Theory : Analysis and Synthesis 6th Ed 2004 - Abhijit Chakrabarti, Dhanpat Rai Publication

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3rd Semester BE (IN)

Syllabus for **Transducers (IN303)**

L-43 T-1 P-0 C-4

Unit no	Contents	%Marks
1	**General concepts and terminology of measurement systems;** Transducer Principles & classification; static and dynamic characteristics of a measurement system; Statistical analysis of measuring data, Error, Probability Density Function, Gaussian Distribution and its application in error analysis, Chi Square Test, Significance Test, Goodness of fit, Curve Fitting--- Least Square Method. Introduction to Standard Primary sensing Devices	25
2	**Resistive transducers**: a) Potentiometers: Principle, signal conditioning. b) Strain gauges : types, principle, signal conditioning circuits, applications in measurement of pressure, force, torque and vibration etc	10
3	**Inductive transducers**: Principle, signal conditioning , applications etc of LVDT & Synchros	10
4	**Capacitive transducers**: Air gap and dielectric types and their applications.	10
5	**Temperature Measuring Transducers:** RTD, Thermistors, Thermo couple & IC temperature sensor --- their working, materials used, signal conditioning, Characteristics, Installation and compensation and applications.	15
6	**Piezoelectric transducers**: Piezoelectric crystal and its properties; Sensitivity coefficients; Materials, Application.	10
7	**Special transducers:** LDR, Radiation pyrometer , Fibre optic sensor, Smart sensors, Hall effect sensors, Magnetostrictive transducers.	10

Text books:

1. Measurement Systems: Application and Design – Doeblin E.O., McGraw Hill.
2. John P. Bentley, Principles of Measurement Systems, Pearson Education, 4th Edition, 2005.
3. Instrument transducers – An introduction to their performance and design – Neubert MKP, Clarendon Press.
4. Transducers and Instrumentation – Murthy D.V.S., P.M.I. New Delhi.
5. Sensors and Transducers – Patranabis D., Wheeler.
6. Instrumentation Devices and Systems – Ranga, Sarma, Mani; T.M.H.
7. Instrumentation Measurement and Analysis- B C Nakra, K K Chaudhry.

3rd Semester BE (IN)

Syllabus for **Object Oriented Programming & Data Structure (IN304)**

L-3 T-0 P-0 C-3

Unit	Content	%Marks
1	Object Oriented Programming, Features of object oriented programming languages like data encapsulation, inheritance, polymorphism and late binding.	15
2	Concept of a class, Access control of members of a class, instantiating a class, static and non-static members, overloading a method.	15
3	Deriving a class from another class, access control of members under derivation, different ways of class derivation, overriding of a method, run time polymorphism.	15
4	Concept of an abstract class. Concept of an interface, Implementation of an interface, Exception and exception handling mechanisms, Introduction to streams, use of stream classes, Serialization and de-serialization of objects.	15
5	Data structures- definition, representation and operations on linear data structures like linear list, array, stack, queue, singly linked circular and non-circular lists, doubly linked circular and non-circular lists, double ended queue, priority queue; representation and operations on non-linear data structures like graph, tree, binary search tree, spanning tree; implementation of linear and non-linear data structures by writing C++ programs.	40
6	Example language: C++	

Text/References:

1.BjaneStrostrup, ―The C++ programming language‖, Addison-Wesley

2. Herbert Shildt, ―C++: The Complete Reference‖, 4th Edition

3. Matt Weisfeld, ―The Object-Oriented Thought Process‖, Pearson

4. J. P. Tremblay and P. G. Sorenson, "An Introduction to Data Structures with applications", Second Edition, Tata McGraw Hill, 1981

5. SartajSahni, “Data Structures, Algorithms and Applications in C++”, Universities Press (I) Pvt. Ltd

6. YedidyahLangsam, Moshe J. Augenstein, Aron m. Tenendaum, “Data Structures using Cand C++”, second edition, Pearson

LABORATORIES

3rd Semester BE (IN)
Syllabus for **OOP Laboratory (IN305)**
L-0 T-0 P-2 C-1

C and C++ Experiments:

1. Write a program to implement the concept call by value & call by reference in C.
2. Write a program to display the mark sheet of N students using concept of array and structures in C.
3. Write a program to multiply two matrices using array of pointers.
4. To write a C++ program to find the sum for the given variables using function with default arguments.
5. To write a C++ program to find the value of a number raised to its power that demonstrates a function using call by value.
6. To write a c++ program and to implement the concept of Call by Address.
7. To write a program in C++ to prepare a student Record using class and object.
8. Write a program to design a class representing complex numbers and having the functionality of performing addition and multiplication of two complex numbers using operator overloading.
9. Write a program for developing a matrix class which can handle integer matrices of different dimensions. Also overload the operator for addition, multiplication and comparison of matrices.
10. To write a C++ program to implement the concept of Function Overloading.
11. To write a C++ program for implementing the inheritance concept.
12. To write a C++ program to implement the concept of Virtual functions.
13. To write a C++ program for sorting elements by bubble sort using function templates.
14. Write a C++ program to print the Fibonacci series.
15. Write a C++ program to find the number of vowels present in the given character array using pointer arithmetic.

3rd Semester BE (IN)

Syllabus for **Instrumentation—I Laboratory (IN2C06)**

L-0 T-0 P-2 C-1

1. Study and use of a direct reading Strain indicator. And apply it as Torque sensor, Proximity sensor etc.
2. Study and use of a i) Potentiometer & ii) LVDT in displacement sensing. Also Weight/Force/Pressure measurement using LVDT.
3. To study input output characteristics of LVDT. To study characteristics of Strain gauge. Measurement of loads using Column type Load Cell & associated circuits.
4. Study and use of flow sensors like V- notch weir, Orifice , Rotameter, Hotwire, Electromagnetic type etc.
5. Study and use of various vibration sensors like strain gauge type, LVDT type, piezoelectric type, semiconducting strain gauge type etc for measuring vibration of a cantilever beam at different frequencies.
6. Familiarization with IC temperature sensors AD590 and setting up a direct temperature indication system.
7. To study &set up and test the performance of a direct reading temperature indicator using thermocouple.
8. To study & set up and test the performance of a direct reading temperature indicator using RTD.
9. To study & set up and test the performance of a direct reading speed sensing scheme using: Magnetic pick up& Photoelectric pick up unit.
10. To study & set up a displacement sensing scheme using LDR unit.
11. To study and test a variable inductance transducer.
12. To determine I/O characteristics of Hall Effect Transducer/ Rotary Potentiometer etc.
13. Level measurement using Capacitive transducer.
14. To study the transient response analysis of RLC circuit

3rd Semester BE (IN)

Syllabus for Basic Electronics Laboratory (IN2C07)

L-0 T-0 P-2 C-1

25

1 Study of Electronic Components
2 Study of Instruments and Equipment (DMM, CRO, FG and Power Supply etc.)
3 Find the step response of RC and RL circuits and RLC series circuit resonance
4 Characteristic of a PN diode
5 Voltage regulation of Half wave and Full wave rectifier at No-load and Full-load
6 Design and analysis of clipper circuits.
7 Design and analysis of clamper circuits.
8 Transistor Characteristic in CB configuration.
9 Transistor Characteristic in CE configuration
10 Current, Voltage and Power Amplifications of an CE NPN/PNP Transistor Amplifier

11 Study of FET characteristics (n-channel JFET)
12 Study the switching characteristic of a switching transistor.

**********END **********

SEMESTER IV

Sl no	Course Code	Course Title	L	T	P	Contact hrs/week	Credit
01	MA401	Mathematics IV	3	1	0	4	4
02	IN401	Automatic Control Theory-I	3	0	0	3	3
03	IN402	Digital Systems & Logic Design	3	0	0	3	3
04	IN403	Analog Integrated Circuits	3	1	0	4	4
05	IN404	Electrical Machines & Applications	3	0	0	3	3
06	IN405	Industrial Instrumentation	3	1	0	4	4
07	IN406	DSLD Laboratory	0	0	2	2	1
08	IN407	Analog Integrated Circuits Lab	0	0	2	2	1
09	IN408	Electrical Machines &Applications Laboratory	0	0	2	2	1
		TOTAL				**27**	**24**
10	AC401	Language Laboratory	0	0	4	4	0

4th Semester BE (IN)

Syllabus for **Automatic Control Theory - I (IN401)**

L-3 T-0 P-0 C-3

Md No.	Contents	%Marks
1	**Introduction**: Concept of automatic control systems; Classifications- open loop and closed loop systems, Linear and Non-linear systems, Continuous and Discrete time systems, SISO and MIMO systems, Time-invariant and Time varying systems, Servo systems and Automatic regulating systems, Adaptive control systems.	10
2	**Block diagram and signal flow graphs**: Block diagram (BD) representation of physical systems, BD reduction techniques;	10
	Signal Flow Graph (SFG): Definition, terminology, SFG representation of physical systems, Mason's Gain formula, BD reduction using SFG techniques.	10
3	**Mathematical modelling of physical systems**: Differential equations and transfer function form of models, Mathematical model of electrical, Mechanical and Electro-mechanical systems, Analogous systems.	20
	Control system components: Potentiometer, Synchros, DC and AC Servomotors, Rotating Amplifier, Stepper Motor, Tachogenerators.	
4	**Transient response analysis**: Type and order of systems, standard test signal, Steady state error and error constants, Generalized error series, Sensitivity, Characteristic equation, Transient response of 1st, 2nd and higher order systems, Transient response specifications, Definition of absolute and relative stability, Routh-Hurwitz stability criterion.	20
5	**Root locus method**: Introduction, Angle and Magnitude conditions, Construction of complete root locus, Stability analysis, Effect of addition of poles and zeroes.	15
6	**Control System Design based on Root Locus method**: Preliminary design considerations, Lead, Lag and Lag-Lead Compensation techniques based on Root locus.	15

Text Books:

1) Control System Engineering 5th Ed 2009 – I J Nagrath and M Gopal, New Age International Publishers
2) Modern Control Engineering 2015 – K Ogata, Pearson
3) Control System Engineering 6th Ed 2010 - Norman S. Nise, John Wiley & Sons
4) Control Systems: Theory and Applications 2nd Ed 2012 - Smarajit Ghosh, Pearson
5) Schaum's Outline of Feedback and Control Systems 2nd Ed 2014 – Joseph J. DiStefano, Allen J. Stubberud and Ivan J. Williams, McGraw-Hill
6) Modern Control System 12th Ed 2013 - Richardo C. Dorf, Robert H. Bishop, Pearson

7) Control Systems –Principles & Design 4th Ed 2012 - M Gopal, Tata McGraw Hill

4th Semester BE (IN)

Syllabus for **Digital Electronics and Logic Design (IN402)**

L-3 T-0 P-0 C-3

Unit no	Contents	%Marks
1	**Introduction** : Switching circuits & devices ; Characteristics of ICs and logical level; Positive & negative logic levels.	10
2	**Realization of Logic Gates**: Switching circuits & devices; Characteristics of ICs and logical level; Positive & negative logic levels; Tri-state devices; AND, OR, NOT, NAND, NOR, XOR & XNOR gates and their truth tables; Elementary idea of TTL & MOS technology for logic gates; Important Characteristics of logic gate families.	15
3	**Representation of Informations** : General number Systems – decimal, binary , octal & hexadecimal numbers ; Conversion from one system to another ; Codes & code conversion ; BCD, Gray, Natural BCD & Extended code ; Negative, positive & floating point numbers ; Sign magnitude ; 1's compliment and 2's compliment representation ; Arithmetic operations ; Representation of textual informations in ASCII & EBCDIC codes.	15
4	**Boolean Algebra & Logic Functions** : Concept of Boolean algebra ; Theorems & laws ; Boolean expressions ; Canonical & standard forms of logic functions & their properties ; Truth table representation ; Minimization of logic functions – Karnaugh map and Quine Mclusky method of minimization.	15
5	**Combinational Logic Circuits** : Implementation of Boolean functions using logic gates ; Multiplexer ; Decoder ; Encoder ; Code converters ; Half and full adder ; Parity generator & parity checker.	15
6	**Sequential Logic Circuits** : Concept of sequential circuits ; Flip-flop and its different types – clocked R-S , J-K, D, T & master slave ; Registers – buffers, serial and parallel ; Hazards of sequential circuits ; Sequence generator ;State diagram ; Design of Counters – Synchronous & Asynchronous , Up & down ; Pre settable counters.	15
7	**Memory Devices** classification of memories ROM organization, RAM organization, Read and write operations, Memory cycles, Timing waveforms, Memory decoding, Memory expansion, static and dynamic RAM cell, MOSFET RAM cell, Programmable logic Devices-PLA , PAL , FPGA, Implementation of combinational logic circuits using ROM,PLA, PAL.	15

Text Books:

1. Digital Electronics: Principles, Devices and Applications 1st Ed 2007 – Anil K Maini, Wiley
2. Fundamentals of Digital Circuits 4th Ed 2016 – A. Anand Kumar, PHI
3. Solid State Pulse Circuits 4th Ed 1991 – David A. Bell, PHI
4. Digital Circuits and Logic Design 1976 – Samuel C. Lee, Prentice Hall
5. Digital Fundamentals 10th Ed 2011 – Thomas L. Floyd, Pearson
6. Digital Principles and Applications 5th Ed 1994 – Don Leach and Albert Malvino, McGraw Hill
7. Digital Electronics – An Introduction to Theory and Practice 1982 – William H. Gothmann, PHI
8. Integrated Electronics Analog and Digital Circuits and Systems 1991 – J. Millman and C. C. Halkias, TMH
9. Microelectronics 2nd Ed 2001- Jacob Millman and Arvin Grabel, TMH
10. Logical Design of Switching Circuits – Douglas Lewin, Elsevier Science & Technology
11. Microprocessor Architecture, Programming and Applications with the 8085 6th Ed 2013 - Ramesh S. Gaonkar, Penram International Publishing
12. Fundamentals of Microprocessors and Microcomputers 2012 – B. Ram, Dhanpat Rai Publications

4TH SEMSTER B.E (IN)

Syllabus for **Analog Integrated Circuits (IN403)**

L-3 T-1 P-0 C-4

Md No	Contents	%Marks
1	**Integrated Circuits:** Advantages of Monolithic ICs, Classification of ICs, IC package types, Pin identification and Temperature ranges; Fabrication of monolithic ICs by Epitaxial-diffused method: Crystal growth of the substrate, Epitaxial growth, Isolation diffusion, Base diffusion, Emitter diffusion, Aluminium metalization by vacuum evaporation of aluminium; Masking and Etching; Lateral diffusion of impurities; Monolithic Integrated Diodes, BJTs, FETs, Resistors, Metal-semiconductor contacts and Capacitors; Characteristics of Integrated components, Design rules for Monolithic IC layout: Pin connections, Crossovers, Isolation Islands, Fabrication sequence, Dielectric isolation method.	10
2	**Transistor High Input Impedance and Power Amplifier:**Frequency response of amplifiers: high frequency device models, frequency response, GBW, methods of short circuit and open circuit time constants, dominant pole approximation; Feedback amplifiers: basic feedback topologies and their properties, analysis of practical feedback amplifiers, stability; Power amplifiers: class A, B, AB, C, D, E stages, output stages, short circuit protection, power transistors and thermal design considerations.	10
2.	**Transistor Oscillators:**Positive feedback and Barkhausen criterion for sustained oscillations; Classification of oscillators, Tuned collector oscillator; Hartley oscillator; Colpitt's oscillator, RC oscillators, Crystal oscillator.	20
3.	**Differential amplifiers**: DC and small signal analysis, CMRR, current mirrors, active load and cascade configurations, frequency response; case study: 741 op-amp – DC and small signal analysis, frequency response, frequency compensation, GBW, phase margin, slew rate, offsets; CMOS realizations: current source, sink and mirrors, differential amplifiers, multistage amplifiers.	10
4.	**Linear Applications of OPAMPs:**Open loop operation of OPAMPs; Voltage-series and current-series feedback; Non-inverting and inverting configurations of OPAMP circuits; Instrumentation amplifiers; V to I and I to V converters; Summing scaling and averaging amplifiers; Log and antilog amplifiers; Integrators and differentiators; Electronic	20

analog and computation

5. **Non Linear Applications of OPAMPs**: Comparators; Schimitt trigger; Voltage limiter; F to V and V to F converters; OPAMP oscillators; OPAMP multivibrators; Triangular and sawtooth wave generator; Clipper, clamper, peak detector; Sample and hold circuit 10

6. **Active Filters:**Filter approximations: Butterworth, Chebyshev and elliptic, first order and second order passive/active filter realizations 10

7. **Specialized IC & its Applications**: The 555 timer IC; PLL, Voltage regulator ICs; DAC, ADC ICs 10

Texts

1. S. Smith, "Microelectronics Circuits", 5/e, Oxford, 2005.
2. P. Gray, P. Hurst, S. Lewis, and R. Meyer, "Analysis & Design of Analog Integrated Circuits," 4/e, Wiley, 2001.
3. R. A. Gayakwad, Op-Amps and Linear Integrated Circuit, Prentice Hall of India, 2004
4. Linear Integrated Circuit 3rd Ed 2010 – D. Roy Chowdhury and S. Jain, New Academic Science Ltd
5. Op-Amps and Linear Integrated Circuits 4th Ed 2017 – Dr Sanjay Sharma, S. K. Kataria& Sons Publication
6. Operational Amplifiers and Linear Integrated Circuits 4th Ed 2007 – William D. Stanley, Pearson
7. Integrated Electronics Analog and Digital Circuits and Systems 1991 – J. Millman and C. C. Halkias, TMH

4th Semester BE (IN)

Syllabus for **Electrical Machines and Applications (IN404)**

L-3 T-0 P-0 C-3

Unit no	Contents	%Marks
1	.**D.C generator**: Construction and principle of operation; Armature windings- Lap and Wave windings, Equaliser rings, dummy coils; E.M.F equations, Types of d.c. generators, Armature reaction; Compensation windings, Commutations and methods of improving commutation; Characteristic of separately excited self excited generators; Applications of d.c. generators; Losses and efficiency.	15
2	**D.C Motor**: Construction and principle of operation; Back e.m.f; Torque equation; Condition for maximum torque; Losses and efficiency; Type of d.c. motor; Speed regulation; characteristic of shunt, Series and compound motors; Application of d.c. motors; Starting of d.c. motors; Speed control of d.c. motors.	15
3	**Transformer**: Working principle; Construction of core type and shell type transformer; e.m.f equation; Transformation ratio; Resistance and magnetic lekage reactance; No-load and on-load phasor diagrams; Equivalent circuits; Losses and efficiency; Open circuit and S.C testes; Voltage regulation; Condition for maximum efficiency; All-day efficiency; Autotransformer.	20
4	**Three-phase induction motor**: Classification of a.c. motors; General principle; Construction and classification; Theory of operation, slip and frequency of rotor current; Torque and torque-slip characteristic; Starting torque; Condition for maximum torque; Losses and efficiency; Starting of induction motor.	20
05	**Single phase motor**: Type of single phase motors- Single phase induction motor double revolving field theory; Torque-speed characteristics; Split phase motorsresistance start; Capacitor start, permanent capacitor and capacitor start-capacitor run motors; Shaded pole motors; Single phase commutator motors-repulsion motor, repulsion start induction motor; repulsion induction motor; A.C. series motor series motoruniversal motor; Reluctance motor and hysteresis motor.	15
6	**Alternator**: Classification; Construction, Principle; Voltage regulation; O.C and S.C tests; Determination of voltage regulation by synchronous impedance method and AT method.	15

Text Books:

1) Electric Machinery 6thEd 2003 - A. E. Fitzgerald, Charles Kingsley Jr., Stephen D. Umans, McGraw-Hill
2) A Text Book of Electrical Technology Vol II A.C. & D.C. Machines – B. L. Theraja and A. K. Theraja, S. Chand & Co.
3) Theory and Performance of Electric Machines 2013 – J. B. Gupta, S. K. Kataria & Sons Publication
4) Theory of Alternating Current Machinery 2nd Ed 1984 - A. S. Langsdrof, McGraw Hill
5) Electrical Machines 4th Ed 2010 – D.P. Kothari and I J Nagrath, McGraw Hill
6) Performance & Design of A.C. Machines 3rd Ed 1968 - M. G. Say, Pitman Publishing
7) Advanced Electrical Technology 2011 - H. Cotton, Reem Publications Pvt. Ltd.
8) Fundamentals of Electrical Machines 2005 – B.R Gupta, New Age International
9) Problems in Electrical Engineering 9th Ed 2003 - N. N. Parker Smith, CBS Publication

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4th Semester BE (IN)

Syllabus for **Industrial Instrumentation (IN405)**

L-3 T-1 P-0 C-4

Unit no	Contents	%Marks
1	**Introduction to Metrology.**	10
2	**Pressure Measurement** (Low pressure & High Pressure)- Manometers , Diaphragm, Bellows , Bourdon tubes etc, Electrical Pressure measuring instruments. ,Vacuum measurement – Mcleod gauge, Pirani gauge , Knudsen gauge , Ionization gauge etc.	20
3	**Flow Measurement** - Head type, Area type , Mass flow meter, Electrical type –Electromagnetic, Ultrasonic, Hotwire, Anemometers and Digital type.	15
4	**Level Measurement-** Principles of Mechanical and electrical methods of level measurement, their industrial applications.	15
5	**Measurement of**: force, torque, revolution, velocity, acceleration, vibration--- detail discussion	20
6	**Pneumatic Instrumentation** Pneumatic and Hydraulic Instrumentation - Introduction, Power supply, Air filter, Pressure regulator, Control valve, Relay, Amplifier, Pneumatic Controllers-P,PD,PI,PID, Hydraulic servo valve, Hydraulic controllers-I,P,PI,PD,PID.	20

Books :

1. Doebelin E.O – Measurement Systems : Applications and Design (Mc Grow Hill)
2. Patranibis D – Principles of Industrial Instrumentation
3. Jones B.E – Instrument Technology (Vol-I & II)
4. Backwith T. G , Buch N. L and Marangoni R.D – Mechanical Measurements
5. K.Krishnaswamy- Industrial Instrumentation (New Age)
6. Eckman D.P – Industrial Instrumentation (WE)

LABORATORIS

4th Semester BE (IN)

Syllabus for **DSLD Laboratory (IN406)**

L-0 T-0 P-2 C-1

Md No	Contents
1	**Basic Digital IC's**: Verification of truth table for AND, OR, EXOR, NOT, NOR and NAND gates
2	Design and Implementation of an Universal (NAND) Combinatorial Logic Circuit
3	Design and Implementation of an Universal (NOR) Combinatorial Logic Circuit
4	Design and Implementation of an Half Adder/Full Adder; Subtractor; Code converter; Encoder and Decoder.
5	**Sequential Logic Circuit**: Study of RS, D, T, JK and JK Master-Slave Flip-Flops (FF).
6	Design and Implementation of 4-bit SISO/SIPO/PISO/PIPO Shift registers
7	Design and Implementation of a Modulo-N Synchronous/Asynchronous Counter and Ring counter.

4th Semester BE (IN)

Syllabus for **Analog Integrated Circuits Laboratory (IN407)**

Theory:0 Sessional :0 Practical : 50 L-0 T-0 P-2 C-1

1	**Op-Amp Linear Application**: Comparator, Differentiator, Integrator, Adder, Subtractor.
2	**Op-amp Non Linear Application**: Clipper, Clamper, Peak detector, The 555 Timer IC application, VCO and PLL.
3	**Simple arithmetic operations**: Multi precision addition/subtraction/multiplication /division (8-bit & 16-bit).
	OPAMP Filters.
5	Multistage Amplifiers, Oscillators.

4th Semester BE (IN)

Syllabus for **Electrical Machines & Applications Laboratory (IN408)**

L-0 T-0 P-2 C-1

1 To obtain the speed characteristics of a D.C shunt motor as a function of armature voltage, field current, and external resistance in the armature circuit.
2 To obtain the performance characteristics of a DC shunt motor by load test.

3 To plot O.C.C. and find the critical resistance (Rc) and critical speed (Nc) of a dc shunt generator
4 To conduct a load test on a dc shunt generator and obtain its internal and external characteristics.
5 O.C & S.C tests of single phase transformer
6 Load test of single phase transformer
7 Measurement of three phase power
8 O.C & S.C. test of alternator

********** **END** **********

SEMESTER V

Sl no	Course Code	Course Title	L	T	P	Contact hrs/week	Credit
01	MA501	Mathematics V	3	1	0	4	4
02	IN501	Automatic Control Theory-II	3	0	0	3	3
03	IN502	Microprocessor & Microcontroller	3	1	0	4	4
04	IN503	Power Electronics	3	0	0	3	3
05	IN504	Digital Signal Processing	3	0	0	3	3
06	IN505	Electrical Measuring Instruments & Measurement--I	3	0	0	3	3
07	IN506	Microprocessor Laboratory	0	0	2	2	1
08	IN507	Object Oriented Programming Lab with JAVA	0	0	2	2	1
09	IN508	Control & DSP Laboratory	0	0	2	2	1
		TOTAL				**26**	**23**

5th Semester BE (IN)

Syllabus for Automatic Control Theory - II (IN501)

L-3 T-0 P-0 C-3

Md No.	Contents	%Mark
1	**Frequency response analysis**: Frequency response of systems, frequency domain specifications, correlation between time-domain and frequency-domain specification, Polar plot, Nyquist plot and Nyquist stability criterion, Bode plot, Gain margin & Phase margin, Minimum and Non-minimum phase transfer function, Determination of transfer function from Bode plot, Magnitude and Phase angle plot, Constant-M & Constant-N circles, Nichol's chart.	20
2	**State Space Method of System Analysis**: Concept of State and State variables, State model, State-Space representation of physical systems, Block diagram representation, State transition matrix and its properties, Relation between State equation and Transfer function, Solution of State equation, Characteristic equation, Eigen values and Eigen vectors, Controllability and Observability of linear systems.	20
3	**Control System Design using Bode Plot and State Space methods**: Review of Preliminary design considerations; Lead, Lag and Lag-Lead Compensation techniques based on Bode plot and State Space method.	15
4	**Introduction to Digital Control System**: Introduction, Spectrum Analysis of Sampling Process, Signal Reconstruction, Difference Equation, The z-Transform, z-Transfer Function (Pulse Transfer Function), Inverse z-Transform and Response of Linear Discrete Systems, z-Transform Analysis of Sampled-data Control Systems, Block Diagram Reduction, Stability, Steady-State Errors, Transient Response on the z-Plane, Gain Design on the z-Plane, Cascade Compensation via s-Plane, Implementation of Digital Compensator.	15
5.	**Nonlinear Systems:** Common Physical Nonlinearities, Phase-plane method, Singular points, Stability of Nonlinear System, Construction of Phase-trajectories, Describing function method of Stability analysis, Jump resonance.	15
6.	**Liapunov's Stability Analysis:** Liapunov's Stability Criterion, Direct method of Liapunov and Linear Systems, Methods of constructing Liapunov Functions for Nonlinear Systems.	15

Text Books:

1. Control System Engineering 5th Ed 2009 – I J Nagrath and M Gopal, New Age International Publishers
2. Modern Control Engineering 2015 – K Ogata, Pearson
3. Control System Engineering 6th Ed 2010 - Norman S. Nise, John Wiley & Sons

4. Control Systems: Theory and Applications 2nd Ed 2012 - Smarajit Ghosh, Pearson
5. Schaum's Outline of Feedback and Control Systems 2nd Ed 2014 – Joseph J. DiStefano, Allen J. Stubberud and Ivan J. Williams, McGraw-Hill
6. Modern Control System 12th Ed 2013 - Richardo C. Dorf, Robert H. Bishop, Pearson
7. Control Systems –Principles & Design 4th Ed 2012 - M Gopal, Tata McGraw Hil

5th Semester BE (IN)

Syllabus for Microprocessor and Microcontroller (IN502)

L-3 T-1 P-0 C-4

Module 1: Architecture of Microprocessors General definitions of mini computers, microprocessors, micro controllers and digital signal processors. Overview of 8085 microprocessor.Overview of 8086 microprocessor. Signals and pins of 8086 microprocessor

Module 2: Assembly language of 8086 Description of Instructions. Assembly directives. Assembly software programs with algorithms

Module 3: Interfacing with 8086 , Interfacing with RAMs, ROMs along with the explanation of timing diagrams. Interfacing with peripheral ICs like 8255, 8254, 8279, 8259, 8259 etc. Interfacing with key boards, LEDs, LCDs, ADCs, and DACs etc.

Module 4: Coprocessor 8087 , Architecture of 8087, interfacing with 8086. Data types, instructions and programming

Module 5: Architecture of Micro controllers , Overview of the architecture of 8051 microcontroller. Overview of the architecture of 8096 16 bit microcontroller.

Module 6: Assembly language of 8051 , Description of Instructions. Assembly directives. Assembly software programs with Algorithms.

Module 7: Interfacing with 8051 , Interfacing with keyboards, LEDs, 7 segment LEDs, LCDs, Interfacing with ADCs. Interfacing with DACs, etc.

Module 8: High end processors , Introduction to 80386 and 80486

TEXT BOOKS:

1. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family – Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2007.
2. Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011.
3. DoughlasV.Hall, "Microprocessors and Interfacing, Programming and Hardware",TMH,2012

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5th Semester BE (IN)

Syllabus for Power Electronics (IN503)

L-3 T-0 P-0 C-3

Md No.	Contents	%Marks
1	**Semiconductor Power Devices:** Characteristics of power devices – Diode, Power transistor, Thyristor and Triac; Firing circuits for Thyristor & Triac; Rating, Cooling & mounting of Thyristor; Series & parallel connection of Thyristor; Protection of Thyristor; Gate trigger & commutation circuits; Gate Turn-Off Thyristor (GTO); Power MOSFET; UJT; Diac & IGBT.	15
2	**Rectifier Circuits:** Circuit nomenclature; Commutating diode; Single-phase half wave, 2-phase half wave, Single-phase bridge uncontrolled, fully control & half controlled rectifiers; 3-ph half wave, 6-ph half wave, 3-ph bridge & 12-ph rectifier circuits; Transformer rating; Rectification with R-L & R-C loads; Power factor improvement; Excitation angle control; Symmetrical angle control; Pulse Width Modulation (PWM) & Sinusoidal PWM.	15
3	**Inverter:** Principle of operation of inverter; voltage driven inverter; Current driven inverter; Forced-commutated inverter; Classification of circuits for forced commutation; Parallel inverter; Poly-phase inverter; Self commutated inverter; Bridge inverter; McMurray–Bedford commutation; Bridge circuit using McMurray–Bedford commutation; 3-ph bridge inverter; Current source inverter; PWM inverter; Voltage control of 3-ph inverter; Harmonics reduction; Inverter applications.	15
4	**Chopper:** Principle of operation of chopper; Constant frequency operation; Variable frequency operation; Classification - Class A, Class B, Class C, Class D & Class E operation; Series turn-off chopper; Parallel capacitor turn-off chopper; Morgan chopper; Jones chopper.	15
5	**Cycloconverter:** Mathematical analysis; Bridge configuration; Control circuits; Improved cycloconverter circuits; Harmonic analysis; Input characteristics; Circulating current mode; Control; Envelope cycloconverter.	15
6	**A.C. Voltage Controller:** Introduction; ON-OFF control; Phase angle control; Single phase bi-directional controller with resistive load. **Power Supplies:** D.C. power supply; Switching Mode Power Supply (SMPS) d.c. power supply; Resonant d.c. power supply; Bi-directional power supplies; A.C. power supplies; Uninterrupted Power Supply (UPS) configuration; SMPS a.c. power supplies; Power factor conditioning.	25

Text Books:

1. Power Electronics: Circuits, Devices and Applications 4th Ed 2013 - Muhammad H. Rashid, Pearson Education India

2. Power Electronics: Converters Applications and Design 3rd Ed 2007 - Ned Mohan, Tore M. Undeland and William P. Robbins , John Wiley & Sons
3. Power Electronics 3rd Ed 1993 - Cyril W. Lander, McGraw Hill
4. Modern Power Electronics 2nd Ed 2005 - P. C. Sen, S. Chand & Co.
5. Power Electronics – Sugandhi and Sugandhi
6. Thyristors - Theory and Applications 2nd Ed 2003 - R. K. Sugandhi and K. K. Sugandhi, John Wiley and Sons
7. Power Electronics 2012 – P. S. Bimbhra, Khanna Publishers
8. Power Electronics 2011 – Daniel W. Hart, McGraw Hill
9. Power Electronics 6th Ed 2010 – B. R. Guta and V. Singhal, S. K. Kataria & Sons
10. Thyristorized Power Controllers 2nd Ed 2012 - G. K. Dubey, S. R. Doradla, A. W. Joshi and R. M. K. Sinha , New Age International
11. An Introduction to Thyristors and Their Applications 2nd Ed 1991 - M. Ramamoorthy, Affiliated East-West Press

5th Semester BE (IN)

Syllabus for Digital Signal Processing (IN505)

L-3 T-0 P-0 C-3

Md No.	Contents	%Marks
1	**Introduction:** Introduction to Signals, Systems & Signal processing; Classification of Signals; Concept of frequency in continuous-time and discrete-time Signals; Analog to Digital and Digital to Analog converters from signal processing view point; Linear time-invariant systems.	20
2	**Theory of z-Transform and Applications:** Definitions & properties; Inverse z-transforms; Transfer functions; Unit sample response; Difference equations; Basic network structure for IIR & FIR systems.	20
3	**Theory of Discrete Fourier Transform (DFT):** Fourier transform of discrete-time signals; Fourier series representation of discrete-time signal; Sampling theorem; Discrete Fourier transform and its properties; Filtering of long data sequences.	15
4	**Fast Computational Methods of DFT:** Fast Fourier Transform (FFT); Decimation in time and decimation in frequency radix-2 FFT algorithms; In-place computations and bit-reversing rules; Parallel & pipeline processing of FFT radix-2 algorithms; Efficient computation of the DFT of two real sequences; Efficient computation of DFT of the DFT of a 2N-point real sequence.	15
5	**Theory of FIR filters and Design:** Properties of Finite Impulse Response (FIR) filters; Window method and Frequency sampling method of FIR filter design; Computer Aided Design of FIR filters.	15
6	**Theory of IIR filters and Design:** Properties of Infinite Impulse Response (IIR) filters; Impulse invariance method, Bilinear transform method and Matched z-transform method of IIR filter design.	15

Text Books:

1. Digital Signal Processing - Principles, Algorithms & Applications 4th Ed 2007 - John G. Manolakis and Dimitris K. Manolakis , Pearson
2. Digital Signal Processing 2014 - Tarun Kumar Rawat, Oxford University Press
3. Digital Signal Processing - Fundamentals and Applications 2008 - Li Tan, Elsevier Academic Press.
4. Discrete-Time Signal Processing 2nd Ed 1999 – Alan V. Oppenheim, Ronald W. Schafer, John R. Buck, PHI
5. Schaum's Outlines Theory and Problems on Digital Signal Processing 2nd Ed 2011 - Monson H. Hayes, McGraw Hill
6. Digital Signal Processing - A computer based approach 4th Ed 2010 – Sanjit K. Mitra, McGraw Hill

7. Schaum's Outlines Signals and Systems 3rd Ed 2014 - H. P. Hsu, Tata McGraw Hill
8. Signals and Systems – 1st Ed 2016 – Sanjit K. Mitra, McGraw Hill

5th Semester BE (IN)

Syllabus for Electrical Measuring Instruments & Measurement--I (IN506)

L-3 T-0 P-0 C-3

Md No.	Contents	%Marks
1.	**Ammeter, Voltmeter and Ohmmeter:** a) Construction and working principle of PMMC & MI type instruments; Construction and working principle of Megger. b) Construction, operating principle & torque equation for Electrodynamometer, Electrostatic & Induction type instruments. c) Relative comparison among PMMC, MI, Electrodynamometer, Electrostatic & Induction type instruments.	15
2.	**Wattmeter & Energymeters**: Principle of measuring power by using Dynamometer and Induction type wattmeters; Errors and compensation; Low power factor polyphase wattmeters; Energymeter – difference between wattmeter & energymeter; Principle of construction of Induction type energymeter; Error compensation and adjustments in energymeter.	15
3.	**Special Type Meters** : Construction and working principle of Frequency meter, Synchroscope, Power factor meter, Flux meter, Maximum demand meter.	15
4.	**Instrument Transformers**: Uses of instrument transformers; Theory of CT & PT; Ratio & phase angle errors; Errors compensations; Testing of CT & PT.	15
5.	**Oscilloscope**: Block diagram representation; Cathode ray tube; Vertical and Horizontal deflection systems; Delay line; Multiple trace; CRO probe & transducers; Measurement of voltage, current, phase & frequency by CRO; Storage Oscilloscope.	15
6.	**Electronic Instruments**: (a) Electronic Voltmeters: Advantage & disadvantages of using electronic voltmeters; Different stages in AC & DC electronic voltmeters; Balanced bridge voltmeter; Principle and circuit diagrams for average responding, peak responding & RMS responding voltmeters. (b) Digital voltmeters: Classification of digital voltmeters; Principle, block diagram and signal wave form of ramp type, stair case ramp type and integrating type digital voltmeters. (c) Electronic Multimeter & Q-meter.	25
7.	**Recorders**: Different types of recorders; Construction, working principle and circuit diagrams of Strip-chart & X-Y recorders.	

Text Books:

1) A Course in Electrical and Electronic Measurements and Instrumentation 19th Ed 2011 - A. K. Sawhney and Puneet Sawhney, Dhanpat Rai & Sons.
2) A Course in Electrical and Electronic Measurements and Instrumentation 14th Ed 2014 – J. B. Gupta, S. K. Kataria & Sons.
3) Electrical Measurements and Measuring Instruments 2nd Ed 2013 – R. K. Rajput, S. Chand & Co.
4) Electronic Instrumentation and Measurements 3rd Ed 2013 – Davis A. Bell, Oxford University Press

5) Electronic Instrumentation, 3rd Ed 2010 - H. S. Kalsi, McGraw Hill
6) Electrical Measurement and Measuring Instruments 2011 - E.W. Golding and F.C Widdis, Reem Publications Pvt. Ltd.

LABORATORIES

5th Semester BE (IN)

Syllabus for Microprocessor Laboratory (IN506)

L-0 T-0 P-2 C-1

Contents

1. Simple arithmetic operations: Multi precision addition/subtraction/multiplication /division (8-bit & 16-bit).
2. Programming with control instructions: Increment/Decrement, Maximum/Minimum of numbers, Ascending/Descending order Sorting, Rotate instructions, Hex/ASCII/BCD code conversions.
3. Interface Experiments:

- Simple experiments using 8212, 8251, 8255, 8259, 8279, 8253.
- Interfacing of Linear and Matrix Keyboard, Digital Clock, Traffic light controller, Stepper motor control, ADC & DAC Interfacing, Temperature Monitoring & Control, Voltage & Current Monitoring, Line Power Factor Control.

5th Semester BE (IN)

Syllabus for C++ & Object Oriented Programming Laboratory with JAVA (IN508)

L-0 T-0 P-2 C-1

Experiments with JAVA

A. To write a java program to find area of Rectangle by using an instance of a class.
B. To write a java program to perform various operations using string function.
C. To write a java program to create a package.
D. To write a java program to find the account balance by array of objects using package.
E. To write a java program to develop user defined interfaces.
F. To write a java program using pre defined interfaces.
G. To implement threading and exception handling using java program.
H. To write a java program on multithreading concept.
I. To implement the pre defined exception concept in java.
J. To implement the user defined exception concept in java.
K. To create a java applet program for drawing smiley face.
L. To create a java applet program for adding two numbers by getting input from the user.
M. To create a java applet program for drawing Arcs.
N. To create a java applet program for drawing Buttons.

O. To create a java applet program that lets the user to make a free hand drawing.
P. To create a java applet program for displaying different fonts.
Q. Write a java program for creation of menus (To demonstrates the use of Menubar, Menu, MenuItem and CheckboxMenuItem).
R. Write a java program to demonstrates the use of Layout Managers.
S. Write a java program to demonstrates the use of Color Class.

5th Semester BE (IN)

Syllabus for Automatic Control System & DSP Laboratory (IN508)

L-0 T-0 P-2 C-1

Md No.	Contents	Marks
	PART –I (Control System)	
1	Determination of transfer function parameters of a DC servo motor	
2	Determination of transfer function parameters of Ac servo motor	
3	Analog simulation of Type-0 and Type-1 system	
4	Digital simulation of linear systems.	
5	Design and implementation of compensators	
6	Stability analysis of linear systems	
7	Study of Synchros.	
	PART –II (DSP)	

1. Fundamentals: Generation of signals, study of system properties; convolution and correlation; z-transform; DFT using FFT;
2. Linear convolution using circular convolution; aliasing due to sampling in time and frequency domains; Design of FIR and IIR filters;
3. Estimation of power spectral density using periodogram and Welch's method; Generation of discrete and continuous random variables, statistical analysis and validation, Monte-Carlo simulation.
4. Applications: Array Signal Processing, Communication Systems, Multirate Signal Processing, Image Processing, Speech Processing.

********** END **********

SEMESTER VI

Sl no	Course Code	Course Title	L	T	P	Contact hrs/week	Credit
01	HS601	Introduction to Accountancy & Management	3	0	0	3	3
02	IN601	Principles of Communication Engineering	3	1	0	4	4
03	IN602	Process Dynamics & Control	3	1	0	4	4
04	IN603	Electrical Measuring Instruments & Measurement--II	3	0	0	3	3
05	IN604	Instrumentation System Design & Drawing	0	0	6	6	3
06	IN605	Instrumentation Laboratory- II	0	0	2	2	1
07	IN606	Mini Project	0	0	4	4	2
08		**Elective-I (Open)**	3	0	0	3	3
		TOTAL				**29**	**23**

List of Elective I(Open)

1. EE609 Computer Organization
2. EE611 Basic Thermal Science
3. IN608 Fluid Power & Control
4. IN609 Electro Magnetic Field Theory
5. IN610 Renewable Energy Sources

6th Semester BE (IN)

Syllabus for Principles of Communication Engineering (IN601)

L-3 T-1 P-0 C-4

Md No.	Contents	Marks
	Prerequisites: Signals and Systems	
1	**Introduction**: An over view of communication process-electronic communication; Typical communication channels, Distortion less transmission, Signal transmission through BPF - pre envelope and complex envelope. **Electromagnetic wave propagation**: Electromagnetic radiation, Propagation modes of EM waves-ground wave, Sky wave, Space wave, Tropospheric scatter, Extra terrestrial communication, Dipole antenna, Resonant antenna, Non resonant antenna, Marconi and Hertz antenna, Antenna coupling at medium frequencies, Directional high frequency antenna, Microwave antenna, Wide band antenna.	15
2	**Random signals and noise**: Review of probability theory, Random variables, Probability distribution functions & probability density function, Joint probability density function, Gaussian distribution, Raleigh's distribution and exponential distribution, Error function, Random processes, Average and variance of random processes, Source of noise, Noise as a random process, White noise, Noise transmission through LTI system, SNR, Noise temperature, Available power of a noise source, Calculation of rms noise voltage, Noise equivalent resistance of an amplifier, Noise figure.	20
3	**Carrier Wave modulation and detection**: Need for modulation, Amplitude modulation (AM), AM modulators-low level and high level modulation techniques, AM detectors, Superheterodyne reciever principles, ICIC receiver for AM, Frequency modulation (FM) – Narrow Band (NB) FM & Wide Band (WB) FM, FM modulators, FM detectors, Noise in FM systems, Phase modulation, Suppressed Carrier (SC) modulation – Double Side Band (DSB)-SC & Single Side Band (SSB)-SC, Generation and detection of SC modulation system, Phase and frequency error in SC modulation system, Frequency Division Multiplexing (FDM).	15
4	**Pulse modulation**: Nyquist sampling theorem, Pulse modulation systems – Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Phase Modulation (PPM), Aliasing, Natural sampling and flat top sampling, Quantization, Quantization error, Pulse Code Modulation (PCM), Companding, Time Division Multiplexing (TDM), Cross top, Differential PCM, Delta	15

modulation (DM), Adaptive DM.

5	**Digital Data Transmission:** Coherent and Non-coherent Techniques, Base band data transmission & reception, Binary matched filter, Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Quadrature Phase Shift Keying (QPSK), Differential Phase Shift Keying (DPSK), Quadrature Amplitude Modulation (QAM), Minimum Shift Keying (MSK), Error probability, Gaussian Minimum Shift Keying (GMSK), M-ary Communication, Timing & synchronization.	15
6	**Information Theory and Coding:** Information content of a signal, Information rate, Shannon's Capacity theorem, Channel capacity, Shannon Limit, Coding: Entropy coding, Error detection & correction codes, Parity check codes, Block codes, Algebraic codes, Convolutional codes.	10

Text Books:

(1) Communication Systems (Analog and Digital) 6th Ed 2012 – Dr Sanjay Sharma, S. K. Kataria & Sons.
(2) Communication Systems 4thEd 2001 - Simon Haykin, John Wiley & Sons
(3) Communication Systems 5thEd 2009 - Simon Haykin, John Wiley & Sons
(4) Modern Digital and Analog Communication Systems 4th Ed 2009 - B P Lathi and Zhi Ding, Oxford University Press
(5) Communication Systems 1968 - B. P. Lathi, John Wiley & Sons
(6) Principles of Communication Systems 4th Ed 2013 - Herbut Taub, Donald L. Schilling, Goutam Saha, McGraw Hill.
(7) Electronic Communication Systems 4th Ed 1992 - George Kennedy and Bernard Davis, McGraw Hill
(8) Analog and Digital Communication Systems 5th Ed 2003 - Martin S. Roden, Discovery Press.
(9) Digital Transmission Engineering 2ndEd 2005 - John B Anderson, John Wiley and Sons

6th Semester BE (IN)

Syllabus for Process Dynamics and Control (IN602)

L-3 T-0 P-0 C-3

01	**Introduction** : Definition of process & process control systems; Objectives & requirements; Classification & selection of process variables; Sources &nature of disturbances; hardware elements of process control systems, Block diagram reduction for MIMO system.	**15**
02	**Modelling of physical systems:** Mathematical model of physical systems-liquid level system, thermal system, mixing process, CSTR, pressure system, flow system etc; interacting and non interacting systems, RLC elements in process, linerization of non linear systems.	**20**
03	**Transient response analysis:** Response of first and second systems due to load change at arbitrary points with P, I, P-I and P-I-D controllers; transient response specifications, effect of time delay and measurement lag on system response.	**20**
04	**Control action and controllers:** On-Off, P, I, D, PI, PD and PID control actions, electronic controllers **.**	**25**
05	**Control valve**: Construction and working principle, valve sizing, valve plug, valve characteristics, selection of control valve, valve positioners.	**20**

Ref. Books:

1) Stephinopoulos G- Chemical process control (PHI).
2) Pollard A –Process control.
3) Coughanowr – Process System Analysis and Control (MH).
4) Hariot P-Process Control (TMH).
5) Johnson-Process Control Instrumentation Technology (JW).

6th Semester BE (IN)

Syllabus for Electrical Measuring Instruments & Measurement--II (IN603)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1.	**Introduction**: D.C Potentiometer, Basic D.C Potentiometer CKT, Crompton's Potentiometer, Multirange Potentiometer, Standard Cell Dial, Volt-Ratio Box, Measurement of Voltage, Resistance and Power, Calibration of Voltmeter, Ammeter and Wattmeter, Self Balancing Potentiometer, A.C Potentiometer - Gall-Tinsley (Co-ordinate Type) A.C Potentiometer, Drysdale (Polar Type) Potentiometer, Standardization, Errors, Applications.	15
2.	**Measurement of Resistance**: Definition of Low, Medium and High Resistance, Measurement of Medium Resistance by Ammeter - Voltmeter Method, Substitution Method, Wheatstone Bridge Method, Measurement of Low Resistance by Kelvin Double Bridge Method, Difficulties of Measurement of High Resistances; Use of Guard Circuit; Loss of Charge Method; Measurement of Insulation Resistance with Power ON, Factors effecting Earth Resistance; Methods of Measuring Earth Resistance.	15
3.	**A.C Bridges**: General Form of A. C. Bridge; Maxwell's Inductance Bridge; Maxwell's Inductance/ Capacitance Bridge; Hay's Bridge; Anderson's Bridge; Owen's Bridge; High Voltage Schering Bridge, Heaviside Mutual Inductance Bridge; Campbell's Modification of Heaviside Bridge; Heaviside – Campbell Equal Ratio Bridge; Caey – Foster Bridge; Wien's Bridge; Sourcesof Errors in Bridge Circuits; Shielding of Bridge Elements; Wagner's Earthing Device.	15
4.	**Magnetic Measurements**: Magnetic Fluxmeter; Construction and Principle of Operation of Magnetic Potentiometer; Ewing Double Bar and Illiovici Permeameter Method of Measurement of Magnetic Field Intensity; Determination of B-H Curve and B-H Loop by the Method of Reversal and Step-by-Step Method; Measurement of Hysteresis Loss by Wattmeter, Bridge method and Potentiometer Method.	15
5.	**Transducers**: Classification and Selection of Transducers - Primary and Secondary Transducers; Construction, Principle of Operation and Applications of Diaphgrams, Bellows, Bourden Tubes, Springs, Capacitive, Piezoelectric and Photoelectric Transducers; Strain Gauges; Linear Variable Differential Transformer (LVDT).	20
6.	**High Voltage Measurements and Testing**: Types of High Voltage Tests; High Voltage Testing (Impulse) Transformers; Voltage Control by Variation of Alternator Field Current, Tapped Transformers; Induction Regulators; Control Gear and Protective Devices; Equipments for Voltage Measurement, Measurement of R.M.S., Peak, and Instantaneous Values of Voltages; Low Frequency High Voltage Tests; High Voltage D.C. Tests; High Voltage D.C. Testing of Cables; Localization of Faults in H.V. Cables; High Frequency H.V. Testing; Surge Testing; Basic Impulse Generator; Testing of Insulating Material; Impulse Testing of Transformer; H.V. Testing of Cables; Testing of Strength of	20

Insulating Oils; High Voltage Testing of Porcelain Insulators.

Text Books:

1. A Course in Electrical and Electronic Measurements and Instrumentation 19th Ed 2011 - A. K. Sawhney and Puneet Sawhney, Dhanpat Rai & Sons.
2. A Course in Electrical and Electronic Measurements and Instrumentation 14th Ed 2014 – J. B. Gupta, S. K. Kataria & Sons.
3. Electrical Measurements and Measuring Instruments 2nd Ed 2013 – R. K. Rajput, S. Chand & Co.
4. Electronic Instrumentation and Measurements 3rd Ed 2013 – Davis A. Bell, Oxford University Press
5. Electronic Instrumentation, 3rd Ed 2010 - H. S. Kalsi, McGraw Hill
6. Electrical Measurement and Measuring Instruments 2011 - E.W. Golding and F.C Widdis, Reem Publications Pvt. Ltd.

6th Semester BE (IN)

Syllabus for **Instrumentation System Design & Drawing(IN604)**

L-0 T-0 P-6 C-3

01	**Basic concept of Instrumentation** Design :Functional requirements & specifications; NEMA, DIN, BSI, ANSI standards; Guidelines of enclosure design, cable design.	
02	**Electronic design guidelines**: Noise in electronic circuits; capacitive & inductive coupling; shielding; co-axial & twisted pair cable; grounding.	
03	**Electrostatic discharge introduction**: ESD protection in equipment; software used; EMI; noises; filters; fault finding and troubleshooting.	
04	**Introduction to protection techniques**: Shielding with magnetic material; contact protection; intrinsic noise sources etc.	
05	**Printed circuit board design guidelines**: Layout scheme; grid systems; PCB size; Design rules for digital & analog circuits; Automation in PCB design artwork: CAD; System design; selection of sensors; signal conditioning; standard signals; noise considerations of typical systems.	
07	**Reliability:** reliability for series parallel systems, K-out of n system; MTTF, MTTR, MTFB; availability, redundancy and stand by.	
08	**Practical/Drawing/Design/Workshop:** Minimum 10 drawings & report from the following list 1. Instrument symbols 2. Piping & Instrumentation diagrams- ISA symbols; PI diagram of typical Process Plants 3. Various transducers' detail dimensions, views & specifications ;drawing 4. Design of inverse transducers 5. Case study with design of transducers module for measurement	100

Text Books and References:

1. Measurement systems : E.O.Doeblin;
2. Principles of Industrial Instrumentation : D. Patranabis ; TMH
3. Process/Industrial Instruments and Control Handbook: D.M. Considdine; McGraw Hill
4. Instrument Engineers' Handbook—Vol-I & II: B.G.Liptak ; Chilton Books

LABORATORY

6th Semester BE (IN)

Syllabus for **Instrumentation Engineering Lab--II(IN604)**

L-0 T-0 P-2 C-1

1. To study I/P and P/I converter.
2. To study characteristics of vibration sensor
3. To study the SCR speed control of Motors
4. To study AC servo Motors
5. To study the Auto transformers
6. To study the of characteristics of Optical fibers
7. To study Weight measuring using optical fibers
8. Study of photo voltaic cell
9. Study of Characteristics of U.S devices
10. study of PID temperature Controller
11. Study of CSTR
12. Geographical programming using LabVIEW
13. Applications of LabVIEW

BOOKS RECOMMENDED

1 . Learning with LabVIEW 7 Express – R.H. Bishop, Pearson Education, Delhi,

2. LabVIEW Basic 1 Course Manual, National Instruments

ELECTIVE—I

6th Semester BE (IN)

Syllabus for Computer Organization (EE609)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1	**Computer Evolution & Arithmetic (8 Hours)**: A Brief History of computers, Designing for Performance, Von Neumann Architecture, Hardware architecture, Computer Components, Interconnection Structures, Bus Interconnection, Scalar Data Types, Fixed and Floating point numbers, Signed numbers, Integer Arithmetic, 2's Complement method for multiplication, Booths Algorithm, Hardware Implementation, Division, Restoring and Non Restoring algorithms, Floating point representations, IEEE standards, Floating point arithmetic	20
2	**The Central Processing Unit (8 Hours)**: Machine Instruction characteristics, types of operands, types of operations, Addressing modes, Instruction formats, Instruction types, Processor organization, Intel 8086 as example, Programmers model of 8086, max/min mode, Register Organization, Instruction cycles, Read Write cycles, 8086 assembly instruction examples to explain addressing modes	15
3	**The Control Unit (6 Hours)**: Single Bus Organization, Control Unit Operations: Instruction sequencing, Micro operations and Register Transfer. Hardwired Control: Design methods – State table and classical method, Design Examples - Multiplier CU. Micro-programmed Control: Basic concepts, Microinstructions and microprogram sequencing	15
4	**Memory Organization (6 Hours)**: Characteristics of memory systems, Internal and External Memory, Types of memories: ROM: PROM, EPROM, EEPROM, RAM: SRAM, DRAM, SDRAM, RDRAM High-Speed Memories: Cache Memory, Organization and Mapping Techniques, Replacement Algorithms, Cache Coherence, MESI protocol. Virtual Memory: Main Memory allocation, Segmentation, Paging, Address Translation Virtual to Physical. Secondary Storage: Magnetic Disk, Tape, DAT, RAID, Optical memory, CDROM, DVD	20
5	**I/O Organization (6 Hours)**: Input/Output Systems, Programmed I/O, Interrupt Driven I/O,8086 Interrupt structure, Direct Memory Access (DMA), 8237 features Buses and standard Interfaces: Synchronous, Asynchronous, Parallel I/O 8255 features, Serial I/O 8251 features, PCI, SCSI, USB Ports Working mechanisms of Peripherals: Keyboard, Mouse, Scanners, Video Displays, Touch Screen panel, Dot Matrix, Desk-jet and Laser Printers.(features and principles)	15

6	**Parallel Organization (8 Hours)**: Instruction level pipelining and Superscalar Processors, Multiple Processor Organizations, Closely and Loosely coupled multiprocessors systems, Symmetric Multiprocessors, Clusters, UMA NUMA, Vector Computations, RISC: Instruction execution characteristics,, RISC architecture and pipelining. RISC Vs CISC	15

Text Books:

1. Computer Organization and Architecture: Designing for performance, 6thEd - W. Stallings, Prentice Hall of India, 2003.
2. Computer Organization, 5thEd - C. Hamacher, V. Zvonko, S. Zaky, McGraw-Hill, 2002.
3. Computer Architecture and Organization, 2ndEd - J. Hays, McGraw-Hill, 1988.
4. Computer Organization and Architecture: Principles of Structure and Function, 2ndEd - W. Stallings, Maxwell Macmillan Editions, 1990.
5. Structured Computer Organization, 4thEd - A. Tanenbaum, Prentice Hall of India, 1991.
6. Computer Organization: Hardware and Software, 2ndEd - G. George, Prentice Hall of India, 1986.
7. Computer Organization and Design: The Hardware Software Interface, 2ndEd - D. Paterson, J. Hennesy, Morgan Kauffman, 2000.

6th Semester BE (IN)

Syllabus for Advance Discrete Time Signal Processing (EE610)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1	**Review of Signals and Systems**: Introduction, Continuous time and discrete time signals, Transformations of independent variable, Exponential and Sinusoidal Signals, Unit impulse and unit step functions, basic properties. LTI Systems: Introduction, Convolution sum, Convolution integral, Properties of LTI systems.	20
2	**Multirate Signal Processing & Filter Banks**: Introduction, Decimation, Interpolation, Fractional rate conversion, Multistage Filter implementation. Interpolated FIR filter (IFIR), IFIR technique for decimation filter and interpolation filter. Analysis and Synthesis banks. Poly phase structures – Polyphase structure for decimation and interpolation filters.	15
3	**Applications of Multirate Signal Processing**: Filter banks, digital audio, analog voice privacy system, transmultiplexers, Multirate adaptive filters, Sub band coding – spectral analysis, amplitude and phase analysis, simple and M channel QMF	15
4	**Adaptive Filtering**: Principles of adaptive filtering, LMS and RMS algorithms. Applications in noise and echo cancellation.	20
5	**Homographic Signal Processing**: Homograph systems for convolution, properties of complex spectrum, application of homographic deconvolution.	15
6	**Time Frequency Analysis**: Need for time frequency analysis, Time frequency distributions, short time Fourier transform, Wigner distribution, Introduction to wavelet transformation.	15

Text Books:

1. Digital Signal Processing - Principles, Algorithms & Applications 4th Ed 2007 - John G. Manolakis and Dimitris K. Manolakis , Pearson
2. Digital Signal Processing 2014 - Tarun Kumar Rawat, Oxford University Press
3. Multirate Systems and Filter Banks 1st Ed 1992 – P. P. Vaidyanathan, Prentice Hall
4. Digital Signal Processing: A Practical Approach 2nd Ed 2004 - Emmanuel Ifeachor and Barrie Jervis, Prentice Hall.
5. Discrete-Time Signal Processing 2nd Ed 1999 – Alan V. Oppenheim, Ronald W. Schafer, John R. Buck, PHI
6. Adaptive Signal Processing 1985 - Bernard Widrow and Peter N. Stearns, Pearson
7. Adaptive Filter Theory 5th Ed 2013 - Simon Haykin, Pearson
8. Wavelets and Filter Banks 2nd Ed 1996 - G Strang and T Nguyen, Wellesley-Cambridge

Press
9. Time Frequency analysis: Theory and Applications 1994 - Leon Cohen, Prentice Hall
10. Optimum Signal Processing: An Introduction 2nd Ed 1988 - Sophocles J Orfanidis, Collier Macmillan

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6th Semester BE (IN)

Syllabus for Fluid Power and Control (IN608)

L-3 T-0 P-0 C-3

UNIT	CONTENTS	%WEIGHTAGE
01	**HYDRAULIC COMPONENTS :** Introduction to fluid power system-Pascal's Law-Hydraulic fluids-Hydraulic pumps-Gear, Vane and Piston pumps-Pump Performance-Characteristics and Selection-actuators-valves-pressure control-flow control and direction control valves-Hydraulic accessories-Hydraulic Accumulator. Hydraulic actuators, control elements – direction, pressure and flow control valves. Valve configurations, General valve analysis, valve lap, flow forces and lateral forces on spool valves. Series and parallel pressure compensation flow control valves. Flapper valve Analysis and design.	**25**
02	**PNEUMATIC COMPONENTS:** Introduction to Pneumatics-Compressors-types-Air treatment-FRL unit-Air dryer-Control valves-Logic valves-Time delay valve and quick exhaust valve-Pneumatic Sensors–types-characteristics and applications.	**20**
03	**FLUID POWER CIRCUITS:** Circuit Design Methodology-Sequencing circuits-Overlapping signals-Cascade method-KV Map method-Industrial Hydraulic circuits-Double pump circuits-Speed control Circuits-Regenerative circuits-Safety circuits-Synchronizing circuits-Accumulator circuits.	**20**
04	**ELECTRO - PNUEMATICS AND HYDRAULICS:** Relay, Switches-Solenoid-Solenoid operated valves-Timer-Counter-Servo and proportional control-Microcontroller and PLC based control-Design of electro-pneumatic and hydraulic circuits.	**15**
05	**APPLICATION, MAINTENANCE AND TROUBLE SHOOTING:** Development of hydraulic / pneumatic circuits applied to machine tools-Presses-Material handling systems-Automotive systems-Packaging industries-Manufacturing automation-Maintenance and trouble shooting of Fluid Power circuits-Safety aspects involved.	**20**

TEXT BOOKS

1. Anthony “Esposito, Fluid Power with applications”, Prentice Hall international–1997.
2. Majumdar.S.R, “Oil Hydraulics”, Tata McGraw Hill, 2002.
3. Majumdar S.R, “Pneumatic systems-principles and maintenance”, Tata McGraw Hill 1995.
4. Werner Deppert, “Kurt Stoll, Pneumatic Application”, Vogel verlag–1986.

REFERENCES

1. John Pippenger, Tyler “Hicks, Industrial Hydraulics”, McGraw Hill International Edition, 1980.
2. Andrew Parr, “Hydraulics and pneumatics”, Jaico Publishing House, 2003.FESTO, “Fundamentals of Pneumatics”, Vol I, II, III.

6th Semester BE (IN)

Syllabus for Electromagnetic Field Theory (IN609)

L-3 T-0 P-0 C-3

1.**Vector Analysis** : Scalar & vector field ; Vector algebra ; Vector calculus – gradient, divergence and curl of a vector ; Cartesian , cylindrical and spherical systems of vectors ; Transformation between vectors ; Line & surface integral ; Divergence theorem ; Stokes theorem and Green's theorem.

2. **Electrostatics in Vacuum & Dielectrics** : Coulomb's law ; Principles of superposition of forces ; Electric field intensity ; Field due to point charges , line charges and sheet of charges ; Electric flux & flux density ; Gauss's law (Integral & differential form) ; Applications of Gauss's law ; Laplace's & Poisson's equations; Maxwell's first equation (Electrostatics) ; Electric potential & potential difference ; Relation between field & potential ; Equipotential surface ; Potential gradient ; Electric dipole ; Electrostatic energy ; Energy & field in presence of dielectrics ; Boundary equations.

3. **Boundary Value Problems** : Poisson's & Laplace's equations ; Uniqueness theorem and boundary conditions ; Solution of Laplace's equation in different co-ordinate systems ; Solution of Poisson's equation ; Method of images.

4**. Magnetostatic Field** : Magnetic field ; Biot-savart law ; Ampere's circuital law ; Laws of magnetostatic in vector form ; Magnetic scalar & vector potential ; Magnetic dipole moment of current loop.

5. **Electromagnetic Field** : Faraday's laws in integral & differential form ; Energy in magnetic field ; Force & Torque on current loop ; Magnetic boundary conditions.

6. **Time Varying Fields** : Maxwell's equations in differential & integral form ; Retarded potential ; Poynting vector ; Power & energy consideration ; Poynting theorems.

7. **Plane Electromagnetic Waves** : Wave equation in free space ; Wave equation in perfect dielectrics ; Plane wave in lossy dielectrics ; Propagation in good conductors ; Polarization of plane electromagnetic waves ; Retarded potential ; Standing wave ratio ; Reflections of uniform plane waves.

Reference Books : 1) Engineering Electromagnetics – W.H.Hayt (TMH)
2) Elements of Electromagnetic Fields – S.P Seth (Dhan Pat Rai)
3) Electromagnetics – Joseph A Edminister (Schaum's Series)
4) Basic Electromagnetics with Applications – N.N.Rao (PHI)
5) Introduction to Electromagnetic Field and Waves – Dale Carson & Paul
6) Introductory course in electromagnetic Fields– P.V Gupta (Wheeler)
7) Electromagnetic Fields-R.Meenakumari & C.R Subasni (New Age)

6th Semester B E (IN)

Syllabus for Basic Thermodynamics (EE611)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1	**System and Continuum:** Intensive and Extensive properties – Thermodynamic state, pressure, energy, work and heat – process and cycle – Macroscopic and Microscopic points of view – Kinetic theory of gases.	20
2	**Laws of thermodynamics:** Zeroth law – Concept of equilibrium – Principles of thermometry – Fixed points. First law of thermodynamics and its application to open and closed systems – Concept of internal energy – Steady flow energy equation – Processes of closed systems. Second law of thermodynamics – Various statements – Carnot cycle – Irreversible and Irreversible processes – Thermodynamic efficiency and temperature scales – Concept of entropy – Entropy changes in various processes.	20
3	**Properties of steam:** Latent heat – Saturation pressure and temperature – Dryness fraction – Degree of superheat – Total heat; Rankine cycles.	20
4	**Air standard cycles:** Otto, Diesel – Principles of working and description of two and four stroke SI and CI engines – Representations of processes on T-S and p-v diagrams.	20
5	**Fuels and Combustions:** Classification of fuels; HCV, LCV, Bomb Calorimeter, Boy's gas calorimeter; Combustion of fuels; Minimum air required (by weight and by volume); Conversion of volumetric analysis into weight analysis and vice verse; excess air and Orsat apparatus.	20

Text Books:

1. Engineering thermodynamics by P K Nag, Tata McGraw Hill Publication
2. Fundamentals of Thermodynamics by Cengel and Boles, Tata McGraw Hill Publication
3. Fundamentals of Engineering Thermodynamics by E. Rathakrishnan, PHI

********** **END** **********

SEMESTER VII

Sl no	Course Code	Course Title	L	T	P	Contact hrs/week	Credit
01	IN701	Analytical Instruments	3	0	0	3	3
02	IN702	Advanced Process Dynamics & Control	3	0	0	3	3
03	IN703	Seminar Presentation	0	0	2	2	1
04	IN704	Project--I	0	0	12	6	6
05		**Elective--II**	3	0	0	3	3
06		**Elective—III**	3	0	0	3	3
07		**Elective—IV(Open)**	3	0	0	3	3
		TOTAL				**23**	**22**
08	AC701	Industrial Training	0	0	0	0	0

List of Elective – II, III

9. EE705 VLSI Circuits Design
10. EE706 Speech Processing
11. EE708 Advances in Tele-communication Engineering
12. EE715 Advance Control System
13. IN705 Biomedical Instrumentation
14. IN706 MEMS & NEMS
15. IN707 Ultrasonic & High Frequency Instrumentation
16. IN708 Advance Microprocessor and Microcontroller

Elective-IV (Open)

6. EE707 Digital Image Processing
7. EE709 Optimization Techniques
8. EE710 Operating System Design
9. IN708 Data Communication & Networks
10.

7th Semester B E (IN)

Syllabus for Analytical Instruments (IN701)

L-3 T-0 P-0 C-3

	Content	Marks
01	**Measurement of analytical quantities** e.g. Viscosity, Consistency, Specific gravity, Humidity, Moisture	20
02	**CHROMATOGRAPHY** : Different techniques – Gas chromatography – Detectors – Liquid chromatographs– High-pressure liquid chromatographs ; Applications.	20
03	**INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING INSTRUMENTS**: types of gas analyzers – Oxygen, NO2 and H2S types, IR analyzers, thermal conductivity ana lyzers, analysis based on ionization of gases. Air pollution due to carbon mo noxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation - Dust and smoke measurements.	20
04	**pH METERS AND DISSOLVED COMPONENT ANALYZERS** : Principle of pH measurement, glass electrodes, hydrogen electrodes, re ference electrodes, selective ion electrodes, ammonia electrodes, cyclic voltametry, biosensors, dissolved oxygen analyzer –Sodium analyzer – Silicon analyzer.	10
05	**ELECTRO MAGNETIC RESONANCE AND MICROSCOPIC TECHNIQUES** : NMR – Basic principles – NMR spectrometer applications. Electron spin Resonance spectroscopy– Basic principles, Instrumentation and applications. Scanning Electron Micr oscope (SEM), - Basicprinciples, Instrumentation and applications. Transmission Electron Microscope (TEM) – Basic principles – Instrumentation and applications. Mass spectrometers – Different types – Applications.	15
06	**SPECTROPHOTOMETRY :** Special methods of analysis – Beer-Lambert law – Colorimeters – UV-Visible spectrophotometers – Singleand double beam instruments – Sources and detectors-- IR Spectrophotometers – Types – Attenuated totalreflectance flame photometers – Atomic absorption spectrophotometers – Sources and detectors –	15

FTIRspectrophotometers – Flame emission photometers – Fluorescence spectrophotometer

TEXT BOOKS:

1. G.W. Ewing, 'Instrumental Methods of Analysis', McGraw Hill, 1992.
2. R.K.Jain, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi, 1999
3. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, 'Instrumental Methods of Analysis', CBS publishing & distribution, 1995.

REFERENCES:

1. Robert D. Braun, 'Introduction to Instrumental Analysis', McGraw Hill, Singapore, 1987.
2. R.S. Khandpur, 'Handbook of Analytical Instruments', Tata McGraw Hill publishing Co. Ltd., 2003.
3. Liptak, B.G, Process Measurement and Analysis, Chilton Book Company, 1995

7th Semester B E (IN)

Syllabus for Advance Process Dynamics & Control (IN702)

L-3 T-0 P-0 C-3

01	**Design of feed back controllers** : Selection criterion for type of controllers, controller tuning-process reaction curve, Zeigler-Nichol's method, Cohen and Coon method and frequency domain method.	20
02	**Multi loop control systems:** Cascade control, override control, split-range control, feed-forward control and ratio control systems.	20
03	**Programmable logic controller**, Concept of Ladder diagram, Ladder programming,	20
04	**Direct digital control** , DCS and SCADA systems.	20
05	**State space representation of physical systems**, State transition matrix, eigen values and eigen vectors, concept of controllability and observability of linear system , Concept of multivariable control and Nonlinear control, Lyapunov Stability. .	20

Ref. Books:

1) Stephinopoulos G- Chemical process control (PHI).
2) Pollard A –Process control.
3) Coughanowr – Process System Analysis and Control (MH).
4) Hariot P-Process Control (TMH).
5) Johnson-Process Control Instrumentation Technology (JW).
6)M Gopal- Control Systems Principles and design(TMH)

ELECTIVES –II, III & IV

7^{th} Semester BE (IN)

: VLSI Circuits Design (EE705)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1	**Review of Design of Digital Systems (8 lectures)**: MUX based digital design (1); Design using ROM, Programmable Logic Arrays (PLA) and Programmable Array Logic (PAL) (2); Sequential circuits and timing: Setup and hold times (1); Sequential circuit design: Design of Moore and Mealy circuits (2); Design of a pattern sequence detector using MUX, ROM and PAL (1); Design of a vending machine controller using PAL (1).	20
2	**Introduction to Verilog coding (6 lectures)**: Introduction to Verilog (1); Realization of Combinational and sequential circuits (2); RTL coding guidelines (1); Coding organization and writing a test bench (2). **Simulation, Synthesis, Place and Route, and Back Annotation (12 lectures):** Design flow (1); Simulation using Modelsim (4); Synthesis using Synplify (4); Place and Route, and Back Annotation using Xilinx (3).	20
3	**Design using Algorithmic State Machine Charts (7 lectures)**: Derivation of ASM charts (1); Design examples such as dice game, etc. using ASM charts (3); Implementation of ASM charts using microprogramming (2); and Verilog design of bus arbitrator (1). **Design of memories (3 lectures)**: Verilog realization of Read Only Memory (ROM) (1); Verilog realization of Random Access Memory (RAM); and Verilog coding of controller for accessing external memory (2).	20
4	**Design of Arithmetic functions (5 lectures):** Pipelining concept, Verilog design of a pipelined adder/subtractor (1); Design of Multipliers (3); and Verilog design of a pipelined multiplier (1).	15
5	**Design for testability (3 lectures)**: Testing combinational and sequential logic (1); Boundary scan testing, and Built-in self test (2). **Design Applications (4 lectures):** Design of a traffic light controller using Verilog (1); and Design of discrete cosine transform and quantization processor for video compression using Verilog (3). **Hardware implementation using FPGA board (2 lectures):** Features of FPGA board and demonstration of traffic light controller design (1); and Universal, asynchronous, receiver-transmitter design using FPGA board (1).	25

Text Books:

1. Algorithms for VLSI physical design automation - Naveed Sherwani, Kluwer academic publisher, 1993.

2. Principles of CMOS VLSI Design: A Systems Perspective, 2ndEd - Neil E. Weste and Kamran Eshraghian, Addison-Wesley, 1994.
3. Application-Specific Integrated Circuits: An Introduction to VHDL & Verilog HDL - Michael John Sebastian Smith, Addison-Wesley, 2001.
4. Analog Integrated Circuit Design - D. A. Johns and K. W. Martin, John Wiley & Sons, 1997.
5. Design of Analog CMOS Integrated Circuits - B. Razavi, McGraw-Hill, New York, 2001.
6. Analysis and Design of Analog Integrated Circuits, 4thEd - Paul Gray, Robert Meyer and Paul Hurst and S. Lewis, John Wiley & Sons, 2003.
7. CMOS Circuit Design, Layout, and Simulation - R. J. Baker, H. W. Li and D. E. Boyce, IEEE Press, 1998.
8. Low-Voltage Low-Power Integrated Circuits - E. Sanchez-Sinencio and A. Andreou (Editors), IEEE Press, 1999.

Reference: NPTEL Lectures

7th Semester BE (IN)

Speech Processing (EE706)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1	**Introduction**: Spoken Language System Architecture and Structure; Sound and Human Speech System; Phonetics and Phonology; Syllables and Words; Syntax and Semantics; Probability Theory; Estimation Theory; Significance Testing.	15
2	**Speech Representation and Coding**: Short Time Fourier Analysis; Filter bank analysis, Spectrographic analysis, Cepstral Analysis; Pitch and Formant frequencies; Formant extraction, Pitch extraction, Analysis - Synthesis systems; Acoustic Model of Speech Production; Linear Predictive Coding; Perceptually Motivated Representations; Scalar Waveform Coders; Scalar Frequency Domain Coders; Vector Quantization (VQ); Code excited linear Prediction; Low-bit rate Speech coders.	30
3	**Speech Recognition**: Hidden Markov Models (HMM); Practical Issues in Using HMMs; HMM Limitations Acoustic Modeling; Phonetic Modeling; Language Modeling; Dynamic Time Warping (DTW); Signal Enhancement for Mismatched Conditions.	15
4	**Speaker Recognition and Verification**: End-point detection; Silence detection and removal; Pre-emphasis; Framing; Windowing; Extraction of speech features: Linear Predictive Cepstral Coefficients (LPCCs) and Mel-Frequency Cepstral Coefficients (MFCCs); Speaker Recognition/Verification Algorithms using HMM, Gaussian Mixer Model (GMM) and UBM-GMM; Close-set, Open-set, Text-dependent and Text-independent; Equal Error Rate (EER); Normalization methods; Language and Dialect recognition.	20
5	**Speech Synthesis**: Formant Speech Synthesis; Concatenative Speech Synthesis; Prosodic Modification of Speech; Source Filter Models For Prosody Modification; Evaluation of Text-To-Speech (TTS) System.	20

Text Books:

1. Discrete-Time Speech Signal Processing 2002 - Thomas F. Quatieri, Pearson Education
2. Spoken Language Processing 2001 - Xuedong Huang, Alex Acero, Hsiad, Wuen Hon, Prentice Hall
3. Speech and Audio Signal Processing 2000 - B.Gold and N.Morgan, John Wiley & Sons
4. Computer Speech 1999 – Recognition, Compression, Synthesis - M.R.Schroeder, Springer Series in Information Sciences
5. A Brief Introduction to Speech Analysis and Recognition, An Internet Tutorial - http://www.mor.itesm.mx/~omayora/Tutorial/tutorial.html
6. Speech and Language Processing 2000 - Daniel Jurafsky & James H.Martin, Pearson

7th Semester BE (IN)

Digital Image Processing (EE707)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1	**Introduction**: Digital image representation, fundamental steps in image processing, elements of image processing systems, geometry of image formation, image acquisition, color image sensing, stereo imaging, range sensing, tesselation, sampling and quantization. **Image transforms**: Fourier, Walsh, Hadamard, Discrete Cosine, Hotelling, Discrete Wavelet Transforms and their properties.	20
2	**Image enhancement and restoration**: Spatial and frequency domain enhancement Techniques (Histogram based techniques, smoothing, filtering, sharpening, Homomorphic filtering), Unconstrained and Constrained Restoration, Inverse filtering, Wiener filter.	15
3	**Image compression**: Coding, Interpixel and Psychovisual Redundancy; Image compression models; Error free compression – Huffman, Arithmetic and LZW, Bit-Plane coding (Constant Area coding, 1-D & 2-D Run length coding), Lossless predictive coding; Lossy compression – Lossy predictive coding (Delta modulation, Optimal predictors – Differential Pulse Code Modulation), Transform coding – (Discrete Fourier Transform, Walsh-Hadamard Transform, Discrete Cosine Transform, and Discrete Wavelet Transform methods), Sub-image size selection, Bit Allocation, Zonal & Threshold coding, Image compression standards – CCITT Group 3 & 4 Binary Image 1-D & 2-D Compression standards, JPEG using DCT & DWT Continuous Tone Still Image Compression standard, Basics of MPEG Video Compression standard.	20
4	**Digital geometry and its application in image processing**: Neighbourhood, connectedness, path, holes and surroundness, Borders, distances, Medial axis transformation, shrinking and expanding, thinning, Morphological operations-Erosion, Dilation, Opening, Closing, Parallel implementation, Smoothing, Component labelling, Thinning.	15
5	**Image segmentation**: Edge detection – Roberts, Prewitt, Sobel & Laplacian Operators, Edge linking and Boundary Detection – Local Processing, Global Processing via the Hough Transform to detect straight lines and parameterised curves, Global Processing via Graph-Theoretic Techniques; Pixel Classification via Grey Level Thresholding – Optimal Global and Adaptive Thresholding, Multispectral Thresholding; Region based segmentation - Region growing, Region splitting & merging; Segmentation by Morphological Watersheds; Use	15

of motion in segmentation; Frequency domain techniques.

6	**Representation and Description**: Representation: Chain codes, Polygonal Approximations, Signatures, Boundary Segments, Skeletons; Boundary Descriptors – length, diameter, major axis, minor axis, basic rectangle, eccentricity, curvature, shape numbers; Fourier Descriptors; Statistical Moments; Regional Descriptors – area, perimeter, compactness; Topological Descriptors- number of holes, connected component, Euler number, Euler formula; Texture – statistical, structural and spectral description; Moments of Two dimensional functions; Use of Principal Components for Description; Relational Descriptors.	15

Text Books:

1) Digital Image Processing - R C Gonzales and R E Woods, PHI.
2) Fundamental of Digital Image Processing - Anil K Jain, PHI.
3) Computer Vision - D H Ballard and C M Brown, PHI.

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7th Semester BE (IN)

Advance Tele-communication Engineering (EE708)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1	**Telephone System**: Telephone exchange, automatic strowger dialing; Hierarchy of switching offices; Cross bar switch; Switching matrices; Multiple Stage switching; Time Division Multiplexing (TDM) in telephone; Time slot interchanging; Space array for digital signals; Combined space & time switching; Mobile phone; Cellular phone; Pager; Global positioning satellites; Fax; Videotext.	25
2	**Computer Communication Systems**: Design features of computer communication networks; Local Area Network (LAN); Packet Radio & Satellite; ALOHA; Time Division Multiple Access (TDMA); Frequency Division Multiple Access (FDMA); Collision Sensing Multiple Access (CSMA), Code Division Multiple Access (CDMA), Computer communication protocols: ISO/OSI 7 layer architecture.	30
3	**Microwave Systems**: Rectangular and circular wave guide; Wave guide coupling; Cavity resonators; Directional couplers; Isolators; Circulators; Mixers; Detectors switches; Microwave tubes - Microwave triodes, Klystron, Magnetron, Travelling wave tube; Cross field amplifier; Backward wave oscillators; Semiconductor microwave devices - Passive microwave components, Microwave transistors, Microwave ICs, Varactor diodes, Step recovery diodes, Parametric amplifier, Tunnel diode, Gunn effect diode, TRAPATT diodes, PIN diodes, Schottkey barrier diode, Backward diode, MASERS & LASERS; Introduction to optical communication.	25
4	**RADAR Systems**: Introduction; Pulsed RADAR; MTI; RADAR beacons; CW doppler RADAR; FM RADAR; Phased array RADAR; Planar array RADAR. **Television Fundamentals**: TV systems and standards; B/W TV transmission and reception; Colour TV.	20

Text Books:

1) Principles of Communication Systems - Taub & Schilling
2) Analog and Digital Communication Systems – Martin S Roden
3) Electronic Communication Systems - George Kennedy
4) Principle of RADAR – Meril Skolnik.
5) Digital Transmission Engineering, 2ndEd - John B Anderson, John Wiley and Sons, 2005
6) Communication Systems, 4thEd, Simon Haykin, John Wiley & Sons, 2001
7) Modern Digital and Analog Communication Systems, 3rdEd - B P Lathi, Oxford University Press, 1998
8) Color Television – Gulati & Gulati
9) Digital and Analog Communication Systems 5thEd 2004 Leon W Couch

7th Semester BE (IN)

Optimization Techniques (EE709)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1	**Introduction**: Concept of optimization; Direct approach; Indirect method; Optimization with constrains. **Indirect Methods**: Maxima minima functions of several variables; necessary and sufficient conditions; equality constraints and solution of Lagrangian multipliers.	20
2	**Direct Optimum Search for Scalar Case**: Unimodal functions; Resolution; Implicit and Explicit functions; Simultaneous search using even and odd number of experiments; Sequential search; Fibonacci & Golden section search; Searches using quadratic & cubic interpolation.	20
3	**Multivariable Optimization**: Concept of hill climbing; Method of steepest ascent; Newton-Raphson & D.F.P.; Direct search method programming.	20
4	**Multi-Stage Optimization**: Introduction; Principle of optimality; Solution for simple multi-stage problems; Discrete dynamic programming.	20
5	**Optimization With Constrains**: Formulation of optimization problems with equality and inequality constrains; Special case of linear constraints and linear objective functions; Introduction to non-linear problems.	20

Text Books:

1) Optimization : Theory & Applications - S. S. Rao, Wiley Eastern

2) Operation Research - Introduction to Optimization, 4thEd – J. C. Pant

7th Semester BE (IN)

Operating System Design (EE710)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1	**Purpose of Operating Systems (OS)**: Virtualization of Resources; Handling of Resource Sharing; Providing Common Services. **Scheduling and Process Management**: Interrupts; Basics of Scheduling (Time slices, Pre-emptive Queueing, Common Scheduling Algorithms); Basics of Process Management (Context Switching, Process Swapping, Threads).	20
2	**Basics of Synchronization**: Deadlock (Meaning and causes, common prevention mechanisms, common detection and recovery mechanisms); Critical Sections; Semaphores, Monitors; Spin Locks.	15
3	**Virtual Memory**: Basic Concept of Address Spaces; Segmentation; Paging (Working Set Concept, Common Paging Algorithms); Interactions with Hardware. **Caching and Buffering**: Basics of cache design (Hit ratio, LRU and Other Common Cache replacement strategies); Purpose of I/O Buffers and their use.	25
4	**Basics of OS Architecture**: Kernels, Microkernels and Layering; Out-of-Kernel Services. **Basics of Interprocess Communications**: Shared Memory Mechanisms; Messages; Remote Procedure Calls (RPCs).	20
5	**Basics of File Systems**: Directories; Basic Issues of File System Layout on Disk; Basic File System Protection Mechanisms. **Basics of Security**: Access control mechanisms (Access Control Lists, Capabilities); Basic Ideas of Encryption and Authentication (Fundamentals of Encryption, Keys, Digital Signatures).	20

Text Books:

1. Operating Systems: A Modern Perspective 2ndEd - G. Nutt, Addison-Wesley, 2000.

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7th Semester BE (IN)

Prime Movers (EE713)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1	**Introduction to Thermodynamics**: Laws and Principles; Thermodynamics Cycles Related to Power Plants: Carnot Cycle, Rankine Cycle, Reheat Cycle, Regenerative Cycle (Feed Water Heating), Binary Vapour Cycle, Reheat-Regenerative Cycle. **Diesel Power Plant:** Introduction; Operating Principle; Basic Types of IC Engines: Two-Stroke, Spark Ignition Gas Engines/Petrol Engines; Diesel Engines/Heavy Oil Engines; Duel Fuel Engines; High Compression Gas Engines; Advantage of Diesel Power Plant; Disadvantage of Diesel Power Plant; Application of Diesel Power Plant; General Layout of Diesel Power Plant; Performance of Diesel Engine; Indicated Mean Effective Pressure (IMEP); Indicated Horse Power (IHP); Brake Horse Power (B.H.P.); Frictional Horse Power (F.H.P.); Indicated Thermal Efficiency; Brake Thermal Efficiency (Overall Efficiency); Mechanical Efficiency; Fuel System of Diesel Power Plant; Lubrication System of Diesel Power Plant; Liquid Lubricants or Wet Sump Lubrication System; Solid Lubricants or Dry Sump Lubrication System; Mist Lubrication System; Air Intakes and Admission System of Diesel Power Plant; Supercharging System of Diesel Power Plant; Types of Supercharger; Advantages of Supercharging; Exhaust System of Diesel Power Plant; Cooling System of Diesel Power Plant; Open Cooling System; Natural Circulation System; Forced Circulation Cooling System; Diesel Plant Operation; Efficiency of Diesel Power Plant; Heat Balance Sheet; Sensors to measure the important parameters.	20
2	**Steam Turbine Power Plants**: Layout diagram of Steam Turbine Power Plant, Fuels: Pulverised Coal & Oil; Working Principle, Description and functions of the components: Boiler, Superheater, Turbine, Condenser, Reheater (Characteristics of Reheat Turbines)/Preheater, Water Cooling Tower; Sensors to measure the important parameters. **Gas Turbine Power Plants**: Layout diagram of Gas Turbine Power Plant; Classification of Gas Turbine Power Plant: Open Cycle Gas Turbine Power Plant, Closed Cycle Gas Turbine Power Plant; Elements of Gas Turbine Power Plants: Compressors, Intercoolers and Heat Exchangers, Combustion Chambers, Gas Turbines; Regeneration and Reheating; Cogeneration; Auxiliary Systems: Starting Systems, Ignition Systems, Lubrication System, Fuel System and Controls; Control of Gas Turbines: Prime Control and Protective Controls; Gas Turbine Efficiency: Effect of Blade Friction,	20

	Improvement in Open Cycle; Operations and Maintenance Performance; Troubleshooting and Remedies; Combined Cycle Power Plants (waste-heat recovery); Applications of Gas Turbine; Advantages and Disadvantages of Gas Turbine Power Plant; Sensors to measure the important parameters.	
3	**Nuclear Power Plant**: Layout diagram of Nuclear Power Plant; General History and Trends; Major Events; The Atomic Structure; Nuclear Energy Concepts and Terms: Features, Fission, Critical Mass, Alpha Radiation, Beta Particles, Gamma Particles, Uranium Fission, Half Life; Ethical Problems in Nuclear Power Regulation, Chemical and Nuclear Equations, Nuclear Fusion and Fission; Energy From Fission and Fuel Burn Up; Radioactivity; Nuclear Reactor: Nuclear Fuel, Moderator, Moderating Ratio, Reflector, Reactor Vessel, Biological Shielding, Coolant, Coolant Cycles, Reactor Core; Conservation Ratio; Neutron Flux; Classification of Reactors; Cost of Nuclear Power Plant; Nuclear Power Station in India; Light Water Reactor (LWR) and Heavy Water Reactor (HWR); Importance of Heavy Water; Site Selection; Comparison of Nuclear Power Plant and Steam Power Plant; Multiplication Factor; Uranium Enrichment; Reactor Power Control; Nuclear Power Plant Economics; Safety Measures for Nuclear Power Plants; Site Selection and Commissioning Procedure; Major Nuclear Power Disasters; Chernobyl Nuclear Power Plant: Reactor Design: RBMK-1000, Control of the Reactor, Chernobyl Reactor Operations, Accident/Safety Plans, Evacuation; Safety Problems in Chernobyl Reactor Design: System Dynamics, Another Safety Problem with the Design; Other, Earlier, Soviet Nuclear Accidents; Sensors to measure the important parameters.	15
4	**Hydel Power Plants**: Layout diagram of Hydel Power Plants; Run-Off; Hydrograph and Flow Duration Curve; The Mass Curve; Selection of Site for a Hydro-Electric Power Plant; Essential Features of a Water-Power Plant; Calculations of Water Power Plants; Classification of Hydro-Plant: Storage Plants, Run-of-River Power Plants, Pumped Storage Power Plants; Power House and Turbine Setting; Advantages and Disadvantages of Underground Power-House; Prime-Movers; Specific Speed of Turbine; Draft Tubes: Methods to Avoid Cavitation, Types of Draft Tubes, Different Types of Draft Tubes; Models and Model Testing; Selection of Turbine; Sensors to measure the important parameters.	15
5	**Wind Power Plants**: Layout diagram of Wind Power Plant, Working Principle, Description and functions of the components; Wind Turbines; Battery-storage systems; Sensors to measure the important parameters. **Solar Power Plants**: Layout diagram of Solar Power Plant, Working Principle, Description and functions of the components; Battery-storage systems; Sensors to measure the important parameters.	20

Other Non-conventional/Renewable Energy Sources: Bio-mass, Bio-Diesel, Geo-thermal Energy, Sea-water temperature gradient, Tidal and Wave power, Layout diagrams.

6 **Applications**: In-land, On-ship, Sub-marine and Space applications. 10

Text Books:

1. Power Plant Engineering - A. K. Raja, Amit P. Srivastava and Manish Dwivedi, New Age International (P) Ltd., 2006
2. Biofuels - Production Application and Development - A. H. Scragg, Cambridge University Press, 2009
3. Renewable Energy in Power Systems - Leon Freris and David Infield, John Wiley & Sons, 2008

7th Semester BE (E)

Advance Control System (EE715)

L-3 T-0 P-0 C-3

Unit	Content	Marks
	ADAPTIVE CONTROL SYSTEM	
1	*Introduction:* Basic approaches to adaptive control. Applications of adaptive control.	**10**
2	*Gradient and least-squares algorithms*: Linear error equation. Gradient and normalized gradient algorithms. Least-squares algorithms (batch, recursive, recursive with forgetting factor). Convergence properties.	**15**
3	*Identification*: Identification of linear time-invariant systems. Adaptive observers .Sufficient richness condition for parameter convergence. Equation error and output error methods.	**20**
4	*Indirect adaptive control*: Pole placement adaptive control. Model reference adaptive control Predictive control. Singularity regions and methods to avoid them.	**15**
	OPTIMAL CONTROL SYSTEM	
5	Basic mathematical concepts, Conditions for optimality, Calculus of variations, Pontryagin's maximum principle, Hamilton Jacobi-Bellman theory, dynamic programming, structures and properties of optimal systems, various types of constraints, singular solutions, minimum time problems, optimal tracking control problem	**40**

BOOKS:-

1. K.J. Astrom and B. Wittenmark, *Adaptive Control,* Addison-Wesley, 2nd edition, 1995.
2. G.C. Goodwin and K.S. Sin, *Adaptive Filtering, Prediction, and Control*, Prentice-Hall, 1984.
3. P. Ioannou& B. Fidan, *Adaptive Control Tutorial*, SIAM, Philadelpia, PA, 2006.
4. P.A. Ioannou& J. Sun, *Robust Adaptive Control*, Prentice Hall, Upper Saddle River, NJ, 1996. The book is available (for free) in PDF form through the web page: http://www-bcf.usc.edu/~ioannou/RobustAdaptiveBook95pdf/Robust_Adaptive_Control.pdf.
5. I.D. Landau, R. Lozano, and M. M'Saad, *Adaptive Control*, Springer Verlag, London, 1998.
6. K.S. Narendra and A.M. Annaswamy, *Stable Adaptive Systems*, Prentice-Hall, 1989.
7. D. E. Kirk, Optimal Control Theory: An Introduction, Prentice-Hall, 2004.
8. B.D.O. Anderson and J.B. Moore, Optimal Control: Linear Quadratic Methods, 2007.

9. M. Krstic, P. V. Kokotovic, I. Kanellakopoulos, Nonlinear and Adaptive Control Design, John Willey and Sons, 1995.
10. K. J. Astrom and B. Wittenmark, Adaptive Control, 2/e, 2008.
11. G. Feng and R. Lozano, Adaptive Control Systems, Oxford University Press, 19992.
Sage A. P, White C. C, Optimum Systems Control, 2nd Edition, prentice Hall, 1977.

7 th Semester BE (IN)

Biomedical Instrumentation (IN705)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1.	**Introduction** : Basic concepts of medical instrumentation, Introduction to the physiology of cardiac, nervous , mascular & respiratory systems, Sources of bioelectric potentials.	15
2.	**Biopotential Electrodes:** Electrode theory ; Different types of biopotential electrodes-Microelectrodes, Skin surface electrodes and needle electrodes, Biochemical transducers – Reference Electrodes-Hydrogen, Silver silver chloride and calomel , PH Electrodes , PO2 and PCO2 Electrodes.	15
3.	**Cardiovascular measurement** : The heart and other cardiovascular systems; Measurement of blood pressure; Blood flow cardiac output and cardiac rate; Electrocardiography; Phonocardiography; Ballistocardiography; Plethysmography; Magneto-cardiography; Cardiac pacemaker; Computer applications. Respiratory System Measurement: Respiratory Mechanism, Measurement of gas volumes & flow rate; Carbon dioxide and Oxygen concentration in inhaled air; Respiratory controllers.	30
4	**Instrumentation for clinical laboratory** : Measurement of pH values of blood; ESR measurement; Haemoglobin measurement; Measurement of oxygen & carbon dioxide concentration in blood; GSR measurement; Polarographic measurements; Computer applications.	20
5	**Medical Imaging** : Ultra sound imaging ; X Ray , CT Scan , MRI . **Biotelemetry**-Transmission & reception aspects of biological signals via long distance ; Aspect of patient care monitoring.	20

Texts

1. Webster JS – Medical Instrumentation Applications & Design
2. Cromwell L – Biomedical Instrumentation (PHI)
3. Khandpur RS – Hand Book of Biomedical Instrumentation (TMH)
4. Astor BR – Introduction to Biomedical Instrumentation & Measurement (Mc Millan)
5. Introduction to Biomedical Equipment Technology 4thEd – J. J. Carr and J. M. Brown, Pearson Education, 2008.
6.

7th Semester BE (IN)

MEMS and NEMS (IN706)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1	**Nano- and Microengineering, and Nano- and Microtechnologies**: Historical background of Nano- and Micro Electro Mechanical Systems (NEMS and MEMS) and micro-machining; Biological Analogies; Applications of Nano- and Microelectromechanical Systems; Introduction to MEMS Fabrication, Assembling, and Packaging; Bulk micromachining; Isotropic etching and Anistropic etching; Wafer bonding; High aspect ratio processes (LIGA).	10
2	**Mathematical Models and Design of Nano- and Microelectromechanical Systems**: Nano- and Microelectromechanical Systems Architecture; Electromagnetics and its Application For Nano- and Microscale Electromechanical Motion Devices; Classical Mechanics and its Application; Newtonian Mechanics; Lagrange Equations of Motion; Hamilton Equations of Motion; Atomic Structures and Quantum Mechanics; Molecular and Nanostructure Dynamics; Schrödinger Equation and Wavefunction Theory; Density Functional Theory; Nanostructures and Molecular Dynamics; Molecular Wires and Molecular Circuits; Thermoanalysis and Heat Equation. **Structural Design, Modeling and Simulation**: Nano- and Microelectromechanical Systems; Carbon Nanotubes and Nanodevices; Microelectromechanical Systems and Microdevices; Structural Synthesis of Nano- and Microelectromechanical Actuators and Sensors; Configurations and Structural Synthesis of Motion Nano and Microstructures (actuators and Sensors); Algebra of Sets; Direct-Current Micromachines; Induction Motors; Two-Phase Induction Motors; Three-Phase Induction Motors; Microscale Synchronous Machines; Single-Phase Reluctance Motors; Permanent-Magnet Synchronous Machines; Microscale Permanent-Magnet Stepper Motors; Mathematical Model in the Machine Variables; Mathematical Models of Permanent-Magnet Stepper Motors in the Rotor and Synchronous Reference Frames; Nanomachines: Nanomotors and Nanogenerators.	30
3	**Surface Micromachining**: One or two sacrificial layer processes; Surface micromachining requirements; Polysilicon surface micromachining; Some Compatible materials: Silicon Nitride, Piezo electric materials; Surface micro machined systems; Micro motors; Gear Trains and Mechanisms. **Physical Micro Sensors**: Classification of Physical sensors: Integrated, Intelligent or Smart sensors; Sensor principles and examples: Thermal sensors, Electrical sensors, Mechanical sensors, Chemical and Biosensors.	25
4	**Microactuators**: Electromagnetic and thermal micro actuation; Mechanical design of Microactuators; Microactuator examples: Microvalves, Micropumps,	15

	Micromotors; Micro actuator systems: Ink Jet printer heads, Micro-Mirror TV Projector.	
5	**Control of Nano- and Microelectromechanical Systems**: Fundamentals of Electromagnetic Radiation and Antennas in Nano- and Microscale Electromechanical Systems; Design of Closed-Loop Nano- and Microelectromechanical Systems using the Lyapunov Stability Theory; Introduction to Intelligent Control of Nano- and Microelectromechanical Systems. **Application Areas**: All mechanical miniature devices; 3D electromagnetic actuators and sensors; RF electronic devices: Optical/Photonic devices; Medical devices: DNA-chip, Micro arrays.	20

Text Books:

1. Nano- and Microelectromechanical Systems: Fundamentals of Nano- and Microengineering- Sergey Edward Lyshevski, CRC Press, London, 2001.
2. Micro System Design - Stephen D. Senturia, Kluwer Academic Publishers, 2001.
3. Micro Electro Mechanical Systems - Tsu, 2006.

References:

1. Fundamentals of Microfabrication - Marc Madou, CRC Press, 1997.
2. Micromachined Transducers Sourcebook - WCB McGraw Hill, Boston, 1998.
3. Micromechanical Transducers: Pressure Sensors, Accelerometers and Gyroscopes - M. H. Bao, Elsevier, New York, 2000.
4. MEMS and Nanotechnology-based Sensors and Devices for Communications, Medical and Aerospace Applications - A. R. Jha, CRC Press, London, 2008.
5. MEMS and NEMS - Systems, Devices and Structures - Sergey Edward Lyshevski, CRC Press, London, 2002.
6. MEMS/NEMS Handbook - Techniques and Applications Vol 1: Design Methods in MEMS/NEMS – C. T. Leondes, Springer, 2006.
7. Modeling MEMS and NEMS - J. A. Pelesko and D. H. Bernstein, Chapman & Hall/CRC, London, 2003.
8. Smart Material Systems and MEMS - Design and Development Methodologies - V. K. Varadan and K. J. Vinoy, John Wiley & Sons, 2006.
9. Smart Sensors and MEMS - Sergey Y. Yurish and Maria Teresa S. R. Gomes, Kluwer Academic Publishers, Boston, 2004.
10. RF MEMS: Theory Design and Technology - Gabriel M Rebeiz, John Wiley & Sons, 2003.
11. RF MEMS Circuit Design for Wireless Communications - Héctor J De Los Santos, Arctech House, Boston, 2002.
12. MEMS - MOEM Packaging – Concepts, Designs, Materials and Processes – K. Gilleo, McGraw-Hill, 2005.
13. MEMS Mechanical Sensors Microelectromechanical Systems Series – S. Beeby, Artech House, Inc., 2004.

7th Semester BE (IN)

Ultrasonic & High Frequency Instrumentation (IN707)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1	Ultrasonic waves, principles & propagation of various waves, characterization of ultrasonic transmission—reflection & transmission coefficients, intensity & attenuation of sound beam; Power level, medium parameters; Generation of ultrasonic waves.	20
2	(a) Ultrasonic Instrumentation: Ultrasonic wave propagation in material media, velocity, acoustic impedance, reflection at interface, Doppler frequency shift; (b) Transducers; piezoelectricity -inverse piezoelectricity, generation and reception of ultrasonic wave, resonance frequency, continuous and pulse excitation of PET.	25
3	(a) Ultrasonic test methods—pulse echo, transit time, resonance, direct contact and immersion type; (b) Non-destructive testing of materials, interference, sing around method. Transmission reflection methods of flow measurements; Doppler shift flow measurement.	25
4	(a) Imaging pulse excitation, Different types of scans (A,B,C,D,TM scan) and other applications. Laser Instrumentation: Properties of LASER, Coherence, directionality, monochromaticity, interference, fringe. LASER generation, population inversion feedback, He-Ne, Ruby, semiconductor LASER. Measurement of distance, Velocity and other physical variables. Holography Generation of holograms, application of real time, time average holography; (b) Infra Red Instrumentation: Source, window and buses, photoelectric thermal detector, Solar Bolometer, Thermo junction, Pyroelectric. Quantum detector - Vacuum photocell, Photo multiplier, Photo-transistor, Charge-coupled device, Thermal radiation imaging.	30

Text Books:

1. Krauthsamer J and Krauthsamer H---- Ultrasonic Testing Of Materials—Springer
2. Wells N T --- Biomedical Ultrasonics--- Academic Press

7th Semster B.E (IN)

Introduction to Chemical Process(IN708)

L-3 T-0 P-0 C-3

Unit	Content	Marks
1	CHEMICAL AND PHYSICALES PRINCIPLES: - Chemical formulas, chemical equations, Temperature, pressure and Gas laws	**15**
2	UNIT OPERATION:-- The scientific foundation of unit operation, basic laws, material and energy balance. Dimensional and dimensionless equation, dimensional analysis. Classification of units operation e.g. fluid flow, heat transmission, blending operation, separation process, solid handling etc. Classification of chemical process e.g. combustion, oxidation, halogenation, hydrogenation, fermentation etc.	**25**
3	FLUID MECHANICS: Energy and momentum relationships, nature and type of fluid, ideal and non-ideal gas. Compressible and incompressible fluid, basic equation of fluid flow, flow through pipe, fittings and valves, pumps, compressors and blowers, calculation of power and size of agitated vessel.	**20**
4	HEAT TRANSFER: -- Mode of heat transfer, steady and unsteady conductionFourier's law, introduction to convection, individual and overall heat transfer coefficient, nature and force convection with and without phase change, viscous, transition and turbulent region. Design of heat transfer equipment e.g. heat exchanger, condenser, furnace and evaporators. Radiant heat transmission, energy emitted by black body, laws of black body radiation.	**20**
5	MASS TRANSFER:-- Fundamental, theory of diffusion, comparison of diffusion and heat transfer, fick's law, equimolal diffusion, diffusivity of gases and liquid, turbulent diffusion, mass transfer co-efficient and film theory, penetration theory. Experimental measurement of mass transfer and design of mass transfer equipment e.g. absorbers, plate and packed column. Separation process by membrane. Flash distillation of binary mixture, continuous distillation with reflux. Equilibrium stage calculation, no of ideal plate, McCabe-Thiele method. Definition of rate reaction, the general balance equation, batch reactors continuous flow reactors both isothermal and non-isothermal operations, Industrial reactors, Stoichimetric relationship and reactor	**20**

Text books

1. McCabe W L, Smith J.C.; Peter harriott. H- Unit Operation of chemical Engg McGraw
2. Levenspiel O ―Chemical Reaction Engg‖ Wiley Eastern Pvt Ltd. New Delhi.
3. Himmelban D.H: ―Basic Principles and Calculation in Chemical Engg.‖ Prentice Hall of India

Reference Books

1. Coulson, J. M; Rechardson J. F; ―Chemical Engineering ― Pergamon International Library.
2. Williams T Edwin ; Jonson Curtis R; ―Stoichiometry for Chemical Engineers‖ McGraw Hill Book Co.
3. Haugen , O. A; Watson K. M; Ragatz R. A. ―Chemical Process Principle‖ Asia Publishing House.
4. Fogler H C; ―The Elements of Chemical Kinetics and Reactor Calculation‖ Prentice Hall International Series in Physical and Chemical Engineering Sc.
5. Denbigh K. G; Turner J. C. R; ―Chemical Reactor Theory‖ The English Language Book Society

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7th Semester BE (IN)
Data Communication & Networking (IN709)

L-3 T-1 P-0 C-4

Md No.	Contents	Marks
1	**Introduction to Data Communication and Computer Network Concepts**:	
	Introduction to Computer Networks: Network Goals/Motivation; Application of Networks; Point-to-Point or Switched Networks; Circuit Switched Networks; Packet Switched Networks; Message Switched Networks; Broadcast Networks; Packet Radio Networks; Satellite Networks; Local Area Networks (e.g., E-net, Giga-enet, FDDI, Token Ring); Network Protocols; Wireless LANs (e.g., Packet Radio, WaveLAN); Wireless Cellular Networks (e.g., GSM, CDMA); OSI Reference Model; Knowledge of Internet protocol suite (e.g. RIP, BGP, TCP/IP, RTP);	10
	Data Transmission: Transmission Terminology; Simplex, Half Duplex and Full Duplex Networks; Spectrum and Bandwidth, Analog and Digital Data Transmission; Transmission Impairments; Attenuation Distorion and Delay Distortion; Noise; Transmission Media; Twisted Pair, Coaxial Cable, Optical Fibre, Terrestial Microwave, Satellite Microwave, Radio.	10
	Data Encoding and Communication Techniques: Pulse Code Modulation (PCM); Amplitude Modulation (AM); Frequency Modulation (FM); Phase Modulation (PM); Asynchronous and Synchronous Transmission; Interfacing; RS-232; X.21; Digital Interface.	10
	Multiplexing and Communication Hardware: Frequency Division Multiplexing (FDM); Time Division Multiplexing (TDM); Synchronous and Statistical TDM; Modems; Multiplexers; Demultiplexers; Concentrator; Front End Processes.	10
2	**Media Access Control and Data Link Layer**:	20
	Data Link Layer Fundamentals: Framing; Basics of Error Detection; Forward Error Correction; Cyclic Redundancy Check Code for Error Detection. **Retransmission Strategies**: Stop and Wait ARQ; Go-Back-N ARQ; Selective Repeat ARQ; Pipelining. **Contention Based Media Access Protocols**: Advantages of Multiple Access Sharing of Channel Resource; Pure ALOHA, Slotted ALOHA; Carrier Sense Multiple Access (CSMA); CSMA with Collision Detection (CSMA/CD). **Polling Based Media Access Control Protocols**: Token Ring, Token Bus.	
	Media Access Control Protocols for High Speed Networks: FDDI-1 and FDDI-2; DQDB with Bandwidth Balancing for Fair Access; Asynchronous Transfer Mode (ATM).	

3 **Network Layer**: 20

Connection Oriented and Connectionless Services; Addressing; Concept of Congestion and Congestion Control; Routing Techniques; X.25; Internet Protocol (IP); Fragmentation of Assembly; Internetworking; Bridge (Spanning Tree and Source Routing); X.75; Gateways.

4 **Transport Layer and Application Layer Services**: 20

Types and Qualities of Transport Layer Services and Mechanism; Data Transfer; Connection Management; Transport Control Mechanism; Addressing; Multiplexing; Flow Control and Buffering; Connection Establishment; Crash Recovery; TCP/UDP (Standards, Specifications and Fields of Header); **Remote Procedure Call (RPC)**: Client-Server Model, Implementation of RPC, XTR (Presentation Layer Problem); **Application Layer Services**: Web, HTTP, DNS, FTP, TELNET, E-mail, X.400/X.500.

Text Books:

1. Computer Networks – Andrew S. Tanebaum, Prentice Hall of India
2. Data and Computer Communication – William Stalling, Prentice Hall of India
3. Computer Networks: A Systems Approach 2ndEd - B. Davie, L. Peterson and D. Clark, Morgan Kaufmann, 2000 (Home page: http://www.mkp.com/books_catalog/catalog.asp)
4. Computer Networking: A Top-Down Approach Featuring the Internet - J. Kurose and K. Ross, Addison Wesley Longman, 1999. (Home page: http://occ.awlonline.com/bookbind/pubbooks/kurose-ross1/)

6th Semester BE (IN)

Syllabus for Advance Microprocessor and Microcontroller (IN709)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1	**INTEL 8086 Microprocessor**: Architecture of Intel 8086 Microprocessor; Register structure; Memory addressing; Addressing modes; Instruction sets; Timing methods; CPU pins and associated signals/functions; Instruction timing and execution; T-state and Machine cycle; Timing diagrams; Programmed I/O; Interrupt systems; DMA operations.	15
2	**INTEL 8086 Programming**: Assembly Language Program (ALP); Debugging of Program; Programming techniques – looping, counting and indexing, counters and time delays, stack and subroutines; Code conversion – BCD arithmetic and 16/32-bit data operations.	15
3	**Peripheral Interfacing:** General purpose programmable peripheral devices; 8155 & 8255 programmable peripheral interfaces; 8254 programmable interval timer; 8259 programmable interrupt controller; 8257 DMA controller; 8279 programmable key-board/ display controller; Key debounce; 8-bit Input/Output port 8212; Parallel versus Serial transmission; Synchronous and Asynchronous Serial data transmission; Universal Synchronous/Asynchronous Receivers/ Transmitters (USART) & Universal Asynchronous Receivers/Transmitters (UART); 8251 Programmable communication interface; ADC & DAC interfacing; Interfacing standard; IEEE 488 parallel interface bus; RS-232C Serial interface; ISA & PCI Bus; 80X87 Arithmetic Processor.	30
4	**Advanced Microprocessors:** Brief discussion & comparison of INTEL 8088, 80186, 80188, 80286, 80386, 80486 & Pentium processors.	10
5	**8031/8051 Microcontroller**: Architecture and Programming of 8031/8051 Microcontroller. **Microprocessor and Microcontroller Based Applications:** Digital clock; Traffic light controller; Hex key-board interface; Seven segment display interface; Stepper motor control; Washing machine controller; Microprocessor based protective relays; Measurement of electrical quantities; Measurement & control of non-electrical quantities.	30

Text Books:

1. Microprocessor Theory and Applications - M. Raffiqzzaman, McGraw-Hill
2. 8085 Microprocessor Architecture, Programming & Applications – R. S. Gaonkar
3. Fundamentals of Microprocessors and Microcomputers – B. Ram
4. Intel Microproc 8086 8088 80X86 80188 n Pentium - Architechture Programming and Interfacing 4thEd – B. B. Brey, PHI, 1997.

SEMESTER VIII

Sl no	Course Code	Course Title	L	T	P	Contact hrs/week	Credit
01	IN801	Instrumentation System Installation & Professional Practice	3	0	0	3	3
02	IN802	Project--II	0	0	20	20	10
03		***Elective—V***	3	0	0	3	3
04		***Elective--VI***	3	0	0	3	3
05		***Elective--VII***	3	0	0	3	3
		TOTAL				**32**	**22**

List of Elective – V , VI & VII

1. IN803 Power Plant Instrumentation
2. IN804 Optoelectronics & Optical Communication Engineering
3. IN805 Environmental Instrumentation and Safety
4. IN806 Advance Sensors
5. IN807 Industrial Automation and Robotics
6. IN808 Multisensor Data Fusion
7. IN809 Intelligent Instrumentation
8. EE805 Adaptive Signal Processing
9. EE806 Computer Vision
10. EE807 Computer Graphics
11. EE808 Intelligent Control System
12. EE809 Discrete Time Control System

8th Semester B E (IN)

Syllabus for Power Plant Instrumentation (IN803)

L-3 T-0 P-0 C-3

UNIT	CONTENTS	%WEIGHTAGE
01	**Introduction to power plant** : Indian energy scenario; Only principles & working of---Hydroelectric, Nuclear, Gas turbine plants; Safety aspect; Significance of Instrumentation in Power Plants.	20
02	**Combined operation of different power plants :** Introduction; Advantages of combined working; Load division between plants; Storage type Hydro-electric power plant in combination with steam plant; Coordination of Hydro-electric and Gas turbine station; Coordination of Hydro-electric and Nuclear station.	20
03	**Instrumentation and control in power plants :** Importance of measurement and instrumentation in power plant; Measurement of--- water purity, gas analysis, oxygen, carbon-di-oxide, moisture etc; Nuclear measurement; Control for—boiler, condenser, steam heater, pumps, compressor, generator cooling system; Control in nuclear plants.	25
04	**Turbine monitoring and control** : Turbine supervisory system for monitoring of Mechanical parameters--- speed, vibration, eccentricity etc; Turbine trip condition	10
05	**Auxiliaries in power plants**: Blowers; Precipitator; Oil automation system; Water treatment plant; Cooling towers ; ID, FD fans; Economisers ; Air preheater ; Superheater etc.	10
06	**Instrumentation for Transmission** Instrumentation schemes used for HVDC & EHVAC transmission systems. Energy management: Electronic instrumentation schemes adopted for energy conservation and energy audit.	15

LABORATORY/ FIELD EXPERIENCES (Suggested)

1. Preparation of layout of instrumentation and control schemes in a power plant
2. Study of computerized load dispatch system
3. Study of instrumentation scheme for HVDC & EHVAC transmission systems.
4. Study of computer control scheme for data acquisition and

supervisory control ofa power plant.
5. Case study of an energy audit in a small/medium industry.

BOOK RECOMMENDED

1. Economic Control of Interconnected Systems, L.K. Kirchmeyar, John Wiley, NewYork, 1958.
2. Electric Energy Systems Theory: An Introduction, O.I. Elgerd, 2nd Edn TataMcGraw Hill, New Delhi ,1982.
3. Power system stability and control: Anderson and Fouad, Galgotia publications,New Delhi, 2003.
4. Economic scheduling; S. Mukhopadhyay, Wiley Eastern
4. Instrumentation engineers handbook by Liptak; Chilton Book Company
5. Industrial instrumentation servicing handbook by Carrk

8th Semester B E (IN)

Syllabus for Instrumentation System Installation and Professional Practice (IN801)

L-3 T-1 P-0 C-4

UNIT	CONTENTS	Marks
01	A. **Introduction to project management:** Definition of project purpose—scope, time, quality, organizational structure; Basic & detailed engineering; degree of automation; Project S curves; Manpower consideration; Inter-department & inter-organization interaction; Multi agency interaction; Types of projects & Types of contracts. B. **Project management functions**: Controlling, directing, authority, responsibility, accountability etc; Project reviews, planning, scheduling, the statement of work (SOW), project specifications, schedule, work breakdown structure, cost breakdown structure etc. C. **Project cost and Estimation**: Types & estimate; pricing process; salary and overheads, material and support costs Program evaluation and review techniques (PERT) and Critical path method (CPM), Scurve concept and crash time concepts, software used in project management; software features, classification, evaluation and implementation.	20
02	**Instrument Project Control**: **Project engineering documents and drawing** : Process flow sheets; Mechanical flow sheets; Instrument index sheets; loop wiring diagram; Panel drawing & specifications; Plot plans; Installation details; Purchase requisition, other documents needed. **A. Information required**: Process information, Instrument specifications & standards; Piping specifications; Electrical specifications; BID documents etc **B**. Documents & Drawing: P & I diagram based on Process Flow Sheet, Material balance sheet and Temperature, pressure sheet, Methods of tagging and nomenclature scheme based on ANSI / ISA standards. Standards used in instrumentation project: ISA S5.1, S5.3, S5.4, S5.5 and S5.20, ANSI, & NFPA. Instrument index sheet, installation sketches, specification sheets.	20
03	**Engineering Design Criteria:** Control centers, Future & spare capacity ///Specifications for various measurement and control groups: flow, level, temperature, control valves etc///Transmission systems--- materials, distribution, termination, identification Process connection///Miscellaneous design criteria: Mounting instruments;	25

	selection of units; materials of construction; package equipment systems///Electrical safety	
04	**Selecting measurement methods & control valves**	10
05	**Construction and Start up: a.** Organizing/// b. Ordering and receiving equipment & material/// c .Installing instrument systems : Procedure, Coordination, Good installation practices, Calibration/// d. Testing/// e .Loop checking/// f. Start up: Placing instruments in service; Tuning loop control; Evaluating process upsets and disturbances; Repairing or replacing defective equipments,; additional control	15
06	**Introduction to International quality systems**--- ISO 9000------ a management overview, Quality system. Inspection, Test standards and calibration.	10

PRACTICAL / Assignment (Any 8 Experiments)(Optional)

1) Study of standards and symbols (ANSI / ISA Std.)
2) Study of specification sheets.
3) Development of Process & Instrument diagram of typical process.
4) Development of Loop Wiring diagram.
5) Cable scheduling.
6) GA and mimic diagram of a control panel.
7) Development of Bar charts for certain project.
8) Preparation of Inquiry, Quotation, Comparative statement, Purchase orders, SAT, FAT and CAT, Inspection reports for control panel / transmitter/ control valve / recorder.
9) Hands on experience for engineering management software such as MS Project, Primavera,

TEXT AND REFERENCE BOOKS:

1. Project management : A systems approach to planning , scheduling and controlling---by Harold Kerzner and Van Norstrand; John Wiley and Sons; 2013; ISBN: 978-1-118-02227-6
2. Successful Instrumentation & Control System design—by Michael D Whitt; 2012, ISA; ISBN: 978-1-93600-745-5
3. ISO Guidelines
4. Instrument Engineers Handbook—Liptak; CRC Press: ISBN: 13-978-0801982422
5. Applied instrumentation in process industries by Andrew & Williams (Gulf Publishing)
6. Management systems by John Bacon (ISA)
7. Process control Instrument Engineers Hand book by Liptak

ELECTIVES –V & VI

8th Semester BE (IN)

Optoelectronics and Optical Communications(IN805)

L-3 T-0 P-0 C-3

Md No	Contents	Marks
1.	**Introduction: Optical Fiber:** Structures, Wave guiding and Fabrication- Nature of light, Basic optical laws and Definition, Optical fiber modes and Configuration, Mode theory for circular waveguides, Single mode fibers, Graded index fiber, Fiber materials, Fabrication and mechanical properties, Fiber optic cables, Basic Optical Communication System, Advantage of Optical Communication System.	10
2.	**Attenuation in Optical Fibers**: Introduction, Absorption, scattering, Very Low Loss Materials, All Plastic & Polymer-Clad-Silica Fibers. **Wave Propagation:** Wave propagation in Step-Index & Graded Index Fiber, Overall Fiber Dispersion-Single Mode Fibers, Multimode Fibers, Dispersion-Shifted Fiber, Dispersion, Flattened Fiber, Polarization.	20
3.	**Sources & Detectors**: Design of LED's for Optical Communication and their types, Semiconductor Lasers for Optical Fiber Communication System and their types, Semiconductor Photodiode Detectors, Avalanche Photodiode Detector & Photo multiplier Tubes. Source to fiber power launching-Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling. Optical detectors-Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors. Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of error, Quantum limit, Analog receivers.	30
4.	**Optical Fiber Communication Systems:** Data Communication Networks–Network Topologies, Mac Protocols, Analog System. Advanced Multiplexing Strategies–Optical TDM, Sub carrier Multiplexing, WDM Network. Architectures: SONET/SDH. Optical Transport Network, Optical Access Network, Optical Premise Network. **Applications**-Military Applications, Civil, Consumer & Industrial Applications.	20

5. **Optical Fiber Sensors**: Introduction, Fiber optic sensor for industrial applications, Displacement, Pressure, Acceleration, Force, Velocity and Flow sensor, Fiber optic Voltage and current sensor. 20

Texts

8. J. Gowar, "Optical Communication System", IEEE Press – 2nd Edition.
9. R.P.Khare, "Fiber Optics and Opto Electronics", Oxford Publication
10. C. K. Sarkar, D. C. Sarkar, "Optoelectronics and Fiber Optics Communication", New Age International Publishers
11. John M. Senior, "Optical Fiber Communications", Pearson, 3rd Edition, 2010.
12. Culshame and Dakim, "Optical Fiber sensors".
13. P. Bhattacharjee, "Semiconductor Optoelectronics", PHI.
14. Wilson and Hawkas, "Optoelectronics and Introduction", PHI.
15. A. Ghatak, K. Thyagarajan, "An Introduction to Fiber Optics", Cambridge University Press.
16. G. P. Agrawal, Fiber optic Communication Systems, John Wiley & sons, New York, 1992
17. J. H. Franz & V. K. Jain, "Optical Communication Components & Systems", Narosa Publish, 2013

8th Semester BE (IN)

Environmental Instrumentation and Safety (IN806)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1	Characterization of waste and source of pollution; Effects of pollution--- Ecology balance, quality standards and legislation.	10
2	Air pollution: emission, intensity and dispersion, measurement and monitoring techniques using---conductometry, coulometry, electrochemical cell method, piezo electric oscillation method, paper tape method, optical laser method; analysis techniques—photometric gas chromatography, mass spectrometry; Control of air pollution and control instrumentation.	25
3	Water pollution: Effluents and their characterization; Basic techniques of detection and monitoring—emission spectrography, atomic absorption spectrophotometry, absorption photometry, marine pollution monitoring, polarography, chromatographic methods;Waste treatment by biological, physical & chemical process control and instrumentation.	25
4	Land/ soil pollution: instrumentation in sludge handling: Radio-active waste disposal and safety instrumentation; soil characteristic and fertility conservation; Instrumentation for noise and thermal pollution monitoring.	20
5	Industrial pollutants and their monitoring: industrial pollutants; industrial wastes; health hazards; ecological balance; Control instrumentation in specific industrial pollution of steel, paper, cement, power and petrochemical plants. Instrumentation in Hazardous area: Hazardous area classification; Protective concepts; Intrinsic safety & intrinsically safe design; Installation of intrinsically safe systems.	20

Text Books:

1. Handbooks Environmental Control

2. Liptak B G—Environment Engineers Handbook vol –I, II, III

3. Mahajan S P—Pollution control in Process Industries—Tata McGraw Hill

4. Electronic Instruments and Instrumentation Technology---M. M. S. Anand; PHI (Eastern Economy Edn)

8th Semester BE (IN)

Advance Sensors (IN807)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1	Semiconductor sensors: Metal oxide semiconductors; Hall elements. Silicon Sensors: Silicon Planar Technology, Micromachine Technology; Silicon sensors for sensing radiation, mechanical, magnetic, chemical and other signals; IC sensors.	20
2	Chemical and Biochemical Sensors: Polymers, Chemically modified electrodes, Membranes, Electrodes, Thick film devices, Catalytic devices, Gas sensors.	15
3	Optical Sensors: Lasers, Photo-detectors and optical fibre as sensors; Integrated optics. Micro Sensors: Thin film sensors, Micro sensors for sensing thermal, radiation, mechanical, magnetic and chemical signals.	25
4	Intelligent and Smart Sensors: concepts of redundant and multi sensory systems, Operation in coded mode and mapping mode; Interfacing and signal processing.	20
5	Instrumentation for Special Processes: Instrumentation and Control relevant to some fo the following industries---- Cement, Tea, Petrochemical, Steel, Paper, Fertilizer Industries, Power Plants.	20

Text Books:

1. Middlehoek S and Audel S A --- Silicon Sensors--- Academic Press
2. Patranabis D--- Sensors and Transducers---PHI
3. Cannon E M – The making, shaping and treating of steel—
4. Considine--- Process Instruments and Control Handbook---- McGraw Hill
5. Britt K W – Handbook of Pulp and Paper Technology---
6. CEGB Modern Power System Practice--- Pergamon

8th Semester BE (IN)

Industrial Automation and Robotics (IN808)

L-3 T-0 P-0 C-3

Module – I

Basic Concepts

Definition and origin of robotics, Different types of robotics, Various generations of robots, Degrees of freedom, Asimov's laws of robotics, Dynamic stabilization of robots.

Power Sources and Sensors

Hydraulic, pneumatic and electric drives, Determination of HP of motor and gearing ratio, Variable speed arrangements, Path determination, Micro machines in robotics, Machine vision, Ranging, Laser, Acoustic, Magnetic, Fiber optic and tactile sensors.

Module – II

Manipulators, Actuators and Grippers

Construction of manipulators, Manipulator dynamics and force control, Electronic and pneumatic manipulator control circuits, End effectors, Various types of grippers, Design considerations.

Module – III

Kinematics and Path Planning

Solution of inverse kinematics problem, Multiple solution jacobian work envelop, Hill climbing techniques, Robot programming languages.

Case Studies

Multiple robots, Machine interface, Robots in manufacturing and non-manufacturing applications, Robot cell design, Selection of robot.

Textbooks:

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., *Industrial Robotics*, McGraw-Hill Singapore, 1996.
2. Ghosh, *Control in Robotics and Automation: Sensor Based Integration*, Allied Publishers, Chennai, 1998.

Recommended Reading:

1. S.R. Deb, *Robotics technology and flexible Automation*, John Wiley, USA 1992.
2. C.R. Asfahl, *Robots and Manufacturing Automation*, John Wiley, USA 1992.
3. R.D. Klafter, T.A. Chimielewski, and M. Negin, *Robotic Engineering – An Integrated Approach*, Prentice Hall of India, New Delhi, 1994.
4. McKerrow P.J. *Introduction to Robotics,* Addison Wesley, USA. 1991
5. Issac Asimov I *Robot Ballantine Books*, New York. 1986

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8th Semester BE (IN)

MULTISENSOR DATA FUSION (IN809)

L-3 T-0 P-0 C-3

1. **Multisensor data fusion**: Introduction, sensors and sensor data, Use of multiple sensors, Fusion applications. The inference hierarchy: output data. Data fusion model.
2. **Architectural concepts and issues.** Benefits of data fusion, Mathematical tools used: Algorithms, co-ordinate transformations, rigid body motion. Dependability and Markov chains, Meta – heuristics.Taxonomy of algorithms for multisensor data fusion.Data association.Identity declaration.
3. **Estimation:** Kalman filtering, practical aspects of Kalmanfiltering, extended Kalmal filters. Decision level identify fusion. Knowledge based approaches.
4. **Data information** filter, extended information filter. Decentralized and scalable decentralized estimation. Sensor fusion and approximate agreement. Optimal sensor fusion using range trees recursively. Distributed dynamic sensor fusion.
5. **High performance data structures**: Tessellated, trees, graphs and function. Representing ranges and uncertainty in data structures.Designing optimal sensor systems within dependability bounds.Implementing data fusion system.

TEXT BOOKS:

1. David L. Hall, Mathematical techniques in Multisensor data fusion, ArtechHouse, Boston, 1992.
2. R.R. Brooks and S.S. Iyengar, Multisensor Fusion: Fundamentals andApplications with Software, Prentice Hall Inc., New Jersey, 1998.

REFERENCES:

1. Arthur Gelb, Applied Optimal Estimation, The M.I.T. Press, 1982.
2. James V. Candy, Signal Processing: The Model Based Approach, McGraw –HillBook Company, 1987.

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8th Semester BE (IN)

Adaptive Signal Processing (EE 806)

L-3 T-0 P-0 C-3

Md No.	Contents
1	**Introduction**: The adaptive linear combiner; Introduction to gradient search algorithms, steepest-descent algorithm, Convergence properties, Newton algorithm.
2	**Adaptive algorithms**: LMS algorithm, Recursive Least Squares algorithm, LMS/Newton algorithm.
3	Frequency domain and Sub-band adaptive filters; Square root adaptive filters; Order recursive adaptive filters; Finite precision effects; IIR adaptive filters.
4	**Applications of adaptive signal processing**: a) Adaptive modeling and system identification b) Inverse adaptive modeling, deconvolution and equalization c) Adaptive control systems d) Adaptive interference canceling - Canceling noise, Canceling periodic interference; Canceling interference in ECG signals, etc.
5	**Linear optimum filtering**: a) Wiener filters b) Kalman filters

Text Books:

1) Adaptive Signal Processing - B. Widrow and S. Stearns, Prentice Hall, 1985.

2) Adaptive Filter Theory, 3rdEd - S. Haykin, Prentice Hall, 1996.

8th Semester BE (IN)

Computer Vision (EE 807)

L-3 T-0 P-0 C-3

unit	Content	Marks
1	**Image Formation (Sources, Shadows and Shading)**: Radiometric Properties of Light Sources; Qualitative Radiometry; Sources and their Effects; Point Sources; Line Sources; Area Sources; Gourad & Phong Shading models; Shadows; Ambient Illumination; Photometric Stereo; Normal and Albedo from Many Views; Shape from Normals; Interreflections: Global Shading Models.	20
2	**Image Models**: Coordinate Systems and Homogeneous Coordinates; Perspective Projection.	10
3	**Shape from Texture**: Representing Texture; Extracting Image Structure with Filter Banks; Analysis (and Synthesis) Using Oriented Pyramids; The Laplacian Pyramid; Shape from Texture: Planes and Isotropy; Recovering the Orientation of a Plane from an Isotropic Texture; Recovering the Orientation of a Plane from an Homogeneity Assumption; Shape from Texture for Curved Surfaces; Shape from Texture.	20
4	**The Geometry of Multiple Views**: Two Views; Epipolar Geometry; Three Views; Trifocal Geometry; More than 3 Views; **Stereopsis**: Reconstruction; Camera Calibration; Image Rectification; Human Vision: Stereopsis; Binocular Fusion; Correlation; Multi-Scale Edge Matching; Dynamic Programming; Using More Cameras; Trinocular Stereo; Multiple-Baseline	20
5	**Affine Structure from Motion**: Elements of Affine Geometry; Affine Structure from Two Images; The Affine Structure-from-Motion Theorem; Regularization theory; Optical computation; Optical flow; Motion estimation;	15
6	**Projective Structure from Motion**: Motion Estimation from Trifocal Tensors; Motion Estimation from Multiple Views	15

Text Books:

1. Robot Vision - Berthold Klaus Paul Horn, MIT Press, McGraw-Hill
2. Computer Vision 2ndEd PHI 1982 Ballard n Brown
3. Computer Vision A Modern Approach - Forsyth, Ponce
4. Computer Vision and Applications A Guide for Students and Practitioners 2000 - Jahne n Hausecker
5. Fundamentals of Computer Vision 1997 Mubarak Shah
6. Image Processing Analysis and Machine Vision 3rdEd 2008 Sonka, Hlavac and Boyle

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8th Semester BE (IN)

Computer Graphics (EE 808)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1	**Introduction to Computer Graphics:** Overview of Computer Graphics, Computer Graphics Application and Software, Description of some graphics devices, Input Devices for Operator Interaction, Active and Passive Graphics Devices, Display Technologies, Storage Tube Graphics Displays, Calligraphic Refresh Graphics Displays, Raster Refresh (Raster-Scan) Graphics Displays, Cathode Ray Tube Basics, Color CRT Raster Scan Basics, Video Basics, The Video Controller, Random-Scan Display Processor, LCD displays. **Scan conversion – Lines, Circles and Ellipses; Filling polygons and clipping algorithms**: Scan Converting Lines, Mid-point criteria, Problems of Aliasing, end-point ordering and clipping lines, Scan Converting Circles, Scan Converting Ellipses, Filling Polygons, edge data structure, Clipping Lines algorithms– Cyrus-Beck, Cohen-Sutherland and Liang-Barsky, Clipping Polygons, problem with multiple components.	40
2	**Two-Dimensional Transformations**: Transformations and Matrices, Transformation Conventions, 2D Transformations, Homogeneous Coordinates and Matrix Representation of 2D Transformations, Translations and Homogeneous Coordinates, Rotation, Reflection, Scaling, Combined Transformation, Transformation of Points, Transformation of The Unit Square, Solid Body Transformations, Rotation About an Arbitrary Point, Reflection through an Arbitrary Line, A Geometric Interpretation of Homogeneous Coordinates, The Window-to-Viewport Transformations. **Three-Dimensional Transformations**: Introduction, Three-Dimensional Scaling, Three-Dimensional Shearing, Three-Dimensional Rotation, Three-Dimensional Reflection, Three-Dimensional Translation, Multiple Transformation, Rotation about an Arbitrary Axis in Space, Reflection through an Arbitrary Plane, Matrix Representation of 3D Transformations, Composition of 3D Transformations, Affine and Perspective Geometry, Perspective Transformations, Techniques for Generating Perspective Views, Vanishing Points, the Perspective Geometry and camera models, Orthographic Projections, Axonometric Projections, Oblique Projections, View volumes for projections. **Viewing in 3D**: Stages in 3D viewing, Canonical View Volume (CVV), Specifying an Arbitrary 3D View, Examples of 3D Viewing, The Mathematics of Planar Geometric Projections, Combined transformation matrices for projections and viewing, Coordinate Systems and matrices, camera model and viewing pyramid.	20

3	**Plane Curves and Surfaces**: Curve Representation, Nonparametric Curves, Parametric Curves, Parametric Representation of a Circle, Parametric Representation of an Ellipse, Parametric Representation of a Parabola, Parametric Representation of a Hyperbola, A Procedure for using Conic Sections, The General Conic Equation; Representation of Space Curves, Cubic Splines, Bezier Curves, B-spline Curves, B-spline Curve Fit, B-spline Curve Subdivision, Parametric Cubic Curves, Quadric Surfaces; Bezier Surfaces.	20
5	**Visible-Surface Determination**: Techniques for efficient Visible-Surface Algorithms, Categories of algorithms, Back face removal, The z-Buffer Algorithm, Scan-line method, Painter's algorithms (depth sorting). **Illumination and Shading**: Illumination and Shading Models for Polygons, Reflectance properties of surfaces, Ambient, Specular and Diffuse reflections, Atmospheric attenutation, Phong's model, Gouraud shading, some examples.	20

Text Books:

1. Computer Graphics (C Version) - D. Hearn and M. Pauline Baker, Pearson Education, 2nd Edition, 2004.

2. Mathematical Elements for Computer Graphics, 2ndEd - D. F. Rogers and J. A. Adams, McGraw-Hill International Edition, 1990.

3. Procedural Elements for Computer Graphics, 2ndEd - D. F. Rogers and J. A. Adams, McGraw-Hill International Edition, 1990.

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8th Semester BE (IN)

Intelligent Control Systems(EE 809)

L-3 T-0 P-0 C-3

1 **Introduction**: Approaches to intelligent control; Architecture for intelligent control; Symbolic reasoning system; Rule-based systems; AI approach; Knowledge representation; Expert systems.

2 **Artificial Neural Network (ANN)**: Concept of Artificial Neural Networks and its basic mathematical model; McCulloch-Pitts neuron model: Simple perceptron; Adaline and Madaline; Feed-forward Multilayer Perceptron; Learning and Training the neural network; Data Processing: Scaling, Fourier transformation, Principal Component Analysis (PCA) and Wavelet transformations; Hopfield network; Self-organizing network; Recurrent network;Stability analysis of Neural Network Interconnection Systems; System Identification and Control of Linear and Nonlinear Dynamic Systems using Neural Network.

3 **Intelligent Optimization Algorithms**: Gradient Search and Non-gradient search algorithms;Genetic Algorithm (GA): Basic concept of Genetic algorithm and detailed algorithmic steps; Adjustment of free parameters; Stochastic GA; Tabu search; Ant Colony Search; Evolutionary Programming: Operators, Search Algorithms; Particle Swarm Optimization; Applications to Solution of Control System Optimizationproblems.

4 **Fuzzy Logic Systems**: Introduction to crisp sets and fuzzy sets; Basic fuzzy set operation and approximate reasoning; Introduction to fuzzy logic modelling and control: Fuzzification, Inferencing and Defuzzification;Fuzzy Knowledge and Rule Bases; Fuzzy modelling and control schemes for nonlinear systems; Self-organizing fuzzy logic control; Fuzzy logic control for nonlinear time-delay system; Stability analysis of Fuzzy Control Systems; Application of Fuzzy Logic Controllers to Inverted Pendulum.

Text Books:

1. Fundamentals of Neural Networks - LauranceFausett, Englewood cliffs, N.J., Pearson Education, 1992.
2. Neural Networks and Fuzzy Systems – B. Kosko, Prentice-Hall of India Pvt. Ltd., 1994.

3. Fuzzy Logic with Engineering Applications - Timothy J. Ross, Tata McGraw Hill, 1997.
4. Introduction to Fuzzy Control – Driankov and Hellendroon,Narosa Publishers.
6. Genetic Algorithms and Machine learning - David Goldberg, PHI

References:

1. Introduction to Artificial Neural Systems - Jacek M. Zurada, Jaico Publishing Home, 2002.
2. Fuzzy Sets, Uncertainty and Information – G. J. Klir and T. A. Folger, Prentice-Hall of India Pvt. Ltd., 1993.
2. Fuzzy Set Theory & its Applications - H.J. Zimmermann, Allied Publication Ltd., 1996.
3. Neural Networks - Simon Haykin, Pearson Education, 2003.
4. Fuzzy Logic – Intelligence Control & Information - John Yen & Reza Langari, Pearson Education, New Delhi, 2003.
5. Genetic Algorithms + Data Structures = Evolution Programs, 3rdEd - Z Michalewicz, Springer, 1996.
6. Evolutionary Computation Vol 2 Advanced Algorithmsand Operators - T Baeck, D B Fogeland Z Michalewicz, Institute of Physics Publishing, Bristol, UK, 2000.

8th Semester BE (IN)

Discrete Time Control Systems(EE 810)

L-3 T-0 P-0 C-3

1 **Introduction**: Discrete time system representation, Mathematical modeling of sampling process, Data reconstruction.

2 **Modeling discrete-time systems by pulse transfer function**: Review of Z-transform, Mapping of s-plane to z-plane, Pulse transfer function, Pulse transfer function of closed loop system, Sampled signal flow graph.

3 **Stability analysis of discrete time systems**: Jury stability test, Stability analysis using bi-linear transformation.

4 **Time response of discrete systems**: Transient and steady state responses, Time response parameters of a prototype second order system.

5 **Design of sampled data control systems**: Root locus method, Controller design using root locus, Root locus based controller design using MATLAB, Nyquist stability criteria, Bode plot, Lead compensator design using Bode plot, Lag compensator design using Bode plot, Lag-lead compensator design in frequency domain.

6 **Deadbeat response design**: Design of digital control systems with deadbeat response, Practical issues with deadbeat response design, Sampled data control systems with deadbeat response.

7 **Discrete state space model**: Introduction to state variable model, Various canonical forms, Characteristic equation, state transition matrix, Solution to discrete state equation.

8 **Controllability, observability and stability of discrete state space models**: Controllability and observability, Stability, Lyapunov stability theorem.

9 **State feedback design**: Pole placement by state feedback, Set point tracking controller, Full order observer, Reduced order observer.

10 **Output feedback design**: Output feedback design Theory, Output feedback design Examples.

11 **Introduction to optimal control**: Basics of optimal control, Performance indices, Linear Quadratic Regulator (LQR) design.

Text Books:

1. B. C.Kuo, Digital Control Systems, Oxford University Press, 2/e, Indian Edition, 2007.

2. K. Ogata, Discrete Time Control Systems,Prentice Hall, 2/e, 1995.

3. M. Gopal, Digital Control and State Variable Methods, Tata Mcgraw Hill, 2/e, 2003.

4. G. F. Franklin, J. D.Powell and M. L. Workman, Digital Control of Dynamic Systems, Addison Wesley, 1998, Pearson Education, Asia, 3/e, 2000.

5. K. J.Astroms and B. Wittenmark, Computer Controlled Systems - Theory and Design, Prentice Hall, 3/e, 1997.

6. Discrete-time Sliding Mode Control - A Multirate Output Feedback Approach, B. Bandyopadhyay and S. Janardhanan, Springer-Verlag 2006.

7. Digital Self-tuning Controllers - Algorithms, Implementation and Applications, V. Bobal, J, Bohm, J. Fessl and J. Machacek, Springer-Verlag 2005

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8th semester BE (IN)

Syllabus for VLSI Signal Processing (EE813)

L-3 T-0 P-0 C-3

Md No.	Contents	Marks
1	**Introduction to DSP System**: Typical DSP algorithms, DSP application demands and scaled CMOS technology, Representation of DSP algorithms. **Iteration Bound**: Data-flow graph representations, Loop bound and iteration bound, Algorithms for computing iteration bound, Iteration bound of multirate data-flow graphs.	20
2	**Pipelining and Parallel Processing**: Pipelining of FIR digital filters, Parallel processing, Pipelining and parallel processing for low power.	15
3	**Retiming**: Definitions and properties, Solving systems of inequalities, Retiming techniques. **Unfolding**: An algorithm for unfolding, Properties of unfolding, Critical path, unfolding and retiming, Applications of unfolding. **Folding**: Folding transformation, Register minimization techniques, Register minimization in folding architectures, Folding of multirate systems.	20
4	**Systolic Architecture Design**: Systolic array design methodology, FIR systolic arrays, Selection of scheduling vector, Matrix-matrix multiplication and 2D systolic array design, Systolic design for space representations containing delays.	15
5	Scaling and round off noise; Digital lattice filter structures; **Bit-Level Arithmetic Architecture**: Parallel multipliers, Interleaved floor-plan and bit-plane-based digital filters, Bit-serial multipliers, Bit-serial filter design and implementation, Canonic signed digit arithmetic, Distributed arithmetic; Bit level arithmetic architecture; Redundant arithmetic.	15
6	Numerical strength reduction – Synchronous, Wave and Asynchronous pipe lines; Low power design; **Programmable Digital Signal Processors**: Evolution of programmable digital signal processors, Important features of DSP processors, DSP processors for mobile and wireless communications, Processors for multimedia signal processing.	15

Text Books:

1. VLSI Digital Signal Processing Systems, Design and Implementation - K. K. Parhi, Wiley Interscience, New Delhi, 1999.
2. VLSI Digital Signal Processing Systems: Design and Implementation - K. P. Keshab, Jacaranda Wiley, 1999.
3. Digital Signal Processing in VLSI - Richard J, Higgins, Prentice Hall.
4. VLSI Design Methodology for DSP Architectures - M.A. Bayoumi, Kluwer, 1994.
5. Analog VLSI signal and information processing - Mohammad Isamail and Terri Fiez, McGraw-Hill
6. VLSI and Modern Signal Processing - S.Y. Kung, H.J. White House, T. Kailath, Prentice Hall, 1985.

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