REGULATIONS 2015

B.TECH ELECTRONICS AND INSTRUMENTAION ENGG

CURRICULUM - SYLLABUS

SEMESTER – I

S.NO	SUBJECT CODE	COURSE TITLE	L	T	P	C
THEORY						
1	BEN101	English – I	3	1	0	3
2	BMA101	Mathematics – I	3	1	0	3
3	BPH101	Engineering Physics - I	3	0	0	3
4	BCH101	Engineering Chemistry – I	3	0	0	3
5	BCS101	Fundamentals of Computing and Programming	3	0	0	3
6	BFI101	Foreign/Indian Language	3	0	0	3
7	BME102	Engineering Graphics – C (Circuit Branches)	1	0	3	3
8	BEE101	Basic Electrical and Electronics Engineering	2	0	0	2
PRATICALS						
8	BCS1L1	Computer Practice Laboratory –I	0	0	3	1
9	BEE1L1	Basic Electrical and Electronics Engineering Practices Laboratory	0	0	3	1
10	BPC1L1	Physics and Chemistry Laboratory	0	0	3/3	0
For a given program, Total Instruction Periods per Week = 35; Total Number of Credits = 25						

SEMESTER – II

S.NO	SUBJECT CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	BEN201	English – II	3	1	0	3
2.	BMA201	Engineering Mathematics – II	3	1	0	3
3.	BPH201	Engineering physics – II	3	0	0	3
4.	BCH201	Engineering Chemistry – II	3	0	0	3
5.	BCS201	Internet Programming	2	0	0	2
6.	BBA201	Personality Development	2	0	0	2
7.	BBT202	Biology for Engineers	2	0	0	2
8.	BME203	Basic Mechanical Engineering	2	0	0	2
9.	BCE201	Basic Civil Engineering	2	0	0	2
PRATICALS						
10.	BCS2L1	Internet Practices Lab	0	0	3	1
11.	BCM2L1	Basic Civil and Mechanical Engineering Practices Laboratory	0	0	3	1
12.	BPC2L1	Physics and Chemistry Laboratory	0	0	3/3	1
For a Given Program, the Total Instruction Periods per Week = 35; Total Number of Credits = 25						

SEMESTER III

SUB CODE	SUB TITLE	L	T	P	C
BMA301	Mathematics III	3	1	0	4
BCS301	Data Structures & Algorithm Using C++	3	0	0	3
BEE301	Circuit Analysis	3	1	0	4
BEE302	Electrical Machines	3	0	0	3
BEI301	Electrical Measurements and Instrumentation	3	0	0	3
BEI302	Transducer Engineering	3	0	0	3
Practical					
BEI3L1	Measurements & Transducer Engineering Laboratory	0	0	4	2
BEI3L2	Data Structures & Algorithm Using C++ Laboratory	0	0	4	2
BEE3L4	Electrical Machines Laboratory	0	0	4	2
Total Contact Hours – 29		18	02	12	26

SEMESTER IV

SUB CODE	SUB TITLE	L	T	P	C
BEI401	Control Systems Engineering	3	1	0	4
BMA402	Numerical methods	3	1	0	4
BEI403	Electronic Devices, Circuits And Application	3	0	0	3
BEI404	Digital Logic Circuits and system design	3	0	0	3
BME401	Applied Thermodynamics & Fluid Mechanics	3	1	0	4
BCE406	Environmental Studies	3	0	0	3
Practical					
BEI4L1	Control System Engineering Laboratory	0	0	4	2
BEI4L2	Analog & Digital Circuits Laboratory	0	0	4	2
BEI4L3	English Language Laboratory	0	0	4	2
Total Contact Hours – 30		**18**	**03**	**12**	**27**

SEMESTER V

SUB CODE	SUB TITLE	L	T	P	C
BEI501	Digital Signal Processing	3	1	0	4
BEI502	Process Dynamics & Control	3	1	0	4
BEI503	Industrial Instrumentation- I	3	0	0	3
BEI505	Microprocessor And Microcontroller	3	1	0	4
BEI506	Object Oriented Programming	3	0	0	3
	ELECTIVE-I	3	0	0	3
Practical					
BEI5L1	Process Control Laboratory	0	0	4	2
BEI5L2	Microprocessor, Microcontroller & DSP Laboratory	0	0	4	2
BEI5L3	Object Oriented Programming Laboratory	0	0	4	2
Total Contact Hours – 30		**18**	**3**	**09**	**27**

SEMESTER VI

SUB CODE	SUB TITLE	L	T	P	C
BBA601	Management & Professional Ethics	3	0	0	3
BEI602	Industrial Instrumentation-II	3	0	0	3
BEI605	Embedded Systems Design	3	1	0	4
BEI604	Industrial Data Networks	3	0	0	3
BEI606	Modern Electronic Instrumentation	3	0	0	3
	ELECTIVE-II	3	0	0	3
Practical					
BEI6L1	Industrial Instrumentation Laboratory	0	0	4	2
BEI6L2	Instrumentation System design Laboratory	0	0	4	2
BEI6l3	Employability Skills	0	0	3	1
Total Contact Hours – 27		18	1	8	**24**

SEMESTER VII

SUB CODE	SUB TITLE	L	T	P	C
BEI701	Logic & Distributed Control Systems	3	1	0	4
BEI702	Digital Control Systems	3	1	0	4
BEI703	Neural Networks & Fuzzy Logic Control	3	0	0	3
BEI704	Virtual Instrumentation	3	0	0	3
	Elective- III	3	0	0	3
	Elective- IV	3	0	0	3
Practical					
BEI7L1	Advanced Control systems laboratory	0	0	4	2
BEI7L2	Virtual Instrumentation Laboratory	0	0	4	2

BEI7P1	Mini project	0	0	4	2
Total Contact Hours – 29		**18**	**2**	**9**	**26**

SEMESTER VIII

SUB CODE	SUB TITLE	L	T	P	C
	ELECTIVE-V	3	0	0	3
	Elective-VI	3	0	0	3
	Elective-VII	3	0	0	3
BEI8P1	Project work	0	0	18	6
Total Contact Hours – 22		**9**	**01**	**12**	**15**

Total credits for the programme -195

LIST OF ELECTIVES

Sub Code	Subject Title	L	T	P	C
Elective List					
BEI001	Biomedical Instrumentation	3	0	0	3
BEI002	Fiber Optics And Laser Instrumentation	3	0	0	3
BEI003	Computer Organization & Architecture	3	0	0	3
BEI004	Parallel And Distributed Computing	3	0	0	3
BEI005	Instrumentation And Control In Petrochemical Industries	3	0	0	3
BEI006	Power Plant Instrumentation –I	3	0	0	3
BEI007	VLSI Design	3	0	0	3
BEI008	Analog Integrated Circuit Design	3	0	0	3
BEI009	Advanced digital signal processing	3	0	0	3
BEI010	Digital Image Processing	3	0	0	3
BEI011	Microcontroller Based System Design	3	0	0	3
BEI012	Robotics And Automation	3	0	0	3
BEI013	Advanced Control System	3	0	0	3
BEI014	Power Electronics Devices And Circuit	3	0	0	3
BEI015	Digital VLSI Design	3	0	0	3
BEI016	ASIC Design	3	0	0	3
BEI017	Linear Integrated Circuits And Its Application	3	0	0	3
BEI018	Artificial Intelligence &Expert Systems	3	0	0	3
BEI019	Analytical Instruments	3	0	0	3
BEI020	Computer Control Of Processes	3	0	0	3
BEI021	Power Plant Instrumentation-II	3	0	0	3
BEI022	Optimization Techniques	3	0	0	3
BEI023	Fundamentals Of Nanoscience	3	0	0	3
BEI024	System Identification &Adaptive Control	3	0	0	3
BEI025	Total Quality Management	3	0	0	3
BEI026	Operating Systems	3	0	0	3

BEN101 TECHNICAL ENGLISH - I

L	T	P	C
3	1	0	3

OBJECTIVES:

- To make the students learn the basics of communication in order to talk fluently, confidently and vividly.
- Students will be able to use strategies before, during, and after reading to aid in the construction and enhancement of meaning
- Students will be able to respond in discussions and in writing, using personal, literal, interpretative, and evaluative stances, to works of fiction and/or non-fiction.
- Students will be able to identify and explain the function of essential short story elements in the writer's craft (i.e. character, setting, conflict, plot, climax, resolution, theme, tone, point of view).

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: To make them master the techniques of professional communication so that they become employable after completing the course

CO2: Students will be able to engage in informal writing assignments (i.e. reader response, free writing, focused free writing, prediction, response journals, dialectical notebook entries, and other pieces of writing that they do not take through the entire writing process).

CO3: Students will be able to engage in formal writing assignments that require utilization of all stages of the writing process.

CO4: Students will be able to choose and use a relevant pre-writing strategy that will help them to prepare for the assignment.

CO5: Students will be able to write several rough drafts of a paper to revise clarity and depth of content or to edit style and mechanics.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M		M	W							
CO2	M		M	M	S							
CO3	S	M		S	M							
CO4	S	M		M	M							
CO5	S	M		M	S							
CO6	S		M	M	S							

Course Assessment methods:

DIRECT	INDIRECT

1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I **9 + 3**

Parts of speech - Active and passive voices - Subject verb agreement. - Writing about School life, Hobbies, Family and friends – Word formation with prefixes and suffixes - Tenses - Concord - Summarizing - Note-making

UNIT II **9+3**

Cause and effect relations – Punctuations –Differences between verbal and nonverbal communication -E - mail communication – Homophones - Etiquettes of E mail communication. Interpreting graphic representation - Flow chart and Bar chart.

UNIT III **9+3**

Degrees of comparison – Positive, Comparative, and Superlative - WH questions - SI units -Lab reports - Physics, chemistry, workshop and Survey report for introducing new product in the market.

UNIT IV **9+3**

Writing project proposals - Presentation skills - Prefixes and suffixes - If conditions - Writing a review- Preparing minutes of the meeting, Agenda, official circulars.

UNIT V **9+3**

Accident reports (due to flood and fire) - Hints development - Imperatives - Marking the stress Connectives , prepositional relatives.

Total: 60 Periods

Text Book

1. Department of humanities and social sciences division, Anna University, oxford university press, 2013.

Reference:

1. S.P.Danavel, English and Communication for Students of Science and engineering, Orient Blackswan, Chennai, 2011.
2. Rizvi, M.Asharaf, Effective Technical Communication, New Delhi, Tata McGraw Hill Publishibg Company, 2007. MuraliKrishna and SunithaMoishra, Communication Skills for Engineers. Pearson, New Delhi, 2011.

L	T	P	C
3	1	0	3

BMA101 MATHEMATICS –I

OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- Recognize that mathematics is an art as well as a powerful foundational tool of science with limitless applications.
- Demonstrate an understanding of the theoretical concepts and axiomatic underpinnings of mathematics and an ability to construct proofs at the appropriate level.

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: Solve a set of algebraic equations representing steady state models formed in engineering problems

CO2: Fit smooth curves for the discrete data connected to each other or to use interpolation methods over these data tables

CO3: Find the trend information from discrete data set through numerical differentiation and summary information through numerical integration

CO4: Predict the system dynamic behavior through solution of ODEs modeling the system

CO5: Solve PDE models representing spatial and temporal variations in physical systems through numerical methods.

CO6: Have the necessary proficiency of using MATLAB for obtaining the above solutions

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M		M	W							
CO2	M		M	M	S							
CO3	S	M		S	M							
CO4	S	M		M	M							

CO5	S	M		M	S							
CO6	S		M	M	S							

Course Assessment methods:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-1 Matrices **9+3**

Characteristic equations- Eigen values and Eigen vectors of the real matrix- Properties- Clayey-Hamilton theorem(Excluding proof)- Orthogonal transformation of a symmetric matrix to diagonal form- Quadratic form- Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT-II Three Dimensional Analytical Geometry **9+3**

Equation of a Sphere- Plane section of a sphere- Tangent plane- Equation of cone- Right circular cone- Equation of a cylinder- Right circular cylinder.

UNIT-III Differential Calculus **9+3**

Curvature in Cartesian coordinates- Centre and radius of curvature- Circle of curvature- Evolutes- Envelopes- Applications of Evolutes and Envelopes.

UNIT-1V Functions of Several Variables **9+3**

Partial derivatives- Euler's theorem for homogeneous functions- Total derivatives- Differentiation of implicit functions- Jacobeans- Taylor's expansion- Maxima and Minima- Method of Lagrangian multipliers.

UNIT-V Multiple Integrals **9+3**

Double integration- Cartesian and Polar coordinates- Change of order of integration- Change of variables between Cartesian and Polar coordinates- Triple integration in Cartesian coordinates- Area as double integral- Volume as triple integral.

Total: 60 Periods

TEXT BOOK:

1. Ravish R.Singh and Mukkul Bhatt, "Engineering Mathematics-I" First Reprint, Tata McGraw Hill Pub Co., New Delhi. 2011.
2. Grewal.B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi. 2007.

REFERENCES:

1. Ramana.B.V. "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Pearson Education, 2007.

L	T	P	C
3	0	0	3

BPH 101 ENGINEERING PHYSICS –I

OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few basic science technology and give procedures occurring in engineering and technology.
- Identify a problem and generate equivalent statements of a problem
- Apply fundamental statistical methods to analyze data

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: To make a bridge between the physics in school and engineering courses.

CO2: To impart a sound knowledge on the basic concepts of modern sciences like engineering applications of ultra-Sonics, lasers, fundamentals of crystal physics and utility of solar energy.

CO3: Draw sound conclusions from the results of data analysis.

CO4: Produce precise and clear expository written material about physics

CO5: Produce well-organized and clear oral presentations of physics material.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M		M	W							
CO2	M		M	M	S							
CO3	S	M		S	M							
CO4	S	M		M	M							
CO5	S	M		M	S							

Course Assessment methods:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry

4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I Ultrasonics 9

Introduction – Production- Magnetostriction Effect- Magnetostriction Generator- Piezoelectric Effect- Piezoelectric generator- Detection of ultrasonic waves- Properties- Cavitations- Acoustic grating -Industrial applications- Drilling, Welding, Soldering, Cleaning and SONAR- Velocity measurement- - Non-Destructive Testing (NDT) – Pulse-Echo System through transmission and reflection modes- A, B And C Scan Display methods- Important medical applications- Sonogram--problem.

UNIT-II LASER 9

Introduction- Principle of spontaneous emission and stimulated emission- Einstein's A &B Coefficients-Derivation-Condition for producing a laser beam- Population inversion- Pumping-Resonance cavity- Types Of Lasers- ND-YAG- He-Ne- Co2 Lasers-Industrial applications-Heat treatment- Welding-Cutting-Medical applications-Laser surgery- Advantages & disadvantages-problem.

UNIT-III Quantum Physics 9

Drawbacks with classical physics- Blackbody radiation: Max Planck theory and concept of energy quantization, deduction of Wien's displacement law, Raleigh-Jeans law – Matter waves- de Broglie wave length-photoelectric effect – Schrödinger equation (time-independent, and time-dependent equations)- wave functions and energy spectrum- application to particle in box-problem.

UNIT – IV Electromagnetic Theory 9

Electric charges-Coulomb's law of inverse squares- Electric field and its calculations-field lines-Gauss's law-applications of Gauss law. Magnetism - Magnetic field- Magnetic field lines-Magnetic flux- Motion of charged particles in magnetic field- Magnetic field of a moving charge. Electromagnetic wave- speed of electromagnetic wave and its quantitative deduction-group velocity- energy in electromagnetic waves- electromagnetic waves in matters-problems.

Unit-V Crystal Physics 9

Lattice- Unit Cell- Bravais Lattice- Lattice Plane- Miller Indices- d-Spacing in cubic lattices-Calculation of number of atoms per unit cell- Atomic radius- Coordination number- Packing Factor- SC,BCC, FCC, HCP Structures- Polymorphism and Allotropy- Crystal defects- point, line and surface defects- Burger's vector- problems.

Total: 45 Periods

Text Books

1. Sears.F.W., Zemansky.M.W. Young.H.D, University Physics; Narosa Publishing House.
2. Avadhanulu. M.N.; Engineering Physics-Vol-1; S.Chand And Company Ltd, 2010.

Reference Books

1. Rajendran, And Marikani. A, 'Engineering Physics' Tata McGraw? Hill Publications Ltd, 3rd Edition, New Delhi, 2004.
2. Sears., Zemansky, Young; College Physics; Addison Wesley Publishing Company.

3. Mukundan. A, Usha.S. Lakshmi.V; 'Engineering Physics' SciTech Publications (India) Pvt.Ltd. Chennai, 2006.
4. Resnick, R., and Halliday, D. and Walker, J.; Fundamental of Physics; John Wiley and Sons.

BCH 101 ENGINEERING CHEMISTRY -I

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.
- To prepare graduates for employment as chemists, for graduate study in chemistry, or for acceptance to medical or dental school.
- To prepare graduates with the skills to critically assess and solve problems requiring the application of chemical principles.

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: To make the student to be conversant with the principles, water characterization and treatment for portable and industrial purposes.

CO2: To impart knowledge on the essential aspects of Principles of polymer chemistry and engineering applications of polymers

CO3: To impart knowledge on the essential aspects of Principles electrochemistry, electrochemical cells, emf and applications of emf measurements

CO4: To make the students understand the Principles of corrosion and corrosion control

CO5: To impart knowledge about the Conventional and non-conventional energy sources and energy storage devices

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M		M	W							
CO2	M		M	M	S							
CO3	S	M		S	M							
CO4	S	M		M	M							
CO5	S	M		M	S							
CO6	S		M	M	S							

Course Assessment methods:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey

2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I Water Technology 9

Introduction-Characteristics : Hardness of water – types - temporary and permanent hardness - estimation by EDTA method Alkalinity – types of alkalinity - Phenolphthalein and Methyl orange alkalinity - determination –Domestic water treatment – disinfection methods (Chlorination, ozonation , UV treatment) Boiler feed water – requirements – disadvantages of using hard water in boilers Internal conditioning (Calgon Conditioning method) – External conditioning – Demineralization process – Desalination and Reverse osmosis.

UNIT II Polymers 9

Introduction-Polymers- definition – polymerization – degree of polymerization - types of polymerization – Addition polymerization and Condensation polymerization – Mechanism of Polymerization - free radical polymerization mechanism only, Plastics: Classification – thermoplastics and thermosetting plastics – difference between thermoplastics and thermosetting plastics - preparation, properties and uses of PVC, Teflon, nylon-6,6, PET, Rubber :Types – drawbacks of natural rubber -vulcanization of rubber - properties and uses of vulcanized rubber Synthetic rubbers – butyl rubber and SBR

UNIT III Electrochemistry 9

Introduction CELLS : Types of Cells : Electrochemical cells , Electrolytic cells – Reversible and Irreversible cells EMF – measurement of emf – Single electrode potential – Nernst equation Reference electrodes : Standard Hydrogen electrode -Calomel electrode Ion selective electrode :Glass electrode and measurement of pH using Glass electrode Electrochemical series – significance Titrations :Potentiometer titrations (redox - Fe^{2+} vs. dichromate titrations) Conduct metric titrations (acid-base – HCI vs. Noah titrations)

UNIT IV Corrosion and Corrosion Control 9

Introduction: Chemical corrosion Definition - Chemical Corrosion - Electrochemical corrosion – different types – galvanic corrosion –differential aeration corrosion – mechanism of Chemical and Electrochemical corrosion factors influencing corrosion control – sacrificial anode and impressed cathodic current methods – Protective Coatings: Paints – constituents of the paint and their functions Metallic coatings – electroplating of Gold and electroless plating of Nickel.

UNIT V Non-Conventional Energy Sources and Storage Devices 9

Introduction : Nuclear fission and nuclear fusion reactions – differences between nuclear fission and nuclear fusion reactions – nuclear chain Reactions – nuclear energy critical mass - super critical mass - sub - critical mass Light water nuclear reactor for power generation (block diagram only) – breeder reactor Solar energy conversion – solar cells – wind energy Fuel cells – hydrogen – oxygen fuel cell Batteries :Primary and secondary Batteries – differences between Primary and

secondary Batteries Secondary batteries: Lead–acid storage battery –working –uses Nickel–cadmium battery - working –uses Solid – state battery : Lithium battery

TOTAL: 45 PERIODS

TEXT BOOKS:

1. P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S. Dara “A text book of engineering chemistry” S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, “Engineering Chemistry, Volume 1”, Crystal Publications, Chennai, (2007).

REFERENCES:

1. B.K.Sharma “Engineering chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008)

BCS 101 **FUNDAMENTALS OF COMPUTING AND PROGRAMMING**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying computer science.

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: To enable the student to learn the major components of a computer system.

CO2: To know the correct and efficient way of solving problem.
CO3: To learn to use office automation tools.
CO4: To learn and write program in "C".
CO5: To impart knowledge about the Conventional and non-conventional energy sources and energy storage devices

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M		M	W							
CO2	M		M	M	S							
CO3	S	M		S	M							
CO4	S	M		M	M							
CO5	S	M		M	S							

Course Assessment methods:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I: INTRODUCTION TO COMPUTER 9

Introduction-Characteristics of computer-Evolution of Computers-Computer Generations - Classification of Computers-Basic Computer Organization-Number system. Computer Software: Types

of Software—System software-Application software-Software Development Steps

UNIT II: PROBLEM SOLVING AND OFFICE AUTOMATION 9

Planning the Computer Program – Purpose – Algorithm – Flowcharts– Pseudo code Introduction To Office Packages: MS Word, Spread Sheet, Power Point, MS Access, and Outlook.

UNIT III: INTRODUCTION TO C 9

Overview of C-Constants-Variables-Keywords-Data types-Operators and Expressions - Managing Input and Output statements-Decision making-Branching and Looping statements.

UNIT IV: ARRAYS AND STRUCTURES 9

Overview of C-Constants, Variables and Data types-Operators and Expressions -Managing Input And Output operators-Decision making-Branching and Looping.

UNIT V: INTRODUCTION TO C++ 9

Overview of C++ - Applications of C++-Classes and objects-OOPS concepts -Constructor and Destructor- A simple C++ program –Friend classes and Friend Function.

Total: 45Periods

Text books:

1. Ashok, N.Kamthane,"Computer Programming", Pearson Education (2012).
2. Anita Goel and Ajay Mittal,"Computer Fundamentals and Programming in C", Dorling Kindersley (India Pvt Ltd).Pearson Education in South Asia, (2011).
3. Yashavant P. Kanetkar, "Let us C", 13th Edition, BPB Publications (2013).
4. Yashavant P. Kanetkar,"Let us C++"10th Edition, BPB Publications (2013).

References:

1. Pradeep K.Sinha, Priti Sinha "Foundations of Computing", BPB Publications (2013).
2. Byron Gottfried, "Programming with C", 2nd edition, (Indian Adapted Edition), TMH publication.
3. PradipDey, ManasGhosh, Fundamentals of Computing and Programming in 'C' First Edition, Oxford University Press (2009)
4. The C++ Programming Language , 4thEdition, BjarneStroustrop, Addison-Wesley Publishing Company (2013)

BCS 102 COMPUTER GRAPHICS - I

L	T	P	C
3	0	0	3

OBJECTIVES:

- To develop graphical skills in students for communication of concepts, design ideas of engineering products, and expose them to existing standards related to technical drawings.
- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying computer science.

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: To visualize and produce two dimensional graphic representation of three dimensional objects and buildings.
CO2: To comprehend and visualize 3D views of objects.
CO3: To understand and generate the different curves used in engineering applications.
CO4: To learn and write program in "C".
CO5: To introduce the fundamental of CAD Graphics used in design.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M		M	W							
CO2	M		M	M	S							
CO3	S	M		S	M							
CO4	S	M		M	M							
CO5	S	M		M	S							

Course Assessment methods:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I Basic Curves, Projection of points and Straight lines 9

Conics-construction of ellipse, parabola and hyperbola by eccentricity method - construction of involutes of square and circle-Drawing of tangent and normal to the above curves-Scales-Basic drawing conventions and standards-Orthographic projection principles- Principal planes-First angle projection- Projection of points. Projection of straight lines (only first angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method.

UNIT-II Projections of Planes and solids 9

Projection of planes (Polygonal and circular surfaces) inclined to both the principal planes. Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method

UNIT-III Orthographic Projections, Isometric projections & Free hand sketching 9

Orthographic projection of Simple parts from 3D diagram-Principles of isometric projection and isometric view-isometric scale- Isometric projections of simple solids and truncated solids- Prisms, pyramids, cylinders, cones.

UNIT-IV Projection of Sectioned solids and development of surfaces 9

Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other-obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids- Prisms, pyramids cylinders and cones.

UNIT-V Perspective projection, building drawing and Computer aided drafting 9

Perspective projection of cubes and cylinders by visual ray method. Introduction- components of simple residential or office building-specifications-plan and elevation of different types of Residential buildings and office buildings. Introduction to drafting packages and basic commands used in AUTO CAD. Demonstration of drafting packages.

Total: 45 Periods

Text Books:

1. N.D.Bhatt and V.M.Panchal, "Engineering drawing", charotar publishing house, 50th edition, 2010.
2. K.V.Natarajan "A Text book of Engineering Graphics",Dhanalakshmi Publishers, Chennai, 2009.

Reference

1. K.R.Gopalakrishna, "Engineering drawing", (Vol -I & II combined) subhas stores, Bangalore, 2007.
2. K.Venugopal and V. Prabhu Raja, "Engineering Graphics", New age International Private limited, 2008.
3. Luzzader, Warren.J., and Duff, John.M.,, "Fundamentals of Engineering Drawing with an introduction to Interactive computer graphics for design and production", Eastern economy edition, Prentice Hall of India Pvt Ltd, New Delhi,2005

BEE101 BASIC ELECTRICAL ENGINEERING

L	T	P	C
2	0	0	2

Course Objective:

- To impart basic knowledge on electrical machines, principles and its operation.
- Be a practicing engineer in fields such as design, research, testing and manufacturing
- Engage in lifelong learning to maintain and enhance professional skills

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: Outline the basics of electrical machines and analyze the characteristics of DC machines. **CO2:** Understand and implement speed control techniques for practical applications.

CO3: Describe the working of transformer and assess its regulation and efficiency on load and no-load.

CO4: Know the working concept of different types of induction motor and analyze the operating behavior of induction motor using its performance indices.

CO5: Explain the basics of synchronous machines and interpret performance characteristics. **CO6:** Relate how different special electrical machines are functioning and have knowledge to

Choose particular machines for their applications.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2	S	M										
CO3	S		M									
CO4	S											
CO5	S		M									
CO6												

Course Assessment methods:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT – I D.C. AND A.C CIRCUITS **6**

Ohm's law – Kirchoff's Laws, V – I Relationship of Resistor (R) Inductor (L) and capacitor (C). Series parallel combination of R, L&C – Current and voltage source transformation – mesh current & node voltage method –superposition theorem – Thevenin's and Norton's Theorem - Problems.

UNIT – II ELECTRICAL MACHINES **6**

Construction, principle of operation, Basic Equations and applications - D.C.Generators and D.C.Motors**.** -Single phase Induction Motor - Single Phase Transformer.

UNIT – III BASIC MEASURMENT SYSTEMS **6**

Introduction to Measurement Systems, Construction and Operating principles of PMMC,
Moving Iron, Dynamometer Wattmeter, power measurement by three-watt meter and two watt method – and Energy meter.

UNIT IV – SEMICONDUCTOR DEVICES **6**

Basic Concepts of semiconductor devices – PN Junction Diode Characteristics and its Application – HWR, FWR – Zenger Diode – BJT (CB, CE, CC) configuration & its characteristics.

UNIT V – DIGITAL ELECTRONICS **6**

Number system – Logic Gates – Boolean algebra – De-Morgan's Theorem – Half Adder & Full Adder – Flip Flops.

Total No. of Periods: 30

TEXT BOOKS:

1. N.Mittle "Basic Electrical Engineering". Tata McGraw Hill Edition, New Delhi, 1990.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation',Dhanpat Rai and Co, 2004.
3. Jacob Millman and Christos C-Halkias, "Electronic Devices and Circuits", Tata McGraw Hill

REFERENCE BOOKS:

1. Edminister J.A. "*Theory and problems of Electric Circuits*" Schaum's Outline Series. McGraw Hill Book Company, 2nd Edition, 1983.
2. Hyatt W.H and Kemmerlay J.E. "*Engineering Circuit Analysis*", McGraw Hill International Editions, 1993.
3. D. P. Kothari and I. J. Nagrath "Electric machines" Tata McGraw-Hill Education, 2004
4. Millman and Halkias, "Integrated Electronics", Tata McGraw Hill Edition, 2004

BEC101 BASIC ELECTRONIC ENGINEERING

L	T	P	C
2	0	0	2

Course Objective:

- Develop the fundamental knowledge about the need for biasing and its various methods.
- Analyze the small signal equivalents circuits and high frequency analysis of BJT and FET.
- Examine the characteristics of multistage amplifiers.
- Classify and compare the types of large signal amplifier.

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: Discuss the concepts of various biasing methods for BJT.

CO2: Analyze the BJT configurations and BJT amplifiers using small signal model.

CO3: Analyze the FET Biasing concepts, FET and MOSFET amplifier small signal analysis

CO4: Analyze the frequency response of BJT, FET and multistage amplifiers

CO5: Explain the classification and performance of large signal amplifiers.

CO/PO Mapping												
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	W										
CO2	W											
CO3	S	M	M									
CO4	M	W										
CO5	M	W	W									

Course Assessment methods:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT – I D.C. AND A.C CIRCUITS **6**

Ohm's law – Kirchoff's Laws, V – I Relationship of Resistor (R) Inductor (L) and capacitor (C). Series parallel combination of R, L&C – Current and voltage source transformation – mesh current & node voltage method –superposition theorem – Thevenin's and Norton's Theorem - Problems.

UNIT – II ELECTRICAL MACHINES **6**

Construction, principle of operation, Basic Equations and applications - D.C.Generators and D.C.Motors**.** -Single phase Induction Motor - Single Phase Transformer.

UNIT – III BASIC MEASURMENT SYSTEMS **6**

Introduction to Measurement Systems, Construction and Operating principles of PMMC,

Moving Iron, Dynamometer Wattmeter, power measurement by three-watt meter and two watt method – and Energy meter.

UNIT IV – SEMICONDUCTOR DEVICES **6**

Basic Concepts of semiconductor devices – PN Junction Diode Characteristics and its Application – HWR, FWR – Zenger Diode – BJT (CB, CE, CC) configuration & its characteristics.

UNIT V – DIGITAL ELECTRONICS **6**

Number system – Logic Gates – Boolean algebra – De-Morgan's Theorem – Half Adder & Full Adder – Flip Flops.

Total No. of Periods: 30

TEXT BOOKS:

1. N.Mittle "Basic Electrical Engineering". Tata McGraw Hill Edition, New Delhi, 1990.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.
3. Jacob Millman and Christos C-Halkias, "Electronic Devices and Circuits", Tata McGraw Hill

BCS1L1 COMPUTER PRACTICES LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES:

- To develop graphical skills in students for communication of concepts, design ideas of engineering products, and expose them to existing standards related to technical drawings.
- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying computer science.

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: To visualize and produce two dimensional graphic representation of three dimensional objects and buildings.
CO2: To comprehend and visualize 3D views of objects.
CO3: To understand and generate the different curves used in engineering applications.
CO4: To learn and write program in "C".
CO5: To introduce the fundamental of CAD Graphics used in design.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	W	W					M	M		
CO2	S	M	W	W					M	M		
CO3		M							M	M		
CO4	M			W					M	M		
CO5					S				M	M		

Course Assessment methods:

DIRECT		INDIRECT	
1.	Observation Books	**1.**	Students Exit Survey
2.	Lab Records	**2.**	Faculty Survey
3.	Model Examination	**3.**	Industry
4.	Viva Voce	**4.**	Alumni

5.	End Semester Exam		

LIST OF EXPERIMENT

A) Word Processing **11**

Document creation, Text manipulation with Scientific Notations.
Table creation, Table formatting and Conversion.
.Mail merge and Letter Preparation. Drawing-Flow Chart

B) Spread Sheet **12**

Chart – Line, XY, Bar and Pie.
Formula – Formula Editor.
Spread Sheet-Inclusion of Object, Picture and Graphics, Protecting the document and sheet. Sorting and Import / Export features.

C) Simple C Programming * **11**

Data types, Expression Evaluation, Condition Statements.
Arrays
Structures and Unions
Functions

D) Simple C++ Programming **11**

13. Classes and Objects
14. Constructor and Destructor

*For Programming exercises Flow chart and Pseudo code are essential
Total: 45 Periods

BEEL1 **BASIC ELECTRICAL AND ELECTRONICS ENGG. PRACTICES LABORATORY**

L	T	P	C
0	0	3	1

Course Objective:

- To impart basic knowledge on electrical machines, principles and its operation.
- Be a practicing engineer in fields such as design, research, testing and manufacturing
- Engage in lifelong learning to maintain and enhance professional skills

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: Outline the basics of electrical machines and analyze the characteristics of DC machines. **CO2:** Understand and implement speed control techniques for practical applications.

CO3: Describe the working of transformer and assess its regulation and efficiency on load and no-load.

CO4: Know the working concept of different types of induction motor and analyze the operating behavior of induction motor using its performance indices.

CO5: Explain the basics of synchronous machines and interpret performance characteristics. **CO6:** Relate how different special electrical machines are functioning and have knowledge to Choose particular machines for their applications.

CO/PO Mapping									

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M			M					M	M		
CO2	M		W						M	M		
CO3	M		W						M	M		
CO4	M		M						M	M		

Course Assessment methods:

DIRECT		INDIRECT	
1.	Lab Observation Book	**1.**	Students Exit Survey
2.	Lab Record Book	**2.**	Faculty Survey
3.	Model Examination	**3.**	Industry
4.	Viva Voce	**4**	Alumni
5.	End Semester Examination		

LIST OF EXPERIMENTS

I - List of Experiments for Electrical Engineering Lab

1. Fluorescent lamp wiring
2. Stair case wiring
3. Measurement of electrical quantities-voltage current, power & power factor circuit
4. Residential house wiring using fuse, switch, indicator, lamp and energy meter
5. Measurement of energy using single phase energy meter
6. Measurement of resistance to earth of electrical equipment

I - List of Experiments for Electronics Engineering Lab

1. Study of electronic components and equipments.
   A. Resistor color coding using digital multi-meter.
   B. Assembling electronic components on bread board.
2. Measurement of ac signal parameters using cathode ray oscilloscope and function generator.
3. Soldering and disordering practice.
4. Verification of logic gates (OR, AND, OR, NOT, NAND, EX-OR).
5. Implementation of half adder circuit using logic gates.

SEMESTER II

L	T	P	C
3	0	0	3

BEN201 ENGLISH II

OBJECTIVES:

- To make the students learn the basics of communication in order to talk fluently, confidently and vividly.
- Students will be able to use strategies before, during, and after reading to aid in the construction and enhancement of meaning
- Students will be able to respond in discussions and in writing, using personal, literal, interpretative, and evaluative stances, to works of fiction and/or non-fiction.
- Students will be able to identify and explain the function of essential short story elements in the writer's craft (i.e. character, setting, conflict, plot, climax, resolution, theme, tone, point of view).

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: To make them master the techniques of professional communication so that they become employable after completing the course

CO2: Students will be able to engage in informal writing assignments (i.e. reader response, free writing, focused free writing, prediction, response journals, dialectical notebook entries, and other pieces of writing that they do not take through the entire writing process).

CO3: Students will be able to engage in formal writing assignments that require utilization of all stages of the writing process.

CO4: Students will be able to choose and use a relevant pre-writing strategy that will help them to prepare for the assignment.

CO5: Students will be able to write several rough drafts of a paper to revise clarity and depth of content or to edit style and mechanics.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M		M	W				M	W		
CO2	M		M	M	S				M	S		
CO3	S	M		S	M				S	M		
CO4	S	M		M	M				M	M		
CO5	S	M		M	S				M	S		
CO6	S		M	M	S				M	S		

Course Assessment methods:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey

2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I Orientation 9 + 3

Numerical adjectives - Meanings in context - Same words used as different parts of speech - Paragraph writing - Non- verbal communication - Regular and Irregular verbs.

UNIT II Oral Skill 9 + 3

Listening to audio cassettes - C.Ds, News bulletin - Special Lectures, Discourse - Note taking - Sentence patterns - SV, SVO, SVC, SVOC, SVOCA - Giving Instructions - Reading Comprehension and answering questions. Inferring meaning.

UNIT III Thinking Skill 9 + 3

Self- introduction - Describing things - Group Discussion – Debate - Role play – Telephone etiquette – Recommendations and suggestions – Sequencing jumbled sentences to make a paragraph - advertisement and notices, designing or drafting posters, writing formal and informal invitations and replies.

UNIT IV Writing Skill 9 + 3

Definitions - Compound nouns - Abbreviations and acronyms - business or official letters(for making enquiries, registering complaints, asking for and giving information, placing orders and sending replies): (b) letters to the editor(giving suggestions on an issue) .

UNIT V Formal Information 9 + 3

Editing – Prepositions - Articles - Permission letter for undergoing practical training , Essay writing - Application for a job , letter to the principal authorities regarding admissions, other issues, requirement or suitability of course etc.

Total: 60 periods

TEXT BOOK:

Meenakshi Raman, Sangeetha Sharma, Technical English for communication: Principle of practice, OUP, 2009.

REFERENCE BOOKS:

1. Sumanth, English for engineers, Vijay Nicole, Imprints pvt ltd.2013.
2. Meenakshi Raman and SangeethaSharma, Technical Communication Principles and Practice, Oxford University Press, 2009.
3. Sangeetha Sharma, Binodmishra, Communication skills for engineers and scientists, PHI Learning Pvt Ltd, NewDelhi, 2010.

BMA201 **MATHEMATICS -II**

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few numerical methods and Give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- Recognize that mathematics is an art as well as a powerful foundational tool of science with limitless applications.
- Demonstrate an understanding of the theoretical concepts and axiomatic underpinnings of mathematics and an ability to construct proofs at the appropriate level.

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: Solve a set of algebraic equations representing steady state models formed in engineering problems

CO2: Fit smooth curves for the discrete data connected to each other or to use interpolation methods over these data tables

CO3: Find the trend information from discrete data set through numerical differentiation and summary information through numerical integration

CO4: Predict the system dynamic behavior through solution of ODEs modeling the system

CO5: Solve PDE models representing spatial and temporal variations in physical systems through numerical methods.

CO6: Have the necessary proficiency of using MATLAB for obtaining the above solutions

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M		M	W							
CO2	M		M	M	S							
CO3	S	M		S	M							
CO4	S	M		M	M							
CO5	S	M		M	S							
CO6	S		M	M	S							

Course Assessment methods:

DIRECT	INDIRECT

1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I Ordinary Differential Equation 9+3

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Cauchy's and Legendre's linear equations - simultaneous first order linear equations with constant coefficients.

UNIT II Vector Calculus 9+3

Gradient, divergence and curl –Directional derivatives – Irrigational and solenoid vector fields – vector integration– Green's theorem in a plane , Gauss divergence theorem and Stake's theorem (without proofs) – simple applications involving cubes and rectangular parallelepipeds.

UNIT III Analytic Functions 9+3

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equation and sufficient conditions (without proofs) – Harmonic and orthogonal properties of analytic functions – Harmonic conjugate – construction of analytic functions – conformal mapping: W= Z+C, CZ, 1/Z and bilinear transformation.

UNIT IV Complex Integration 9+3

Complex integration – Statement and application of Cauchy's integral theorem and Cauchy's integral formula – Taylor and Laurent expansions – Singular points – Residues – Residue theorem – Application of Residue theorem to evaluate real integrals – Unit circle and semi-circular contour (excluding poles on boundaries).

UNIT V Statistics 9+3

Mean, Median, Mode – Moments – Scenes and Kurtosis – Correlation – Rank Correlation – Regression –Chi square test for contingency tables.

Total: 60 Periods

TEXT BOOK:

1. 1. R.M.Kannan and B.Vijayakumar "Engineering Mathematics – II " 2nd Edition, SRB Publication, Chennai 2007.
2. Bali.N.P and Manish Goyal, "Engineering Mathematics ", 3rd Edition, Laxmi Publications (p) Ltd, 2008.
3. Grewal .B/S " Higher Engineering Mathematics" , 40th Editon , Khanna Publications , Delhi , 2007 .

REFERENCES:

1. Ramana.B.V, "Higher Engineering Mathematics ", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Gupta SC, and VK.Kapoor, "Fundamentals Mathematical Statistics", 11th edition, Sultan Chand Sons, New Delhi, 2014.

BPH 201 **ENGINEERING PHYSICS -II**

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few basic science technology and give procedures occurring in engineering and technology.
- Identify a problem and generate equivalent statements of a problem
- Apply fundamental statistical methods to analyze data

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: To make a bridge between the physics in school and engineering courses.

CO2: To impart a sound knowledge on the basic concepts of modern sciences like engineering applications of ultra-sonics, lasers, fundamentals of crystal physics and utility of solar energy.

CO3: Draw sound conclusions from the results of data analysis.

CO4: Produce precise and clear expository written material about physics

CO5: Produce well-organized and clear oral presentations of physics material.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M		M	W							
CO2	M		M	M	S							
CO3	S	M		S	M							
CO4	S	M		M	M							
CO5	S	M		M	S							
CO6	S		M	M	S							

Course Assessment methods:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT – I Conducting Materials **9**

Classical Free Electron Theory of Metals- Drawback of Classical Theory – Wiedemann Franz Law- Density of States- Fermi-Dirac Statistics- Calculation of Fermi Energy and Its Importance - High Resistivity Alloys – Super Conductors – Properties and Applications – Magnetic Levitation, SQUIID,Cryotron.

UNIT – II Semiconducting Materials **9**

Elemental and Compound Semiconductors and Their Properties- Carrier Concentrations (Electrons and Holes) In Intrinsic Semiconductors - Carrier Concentrations in N- Type and P-Type Semiconductors –Variation of Fermi Level and Carrier Concentration With Temperature - Variation of Conductivity With Temperature – Band Gap Determination – Hall Effect – Experimental Arrangement - Application.

UNIT-III Magnetic and Dielectric Materials **9**

Different Type of Magnetic Material And Their Properties – Hard And Soft Magnetic Material – Domain Theory Of Ferromagnetism – Hysteresis – Energy Product of Magnetic Materials – Ferrites and Their Applications – Various Polarization Mechanisms In Dielectric – Frequency and Temperature Dependence – Internal Field and Detection of Classius – Mosotti Equation – Dielectric Loss- Dielectric Breakdown.

UNIT- IV New Engineering Material **9**

Shape memory Alloys- Types- General Characteristics- Applications – Metallic Glasses- Properties- Applications –transformer as a Core Material – Nano Phase Materials – Properties – Production – Ball Milling Technique – Sol- Gel Method – Chemical Vapour Deposition - Applications.

UNIT-V Optical Materials and Optical Fibers **9**

Light Interaction With Solids- Classification of Optical Material – Optical Properties of Metals, Insulator And Semiconductors – Traps – Colour Centers – Luminescence – phosphorescence – LED – LCD – Construction and Working – Advantages and Disadvantages – Applications. Principle and Propagation of Light In Optical Fibers - Numerical Aperture And Acceptance Angle- Types Optical Fibers (Material, Refractive Index, Mode based) - Double Crucible Technique of Fiber Drawing.

Total: 45 Periods

TEXT BOOKS

1. "Science of engineering materials", by Dr. A.Mukunthan and S.Usha – SciTech publications (India) Pvt Ltd; Chennai, (2007).
2. Charless Kittel 'introduction to solid state physics', john wiley & sons, 7th edition, singpore

REFERENCEBOOKS

1. Material science by r.suresh, v. jayakumar – lakshmi publications; arapakkam (2006).
2. Material science by Dr. P. K. Palanisamy – Scietech publications (India) Pvt Ltd, chennai (2006).
3. Rajendran V and Marikani a, 'material science' Tata McGraw hill publications Ltd, 3rd edition, New Delhi (2004).
4. M.Arumugam, 'material science', anuradha publications, kumbakonam (2006).

BCH 201 ENGINEERING CHEMISTRY -II

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart a sound knowledge on the principles of chemistry involving the different application

oriented topics required for all engineering branches.

- To prepare graduates for employment as chemists, for graduate study in chemistry, or for acceptance to medical or dental school.
- To prepare graduates with the skills to critically assess and solve problems requiring the application of chemical principles.

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: To make the student to be conversant with the principles, water characterization and treatment for portable and industrial purposes.

CO2: To impart knowledge on the essential aspects of Principles of polymer chemistry and engineering applications of polymers

CO3: To impart knowledge on the essential aspects of Principles electrochemistry, electrochemical cells, emf and applications of emf measurements

CO4: To make the students understand the Principles of corrosion and corrosion control

CO5: To impart knowledge about the Conventional and non-conventional energy sources and energy storage devices

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M		M	W							
CO2	M		M	M	S							
CO3	S	M		S	M							
CO4	S	M		M	M							
CO5	S	M		M	S							
CO6	S		M	M	S							

Course Assessment methods:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I - Surface Chemistry **9**

Introduction **:** Adsorption , absorption , desorption , adsorbent , adsorbate and sorption – (definition only) Differences between adsorption and absorption Adsorption of gases on solids –

factors affecting adsorption of gases on solids – Adsorption isotherms – Frendlich adsorption isotherm and Langmuir adsorption isotherm Role of adsorbents in catalysis, Ion-exchange adsorption and pollution abatement.

UNIT II - Phase Rule and Alloys **9**

Introduction **:**Statement of Phase Rule and explanation of terms involved – one component system – water system – Construction of phase diagram by thermal analysis - Condensed phase rule [Definition only] Two Component System : Simple eutectic systems (lead-silver system only) – eutectic temperature – eutectic composition – Pattinsons Process of desilverisation of Lead Alloys : Importance, ferrous alloys – nichrome and stainless steel – 18/8 stainless steel -heat treatment of steel – annealing –hardening – tempering -normalizing – carburizing - nitriding . Non- ferrous alloys: Brass and Bronze

UNIT III - Analytical Techniques **9**

Introduction: Type of Spectroscopy - Atomic spectroscopy – molecular spectroscopy - Explanation IR spectroscopy – principles – instrumentation (block diagram only) – applications - finger print region UV- visible spectroscopy — principle – instrumentation (block diagram only) – Beer-Lambert's law- – estimation of iron by colorimetry – Atomic absorption spectroscopy- principle - instrumentation (block diagram only) - estimation of Nickel by Atomic absorption spectroscopy Flame photometry– principles – instrumentation (block diagram only) - estimation of sodium ion by Flame photometry

UNIT IV - Fuels **9**

Introduction **:** Calorific value – types of Calorific value - gross calorific value – net calorific value Analysis of Coal –- Proximate and ultimate analysis – hydrogenation of coal - Metallurgical coke – manufacture by Otto- Hoffmann method Petroleum processing and fractions – cracking – catalytic cracking – types – fixed bed catalytic cracking method- Octane number and Cetane number (definition only) Synthetic petrol – Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG (definition and composition only) Flue gas analysis – importance - Orsat apparatus

UNIT V Engineering Materials **9**

Introduction : Refractories – classification – acidic, basic and neutral refractories – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) Manufacture of Refractories :alumina bricks and Magnesite bricks, Abrasives – natural and synthetic abrasives Natural type : Siliceous - quartz ; Non –siliceous – diamond Synthetic Abrasives : silicon carbide and boron carbide. Lubricants: Liquid lubricants - Properties – viscosity index, flash and fire points, cloud and pour points, oiliness) Solid lubricants – graphite and molybdenum sulphide

TOTAL: 45 PERIODS

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, "Engineering Chemistry, Volume 1", Crystal Publications, Chennai, (2007).

REFERENCES:

1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).

BBT102 BIOLOGY FOR ENGINEERS

L	T	P	C
3	0	0	3

Course Aim:
To provide a basic understanding of biological mechanisms and their applications from the perspective of engineers

Course Objectives:

The Students will be able to

- To understand the fundamentals of living things, their classification, cell structure and biochemical constituents
- To apply the concept of plant, animal and microbial systems and growth in real life situations
- To comprehend genetics and the immune system
- To know the cause, symptoms, diagnosis and treatment of common diseases
- To give a basic knowledge of the applications of biological systems in relevant industries

Course Outcomes:

CO1: Student will understand the fundamentals of living things and their Classification.
CO2: Able to apply biological concept in real life situation.
CO3: Will have the basic knowledge in application of biological system in relevant industries.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COS/POS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4												
CO5												

Course Assessment Method

Direct	**Indirect**
Internal Test	Student Exit Survey
Assignments	Faculty Survey
Seminar	Industry
Quiz	Alumni
Online Test	
End Semester Examination	

UNIT-I Introduction to Life **7**

Characteristics of living organisms-Basic classification-cell theory-structure of prokaryotic and eukaryotic cell-Introduction to biomolecules: definition-general classification and important functions of carbohydrates-lipids-proteins-nucleic acids vitamins and enzymes-genes and chromosome.

UNIT-II Biodiversity **6**

Plant System: basic concepts of plant growth-nutrition-photosynthesis and nitrogen fixation-Animal System: elementary study of digestive-respiratory-circulatory-excretory systems and their functions-Microbial System: history-types of microbes-economic importance and control of microbes.

UNIT-III Genetics and Immune System

Evolution: theories of evolution-**Mendel's** cell division**–**mitosis and meiosis-evidence of e **laws of inheritance**-variation and speciation- nucleic acids as a genetic material-central dogma immunity-antigens-antibody-immune response.

UNIT-IV Human Diseases **4**

Definition- causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertention, influenza, AIDS and Hepatitis

UNIT-V Biology and its Industrial Application **8**

Transgenic plants and animals-stem cell and tissue engineering-bioreactors-biopharming-recombinant vaccines-cloning-drug discovery-biological neural networks-bioremediation-biofertilizer-biocontrol-biofilters-biosensors-biopolymers-bioenergy-biomaterials-biochips-basic biomedical instrumentation

Total: 45 Periods

Text Books:

1. A Text book of Biotechnology, R.C.Dubey, S. Chand Higher Academic Publications, 2013

2. Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 2011

3. Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004

Reference Books

1. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011

2. Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008

3. Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers, 2012

BCS 201 COMPUTER GRAPHICS - II

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying computer science.

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: To visualize and produce two dimensional graphic representation of three dimensional objects and buildings.
CO2: To comprehend and visualize 3D views of objects.
CO3: To understand and generate the different curves used in engineering applications.
CO4: To learn and write program in "C".
CO5: To introduce the fundamental of CAD Graphics used in design.

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M		M	W				S	M		
CO2	M		M	M	S				M		M	
CO3	S	M		S	M				S	M		
CO4	S	M		M	M				S	M		
CO5	S	M		M	S				S	M		
CO6	S		M	M	S				S		M	

Course Assessment methods:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I Basic Curves, Projection of points and Straight lines 9

Conics-construction of ellipse, parabola and hyperbola by eccentricity method - construction of involutes of square and circle-Drawing of tangent and normal to the above curves-Scales-Basic drawing conventions and standards-Orthographic projection principles- Principal planes-First

angle projection- Projection of points. Projection of straight lines (only first angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method.

UNIT-II Projections of Planes and solids 9

Projection of planes (Polygonal and circular surfaces) inclined to both the principal planes. Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method

UNIT-III Orthographic Projections, Isometric projections & Free hand sketching 9

Orthographic projection of Simple parts from 3D diagram-Principles of isometric projection and isometric view-isometric scale- Isometric projections of simple solids and truncated solids- Prisms, pyramids, cylinders, cones.

UNIT-IV Projection of Sectioned solids and development of surfaces 9

Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other-obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids- Prisms, pyramids cylinders and cones.

UNIT-V Perspective projection, building drawing and Computer aided drafting 9

Perspective projection of cubes and cylinders by visual ray method. Introduction- components of simple residential or office building-specifications-plan and elevation of different types of Residential buildings and office buildings. Introduction to drafting packages and basic commands used in AUTO CAD. Demonstration of drafting packages. **Total: 45 Periods**

Text Books:

1. N.D.Bhatt and V.M.Panchal, "Engineering drawing", charotar publishing house, 50th edition, 2010.
2. K.V.Natarajan "A Text book of Engineering Graphics",Dhanalakshmi Publishers, Chennai, 2009.

References

1. K.R.Gopalakrishna, "Engineering drawing", (Vol -I & II combined) subhas stores, Bangalore, 2007.
2. K.Venugopal and V. PrabhuRaja, "Engineering Graphics", New age International Private limited, 2008.
3. Luzzader, Warren.J., and Duff, John.M.,, "Fundamentals of Engineering Drawing with an introduction to Interactive computer graphics for design and production", Eastern economy edition, Prentice Hall of India Pvt Ltd, New Delhi,2005

BCS 202 INTERNET PROGRAMMING AND WEB DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and

analyze computing systems.

- Graduates will have a solid understanding of the theory and concepts underlying computer science.

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: To enable the student to learn the major components of a computer system.

CO2: To know the correct and efficient way of solving problem.
CO3: To learn to use office automation tools.
CO4: To learn and write program in "C".
CO5: To impart knowledge about the Conventional and non-conventional energy sources and energy storage devices

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M		M	W							
CO2	M		M	M	S							
CO3	S	M		S	M							
CO4	S	M		M	M							
CO5	S	M		M	S							
CO6	S		M	M	S							

Course Assessment methods:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

Unit – I Basic Internet Concepts 6

Internet principles-IP addressing-Internet Service Provider (ISP)-URL-Basic web concepts-World Wide Web (WWW)-Intranet and Extranet-Internet Protocols: HTTP, TCP, UDP, FTP, Telnet-Domain Name System(DNS)-E mail-Next generation internet.

Unit-II Web Design Basics 6

Introduction to HTML – Structure of HTML Document – Tags-Headings – Links – Images – Lists – Tables – Forms – Frames - Style sheets and its types.

Unit-III Dynamic HTML 6

Introduction to Dynamic HTML-Object model and collections-Event model-Filters and transition-Data binding-Data control-Activex control.

Unit-IV Client and Server Side Programming 6

VB Script & Java Script: Introduction-Operators –Data type-Control structures-Looping – Classes and Objects – Arrays-Functions-Events-Example programs.

Unit-V Internet Applications 6

Online database-functions of online database-Merits and Demerits-Internet Information Systems (IIS)-EDI applications in business and its types-Internet commerce-Types and Applications.

Text Books:

1. Deitel, Deitel and Nieto, '' Internet and World Wide Web-How to program'', Pearson Education Publishers, 5th edition, 2008.
2. Elliott Rusty Harold , ''Java Network Programming'', O'Reilly Publishers,2010
3. JavaScript: A Beginners Guide John Pollock 4th Edition, TMH Edition (2013)
4. VB Script Beginners Guide, Jyoti B, Giramkar, Create Space Independent Publishing (2014)

References:

1. R.Krishnamoorthy& S.Prabhu, '' Internet and Java Programming'', New Age International Publishers, 2010.
2. Thomno A. Powell, ''The Complete Reference HTML and XHTML'', fourth edition, Tata McGraw Hill, 2012.
3. E Commerce Kamlesh K.Bajaj, DebjaniNag, Tata McGraw-Hill, Second edition, 2010

TOTAL: 30 Period

E201 BASIC CIVIL ENGINEERING

L	T	P	C
2	0	0	2

Course Objective:

- To impart basic knowledge on electrical machines, principles and its operation.
- Fulfilling lives by pursuing professional licensure, advanced studies, or alternate career paths.
- Meaningful work by applying their strong Civil Engineering, business, leadership, and communication skills to meet the expectations of their employers.
- Responsible citizenship by serving the Civil Engineering profession and their community locally, nationally, and internationally.

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: an ability to apply knowledge of mathematics, science, and engineering

CO2: ability to design and conduct experiments, as well as to analyze and interpret data

CO3: an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

CO4: K an ability to function on multidisciplinary teams

CO5: ability to identify, formulate, and solve engineering problems
CO6: an understanding of professional and ethical responsibility

CO/PO Mapping												
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2	S	M										
CO3	S		M									
CO4	S											
CO5	S		M									
CO6												

Course Assessment methods:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I Basic Curves, Projection of points and Straight lines 9

Conics-construction of ellipse, parabola and hyperbola by eccentricity method - construction of involutes of square and circle-Drawing of tangent and normal to the above curves-Scales-Basic drawing conventions and standards-Orthographic projection principles- Principal planes-First angle projection- Projection of points. Projection of straight lines (only first angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method.

UNIT-II Projections of Planes and solids 9

Projection of planes (Polygonal and circular surfaces) inclined to both the principal planes. Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method

UNIT-III Orthographic Projections, Isometric projections & Free hand sketching 9

Orthographic projection of Simple parts from 3D diagram-Principles of isometric projection and isometric view-isometric scale- Isometric projections of simple solids and truncated solids- Prisms, pyramids, cylinders, cones.

UNIT-IV Projection of Sectioned solids and development of surfaces 9

Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other-obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids- Prisms, pyramids cylinders and cones.

UNIT-V Perspective projection, building drawing and Computer aided drafting 9

Perspective projection of cubes and cylinders by visual ray method. Introduction- components of simple residential or office building-specifications-plan and elevation of different types of Residential buildings and office buildings. Introduction to drafting packages and basic commands used in AUTO CAD. Demonstration of drafting packages.

Total: 45 Periods

Text Books:

1. N.D.Bhatt and V.M.Panchal, "Engineering drawing", charotar publishing house, 50th edition, 2010.
2. K.V.Natarajan "A Text book of Engineering Graphics",Dhanalakshmi Publishers, Chennai, 2009.

References:

1. K.R.Gopalakrishna, "Engineering drawing",(Vol-I & II combined)Subhas stores, Bangalore,2007.
2. K.Venugopal and V. PrabhuRaja, "Engineering Graphics", New age International Private limited, 2008.
3. Luzzader, Warren.J., and Duff, John's.,, "Fundamentals of Engineering Drawing with an introduction to Interactive computer graphics for design and production", Eastern economy edition, Prentice Hall of India Pvt Ltd, New Delhi,2005

BME201 BASIC MECHANICAL ENGINEERING

L	T	P	C
2	0	0	2

Course Objectives:

- The program educational objectives (PEOs) for the mechanical-engineering program are to educate graduates who will be ethical, productive, and contributing members of society.
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- The ability to apply principles of engineering, basic science, and mathematics to design and realize physical systems, components, or processes

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: an ability to apply knowledge of mathematics, science, and engineering
CO2: ability to design and conduct experiments, as well as to analyze and interpret data.
CO3: To provide basic Knowledge of basic manufacturing process.
CO4: an ability to function on multi-disciplinary teams
CO5: ability to identify, formulate, and solve engineering problems

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			M								
CO2		S	M									
CO3	M		W									
CO4	M											
CO5	S		M									

Course Assessment methods:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I Energy Resources and Power Generation 6

Renewable and Non-renewable resources- solar, wind, geothermal, steam, nuclear and hide power plants- Layout, major components and working. Importance of Energy storage, Environmental constraints of power generation using fossil fuels and nuclear energy.

UNIT-II IC Engines 6

Classification, working principles of petrol and diesel engines- two stroke and four stroke cycles, functions of main components of I.C engine. Alternate fuels and emission control.

UNIT-III Refrigeration and Air-Conditioning System 6

Terminology of Refrigeration and Air-Conditioning, Principle of Vapor Compression & Absorption system- Layout of typical domestic refrigerator- window & Split type room air conditioner.

UNIT-IV Manufacturing Processes **6**

Brief description of Mould makes and casting process, Metal forming, Classification types of forging, forging operations, Brief description of extrusion, rolling, sheet forging, and drawing. Brief description of welding, brazing and soldering. Principal metal cutting processes and cutting tools, Brief description of Centre lathe and radial drilling machine.

UNIT-V Mechanical Design **6**

Mechanical properties of material-Yield strength, ultimate strength, endurance limit etc., Stress-Strain curves of materials. Stresses induced in simple elements. Factor of safety - Design of Shafts and belts. Types of bearings and its applications. Introduction to CAD/CAM/CIM & Mechatronics.

Total: 30 Periods

TEXT BOOKS:

1. T.J.Prabhu et al , "Basic Mechanical Engineering" , SciTech Publications(p) Ltd, 2000

REFERENCES:

1. NAGPAL, G.R, "Power plant Engineering", Khanna Publishers, 2004.
2. RAO.P.N, "Manufacturing Technology", Tata McGraw-Hill Education, 2000.
3. Kalpakjian, "Manufacturing Engineering and Technology", Adisso Wesley publishers, 1995.
4. Ganesan. V, "Internal combustion engines", Tata McGraw-Hill Education, 2000.
5. C.P.Arora, "Refrigeration and Air Conditioning", Tata McGraw-Hill Education, 2001.
6. V.B.Bhandari, "Design of Machine elements", Tata McGraw-Hill Education, 2010.

BCS2L1 INTERNET PRACTICES LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES:

- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying computer science.

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: To enable the student to learn the major components of a computer system.

DIRECT		INDIRECT	
1	Observation Books	**1.**	Students Exit Survey
2	Lab Records Book	**2.**	Faculty Survey
3	Model Examination	**3.**	Industry
4	Viva Voce	**4.**	Alumni
5	End Semester Exam		

CO2: To know the correct and efficient way of solving problem.
CO3: To learn to use office automation tools.
CO4: To learn and write program in "C".
CO5: To impart knowledge about the Conventional and non-conventional energy sources and energy storage devices

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	W	W					M	M		
CO2	S	M	W	W					M	M		
CO3		M							M	M		
CO4	M			W					M	M		
CO5					S				M	M		

Course Assessment methods:

LIST OF EXPERIMENTS

1. HTML (Hypertext Mark-up Language):

Basics of HTML.
How to create HTML Document
Steps for creating a simple HTML Program.
a) Favorite Personality b) Resume Preparation

2. Advanced HTML: Advanced Topics of HTML a) Time Table
b) Table Creation

3. JavaScript:

Script Basics.
Incorporating JavaScript into Web page.
a) Star Triangle

b) Temperature Converters

4. VBScript:

VBScript Basics.

Incorporating VBScript into HTML.

a) Changing Background Color b) Simple Calculator

5. Web Design:

Inserting External Media in the Web Page.

a) Forms and Links

b) Frames with Links and Lists

To export a Dream weaver Document as XML File, checking entries, working in frames, windows control, the java script URL.

Total: 45 Periods

BCM2L1

BASIC CIVIL AND MECHANICAL ENGG. PRACTICES LABORATORY

L	T	P	C
0	0	3	1

Course Objectives:

- The program educational objectives (PEOs) for the mechanical-engineering program are to educate graduates who will be ethical, productive, and contributing members of society.
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- The ability to apply principles of engineering, basic science, and mathematics to design and realize physical systems, components, or processes

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: an ability to apply knowledge of mathematics, science, and engineering
CO2: ability to design and conduct experiments, as well as to analyze and interpret data.
CO3: To provide basic Knowledge of basic manufacturing process.
CO4: an ability to function on multi-disciplinary teams
CO5: ability to identify, formulate, and solve engineering problems

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M			M					M	M		
CO2	M		W						M	M		
CO3	M		W						M	M		
CO4	M		M						M	M		
CO5	M		M	S					S	S		

Course Assessment methods:

DIRECT		INDIRECT	
1	Observation Books	**1.**	Students Exit Survey
2	Lab Records Book	**2.**	Faculty Survey
3	Model Examination	**3.**	Industry
4	Viva Voce	**4.**	Alumni
5	End Semester Exam		

L

LIST OF EXPERIMENTS

CIVIL ENGINEERING PRACTICE

Buildings:

Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in household fittings.

b) Study of pipe connections requirements for pumps and turbines.

c) Preparation of plumbing line sketches for water supply and sewage works.

d) Hands-on-exercise: Basic pipe connection of PVC pipes &G.I. Pipes – Mixed pipe material connection – Pipe connections with different joining components.

e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Hand tools and Power tools:

a) Study of the joints in roofs, doors, windows and furniture.

b) Hands-on-exercise: Wood work, joints by sawing, planning and cutting. c) Preparation of half joints, Mortise and Tenon joints.

II MECHANICAL ENGINEERING PRACTICE

Weldin g: Preparation of butt joints, lap joints and tee joints by arc welding.

Basic Machining:

a) Simple Turning and Taper turning

b) Drilling Practice

Sheet Metal Work:

a) Forming & Bending:

b) Model making – Trays, funnels, etc.

c) Different type of joints.

d) Preparation of air-conditioning ducts

Machine assembly practice:

a) Assembling, dismantling and Study of centrifugal pump

b) Assembling, dismantling and Study of air conditioner

c) Assembling, dismantling and Study of lathe.

TOTAL: 45 PERIODS

BPC2L1

PHYSICS AND CHEMISTRY LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES:

- To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.
- To prepare graduates for employment as chemists, for graduate study in chemistry, or for acceptance to medical or dental school.
- To prepare graduates with the skills to critically assess and solve problems requiring the application of chemical principles.

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: To make the student to be conversant with the principles, water characterization and treatment for portable and industrial purposes.

CO2: To impart knowledge on the essential aspects of Principles of polymer chemistry and engineering applications of polymers

CO3: To impart knowledge on the essential aspects of Principles electrochemistry, electrochemical cells, emf and applications of emf measurements

CO4: To make the students understand the Principles of corrosion and corrosion control

CO5: To impart knowledge about the Conventional and non-conventional energy sources and energy storage devices

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M			M					M	M		
CO2	M		W						M	M		
CO3	M		W						M	M		
CO4	M		M						M	M		

Course Assessment methods:

DIRECT		INDIRECT	
1	Observation Books	**1.**	Students Exit Survey
2	Lab Records Book	**2.**	Faculty Survey
3	Model Examination	**3.**	Industry
4	Viva Voce	**4.**	Alumni
5	End Semester Exam		

LIST OF EXPERIMENTS

I. CIVIL ENGINEERING I - LIST OF EXPERIMENTS – PHYSICS

1. Determination of particle size using laser
2. Determination of wavelength of laser light
3. Determination of numerical aperture and acceptance angle of an optical fiber
4. Study of photo electric effect
5 Determination of velocity of sound and compressibility of liquid-ultrasonic
6. Determination of wave lengths of mercury spectrum - spectrometer grating

LIST OF EXPERIMENTS – CHEMISTRY

II -

1. Estimation of hardness of Water by EDTA
2. Estimation of Copper in brass by EDTA
3. Determination of DO in water (Winkler's method)
4. Estimation of Chloride in Water sample (Argento metry)
5. Estimation of alkalinity of Water sample
6. Determination of molecular weight and degree of polymerization using Viscometer.

SEMESTER III

BCS301 DATA STRUCTURES & ALGORITHMS Using C++ PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide a good understanding of the fundamental data structures used in computer science
- To provide a good understanding of how several fundamental algorithms work, particularly
- those concerned with sorting, searching and graph manipulation
- To educate on the space and time efficiency of most algorithms
- To educate on design o f new algorithms or modify existing ones for new applications
- To introduce graph algorithms

Course Outcomes After successful completion of this course, the students should be able to

CO1: Explain the Basic concepts of object oriented programming using c++

CO2: Illustrate the concept of Fundamental algorithms.

CO3: Build applications using graph algorithms.

CO4: Make use of Applet classes for designing GUI.

CO5: Develop solution for problems using server side programming.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		M										
CO3	M				M							
C04		M										
CO5		M			M							

Assessment method:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT -I

9

Basic concepts of object oriented programming-Benefits of OOP‘s-Application of OOPs-Structure of C++ program-Basic Data type, Derived Data type, User defined data type, Operators in C++,Control Statements, inline function, function Overloading-Specifying a class, defining member function, nesting of member function, array of object-friend function-constructor-parameterized constructor, copy of constructor, destructor.

UNIT-II

9

Defining operator overloading-overloading unary operator- overloading binary operator rules for operator overloading-inheritance-single inheritance-multilevel inheritance multiple inheritance-hierarchal inheritance-hybrid inheritance-virtual base class – polymorphism-pointer-pointer to pointer, pointer to object -virtual function –pure virtual function.

UNIT -III **9**

Introduction to Arrays- -Linear arrays-representation of linear arrays in memory –Traversing linear arrays-Sorting-Linear Search-Binary Search-Multidimensional Array-pointers Records-Representation of records in memory-Matrices-Sparse matrices.

UNIT-IV **9**

I*n*troduction to Linked list-Representation of Linked List in memory-Traversing a linked list-Searching a linked list-memory allocation- insertion and deletion in linked list implementation of stack using array and linked representation-An application of Stack recursion-Queues-linked representation of queues.

UNIT-V **9**

Introduction to Trees- -Binary trees-Types of Binary trees-Representation of binary trees, Binary tree Traversal-Binary search trees- Searching & Insertion in binary search trees.

TOTAL: 45 PERIODS

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TEXT BOOK:

1.Data Structures Using C and C+ Yedidyah Langsam, Moshe J. Augenstein, Aaron M. Tenenbaum PHI Learning Private Learning, 2011
2. Data Structures Using C & C++ Paperback – 1 Jul 2009 by Rajesh K. Shukla
3. Data Structures-Seymour LIpschurtz-Tata McGraw Hill-2006 (Adapted by GA V PAS)

REFERENCE BOOKS:

1. Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition.2007.
2. Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson 2006

BEE301 **CIRCUIT ANALYSIS**

L	T	P	C
3	1	0	4

OBJECTIVES:

- To introduce electric circuits and its analysis

- To impart knowledge on solving circuits using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To educate on obtaining the transient response of circuits.
- To Pharos diagrams and analysis of three phase circuits

Course Outcomes After successful completion of this course, the students should be able to

CO1: Analyze and design a bias stability and frequency response of amplifiers.

CO2: Design power amplifier, differential amplifier and how to implement them in electronic circuits

CO3: Understand the working of various types of amplifiers, oscillators, wave shaping and power supply circuits for any practical situation

CO4: Identify, formulate, and solve problems in the practice of electronics engineering using appropriate theoretical and experimental methods

CO5: Use modern engineering tools and techniques in the practice of circuit analysis

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S						W					
CO2	M		S									
CO3	S		M									
CO4			S									
CO5					S		M					

Assessment method:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		

6.	End Semester Exam		

UNIT-I D.C. CIRCUIT ANALYSIS 9

Ohm's law – Ideal voltage and current sources – Independent sources – Dependent sources Source transformation- Circuit elements – Kirchhoff's Laws – Voltage and Current division in series and parallel circuits, Network reduction – Mesh and Nodal analysis with voltage and current sources – Circuit theorems:- Superposition, Thevenin's, Norton's, Reciprocity and Maximum Power Transfer – – Delta to Star and Star to Delta transformation .

UNIT-II A.C.CIRCUIT FUNDAMENTALS AND ANALYSIS 10

Sinusoidal voltage and current – RMS value – Form factor – Phasor representation of sinusoidal of voltages –Current and Voltage relationship in R, L, and C circuits – Impedance and admittance, power factor concepts in RC, RL and RLC circuits – Impedance combinations – Real power, reactive power, complex power, apparent power – Analysis of simple series and parallel circuits .

UNIT-III RESONANCE IN A.C CIRCUITS 9

Resonance in series and parallel circuits –Frequency Variation-Inductance Variation-Capacitance Variation- Half power frequencies – Selectivity-Q-Factor-Bandwidth- Resonance in all frequencies-Magnitude & Phase plots.

UNIT-IV COUPLED CIRCUITS 8

Self Inductance-Mutual Inductance – Dot convention – Coefficient of coupling –Equivalent Circuit of Coupled Coils-Coupled Circuits in Series and Parallel-Tuned Coupled Circuits-Doubled Tuned Circuits.

UNIT-V TRANSIENT ANALYSIS OF FIRST AND SECOND ORDER LINEAR CIRCUITS 9

Source free RC and RL Circuit responses – Step response of RC and RL circuits – source free RLC series and parallel circuit responses – Step responses of RLC series and parallel circuits
– Responses of RC, RL and RLC series circuits to sinusoidal excitation.

TOTAL: 60 PERIODS

TEXT BOOKS

1. HAYT, Jr.W.H. Kemmerly, J.E., and Durbin, S.M., "Engineering Circuit Analysis", Tata McGraw-Hill, 2002.
2. Edminister, J.A. and Nahvi, M., "Electric Circuits", 4th Edition, Schaum's Outline series, McGraw-Hill, 2002.

REFERENCE BOOKS

1. Boylsted, R.L., "Essentials of Circuit Analysis", Prentice Hall, 2003.
2. Alexander, C.K., Matthew, N.O., and Sadiku, "Fundamentals of Electric Circuits", Tata McGraw- Hill, 2003. Decarlo, R.A. and Lin, P.M., "Linear Circuit Analysis", Oxford University Press, 2001.

BEE302 ELECTRICAL MACHINES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the principles of operations of DC machines as motor and generator
- To introduce the principles of operations of Transformers
- To introduce the principles of operations of Induction machines
- To introduce the principles of operations of Synchronous machines
- To introduce other special machines

Course Outcomes After successful completion of this course, the students should be able to

CO1: Design and conduct performance experiments, as well as to identify, formulate and solve machine related problems.

CO2: Analyze and describe aspects of the construction, principle of operation, applications and methods of speed control

CO3: Describe the construction, application and operation of single phase and three phase transformers

CO4: Understand the basic concepts and working of switches and relays.

CO5: Identify suitable motors for industrial applications.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S						W					
CO2		M	S									
CO3	S		M									
CO4			S									
CO5		S					M					

Assessment method:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT- I D.C. MACHINES 9

Construction of D.C. Machines, Principle of operation of D.C. generator, EMF equation, Characteristics of D.C. generators, Armature reaction, Commutation. Principle of operation of D.C. motor, Types, Torque equation, Characteristics, Starters, Speed control of D.C. motors.

UNIT- II TRANSFORMERS 9

Principle, Theory of ideal transformer, EMF equation, Construction details of shell and core type transformers, Tests on transformers, Equivalent circuit, Pharos diagram, Regulation and efficiency of a transformer. Introduction to three phase transformer connections.

UNIT-III SYNCHRONOUS MACHINES 9

Alternator - Construction and principle of operations Equation of induced EMF and Vector Diagram-Voltage regulation; Synchronous motor - Starting methods, Torque, V -curves, Speed control and Hunting.

UNIT-IV INDUCTION MACHINES 9

Induction motor, Construction and principle of operation, Classification of induction Motor, Torque equation , Condition for maximum torque, Equivalent Circuit, Power losses, Efficiency, Starting methods and Speed control.

UNIT- V SPECIAL MACHINES 9

Types of single phase motor, Double revolving field theory, Cross field theory, Capacitor start capacitor run motors, Shaded pole motor, Repulsion type motor, Universal motor, Hysteresis motor, Permanent magnet synchronous motor, Switched reluctance motor, Brushless D.C motor.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Nagrath, I.J., and Kothari, D.P., " Electrical Machines", Tata McGraw - Hill, 1997.
2. Fitzgerald A.E, Kingsley C., Umans, S. and Umans S.D., "Electric Machinery", McGraw

- Hill, Singapore, 2000.

REFERENCE BOOKS:

1. Theraja, B.L., "A Text book of Electrical Technology", Vol.II, S.C Chandand Co., New Delhi, 2007.
2. Del Toro, V., "Electrical Engineering Fundamentals", Prentice Hall of India, New Delhi, 1995.
3. Cotton, H., "Advanced Electrical Technology", Sir Isaac Pitman and SonsLtd., London, 1999.

BE1301 ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the meters used to measure current & voltage.
- To have an adequate knowledge in the measurement techniques for power and energy, power and energy meters are included.
- To provide elaborate discussion about potentiometer & instrument transformers.
- To provide detailed study of resistance measuring methods.
- To provide Detailed study of inductance and capacitance measurement

Course Outcomes After successful completion of this course, the students should be able to

CO1: Describe the working of various electrical and electronic meters

CO2: Describe the working of digital meters urgently in use

CO3: Distinguish between the analog and digital meters

CO4: Demonstrate their knowledge on calibration of industrial meters

CO5: Relate and apply the appropriate measuring techniques to real time application

CO/PO Mapping

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M									
CO2	S											
CO3		M	M									
CO4			S									

CO5	S		S					M				

Assessment method

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I MEASUREMENT OF ELECTRICAL PARAMETERS 9

Types of ammeters and voltmeters – PMMC Instruments, Moving Iron Instruments Dynamometer type Instruments, Resistance measurement - Wheatstone bridge, Kelvin double bridge and Direct deflection methods, Measurement of Inductance - Maxwell Wein bridge, Hay's bridge and Anderson bridge, Measurement of Capacitance - Schering bridge

UNIT-II POWER AND ENERGY MEASUREMENTS 9

Electrodynamic type wattmeter – theory and its errors; LPF wattmeter, Phantom loading, Single phase Induction type energy meter theory and Adjustments, Calibration of wattmeter and Energy meters.

UNIT-III POTENTIOMETERS AND INSTRUMENT TRANSFORMERS 9

Student type potentiometer, Precision potentiometer, A.C. Potentiometers – Polar and Co-ordinate types – Applications, Instrument Transformer - Construction and theory of Current Transformers and Potential Transformers.

UNIT-IV ANALOG AND DIGITAL INSTRUMENTS 10

Wave analyzers, Signal and function generators, Distortion factor meter, Q meter, Digital voltmeter and multimeter, DMM with auto ranging and self diagnostic features, Frequency measurement.

UNIT-V DISPLAY AND RECORDING DEVICES 8

Cathode ray oscilloscope - Sampling and storage scopes –Seven segment and dot matrix displays, X-Y recorders, Magnetic tape recorders, Data loggers.

TEXT BOOKS:

1. A.K. Sawhney, A Course in Electrical & Electronic Measurements & Instrumentation, Dhanpat Rai and Co, New Delhi, 2010
2. R.B. Northrop, Introduction to Instrumentation and Measurements,Taylor & Francis, New Delhi, 2008
3. J.J. Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education India, New Delhi, 2011
4. H.S. Kalsi, Electronic Instrumentation, Tata McGraw-Hill, New Delhi, 2010

REFERENCES:

1. Bell, A.D., "Electronic Instrumentation and Measurements", 2nd Edition, Prentice Hall of India, New Delhi, New Delhi, 2003.
2. Bowens, A. J, "Digital Instrumentation", 4th Edition, Tata McGraw - Hill India Ltd., 1997.

BEI302 TRANSDUCER ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand how physical quantities are measured and how they are converted to electrical or other forms.
- To have an adequate knowledge in resistance, transducers.
- To develop the knowledge of inductance and capacitance transducers.
- To study the characteristics of Transducers.
- To impart knowledge on various types of transducers

After successful completion of this course, the students should be able to

CO1: Define units and standards, elements of measurement system and error analysis

CO2: Understand the static and dynamic characteristics of transducers.

CO3: Describe resistive transducers which are used for measuring various parameters like displacement, temperature, humidity etc.

CO4: Describe the principle of operation, construction and characteristics of inductance and capacitance & other transducers.

CO5: Identify the various transducers used for various applications.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2	S	S			W							
CO3	S	S										
CO4	S	S										
CO5	S	M	W									

Assessment method;

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I MEASUREMENTS AND TRANSDUCERS 9

Units and standards – Calibration methods – Static calibration – Classification of errors: - Limiting error and probable error – Error analysis: – Statistical methods – Odds and uncertainty – Classification of transducers – Selection of transducers.

UNIT-II CHARACTERISTICS OF TRANSDUCERS 9

Static characteristics: – Accuracy, precision, resolution, sensitivity, linearity, span and range - Dynamic characteristics, Mathematical model of transducer – Zero, I and II order transducers - Response to impulse, step, ramp and sinusoidal inputs.

UNIT-III VARIABLE RESISTANCE TRANSDUCERS 9

Principle of operation, construction details, characteristics and applications of potentiometer, strain gauge, resistance thermometer, Thermistor, hot-wire anemometer, piezoresistive sensor and humidity sensor.

UNIT-IV VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE

TRANSDUCERS **9**

Induction potentiometer – Variable reluctance transducers – Principle of operation, construction details, characteristics and applications of LVDT –Capacitive transducer and types – Capacitor microphone – Frequency response.

UNIT-V OTHER TRANSDUCERS **9**

Piezoelectric transducer - Hall Effect transducer – Magneto elastic sensor- Digital transducers – Smart sensors - Fibre optic sensors- Film sensors-Introduction to MEMS and Nano sensors.

TEXT BOOKS:

1. Neubert H.K.P., Instrument Transducers – An Introduction to their Performance and Design, Oxford University Press, Cambridge, 2003.
2. Doebelin E.O. and Manik D.N., Measurement Systems – Applications and Design, Special Indian Edition, Tata McGraw Hill Education Pvt. Ltd., 2007.
3. D. Patranabis, Sensors and Transducers, 2nd edition, Prentice Hall of India, 2010. E.A.

REFERENCES:

1. John P. Bentley, Principles of Measurement Systems, III Edition, Pearson Education, 2000.
2. Murthy, D.V.S., Transducers and Instrumentation, 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
3. W.Bolton, Engineering Science, Elsevier Newnes, Fifth edition, 2006.
4. Ramón Pallás-Areny, John G. Webster, Sensors and Signal Conditioning, Wiley-Interscience 2nd Edition, 1991.
5. Bela G.Liptak, Instrument Engineers' Handbook, Process Measurement and Analysis, 4thEdition, Vol. 1, ISA/CRC Press, 2003.
6. Ian Sinclair, Sensors and Transducers, 3rd Edition, Elsevier, 2012.

BMA 301 ENGINEERING MATHEMATICS - III

L	T	P	C
3	1	0	4

OBJECTIVES:

- To introduce Fourier series analysis which is central to many applications in engineering apart
  - From its use in solving boundary value problems systems.
  - To acquaint the student with Fourier transform techniques used in wide variety of situations.
  - To introduce the effective mathematical tools for the solutions of partial differential equations
  - that model several physical processes and to develop Z transform techniques for discrete time

After successful completion of this course, the students should be able

CO1: Solve a set of algebraic equations representing steady state models formed in engineering problems

CO2: Fit smooth curves for the discrete data connected to each other or to use interpolation methods over these data tables

CO3: Find the trend information from discrete data set through numerical differentiation and

summary information through numerical integration

CO5: Solve PDE models representing spatial and temporal variations in physical systems through numerical method

CO6: Have the necessary proficiency of using MATLAB for obtaining the above solution

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S									
CO2	M		M									
CO3	S	M		M								
CO4	S	S	M		S							
CO5				M	S							
CO6	M	M	M	M	M							

Course Assessment methods:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation - Solutions of standard types of first order equations - Lagrange's Linear equation - Linear partial differential equations of second and higher order with constant coefficients.

UNIT-II FOURIER SERIES 12

Dirichlet's conditions - General Fourier series - Half-range Sine and Cosine series - Parseval's identity - Harmonic Analysis.

UNIT-III BOUNDARY VALUE PROBLEMS 12

Classification of second order linear partial differential equations - Solutions of one - dimensional wave equation, one-dimensional heat equation - Steady state solution of two-dimensional heat equation - Fourier series solutions in Cartesian coordinates

.

UNIT-IV LAPLACE TRANSFORMS 12

Transforms of simple functions - Basic operational properties - Transforms of derivatives and integrals - Initial and final value theorems - Inverse transforms - Convolution theorem - Periodic functions - Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients and simultaneous equations of first order with constant coefficients.

UNIT-V FOURIER TRANSFORMS 12

Statement of Fourier integral theorem - Fourier transform pairs - Fourier Sine and Cosine transforms - Properties - Transforms of simple functions - Convolution theorem - Parseval's identity.

Text Books:

1. Kreyszig, E."Advanced Engineering Mathematics"8th Edition, John Wiley and Sons, (Asia) Pvt., Ltd, Singapore, 2000.
2. Grewal, B.S.,"Higher Engineering Mathematics" (35thEdition), Khanna Publishers, Delhi2000.

References:

1. Kandasamy, P., Thilakavathy, K., and Gunavathy,Kk. "Engineering Mathematics", Volumes 1 and 3(4th Edition) S Chand and Co., New.
2. Narayanan, S.Manicavachangam Pillay, T.K.Ramanaiah, G."Advanced mathematics for Engineering Students", Volume2 and 3(2nd Edition), S.Viswanathan (printers & publishers Pvt, Ltd.,) 1992.
3. Venkataraman, M.K"Engineering Mathematics"Volumes3-A&B, 13th Edition National Publishing Company, Chennai, 1998.
4. Shanmugam,T.N.:http:.www.annauniv.edu/shan/trans.htm.

BEI3L1 MEASUREMENT & TRANSDUCER ENGINEERING LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:
To enable the students to understand the behavior transducers device based on experimentation

After successful completion of this course, the students should be able

CO1: To demonstrate the performance characteristics of various transducers.

CO2: To demonstrate the working of various measurement bridges.

CO3: To design a measurement system for an application.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				S	M							
CO2				S	M							
CO3			S			S			S		M	W

Assessment Method:

DIRECT		**INDIRECT**	
1	Observation Books	**1.**	Students Exit Survey
2	Lab Records Book	**2.**	Faculty Survey
3	Model Examination	**3.**	Industry
4	Viva Voce	**4.**	Alumni
5	End Semester Exam		

Measurement Experiments:

1. Resistance Measurement Using Kelvin and Wheatstone bridge
2. Calibration of wattmeter at different power factors. & testing of current transformers. .
3. Calibration of ammeter, voltmeter and wattmeter using student type potentiometer.
4. Design construction and calibration of series and shunt type ohmmeters.

Transducer Experiments:

1. Displacement versus output voltage characteristics of a potentiometer transducer

2. Strain gauge characteristics
3. Load cell characteristic
4. Characteristics of LVDT
5. Characteristics of LDR, thermistors and thermocouple.
6. Step response characteristic of RTD and thermocouple.
7. Study of smart transducers.

TOTAL: 45 PERIODS

BEI3L2 DATA STRUCTURES AND ALGORITHM USING C++ LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

• To get a clear understanding of object-oriented concepts.
• To understand object oriented programming through C++

Course Outcomes After successful completion of this course, the students should be able to

CO1: Demonstrate class and object concepts

CO2: Demonstrate the significance of constructors and destructor.

CO3: Implement function and operator overloading concepts

CO4: Develop programs using inheritance and polymorphism

CO5: Develop programs using virtual functions

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2	M											
CO3	M	W										
CO4	M		M									
CO5	M	M	M									

ASSESSMENT METHOD:

DIRECT		INDIRECT	
1	Observation Books	**1.**	Students Exit Survey
2	Lab Records Book	**2.**	Faculty Survey
3	Model Examination	**3.**	Industry
4	Viva Voce	**4.**	Alumni
5	End Semester Exam		

List of experiments:

1. Simple C++ programs -Control Structures -Functions - Aggregate data types-File handling.

2. Implementation of-Lists, Stacks, Queues (Using Arrays, linked lists)-Trees - Searching and Sorting algorithms.

BEE3L4 ELECTRICAL MACHINES LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

- To impart hands on experience in verification of circuit laws and theorems, measurement of circuit
- Parameters, study of circuit characteristics and simulation of time response. To expose the students to the basic operation of electrical machines and helps them to develop experimental skills.

Course Outcomes After successful completion of this course, the students should be able to

CO1: To experimentally identify and correct errors in electrical meters through calibration.

CO2: To experimentally verify the principle of operation, performance characteristics and Speed control of DC Machines, AC Machines.

CO3: To experimentally verify the principle of operation and performance characteristics of transformers.

CO4: To experimentally verify the principle of operation, performance characteristics AC Motors and Transformers.

CO5: To experimentally identify the transfer function of Servo motor

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		M					W					
CO2		M	S									
CO3				M								
CO4				M								
CO5		S					M					

Assessment methods:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

1. Open circuit characteristic of dc generator
2. Load characteristics of dc shunt motor
3. Speed control of dc motor
4. Swinburne's test on dc machine
5. Load test on dc shunt generator
6. Load characteristics of dc series motor
7. Regulation of three phase alternator
8. Regulation of alternator by EMF method
9. Open circuit & short circuit test for single transformer
10. Load test on single phase transformer
11. Load test on three phase induction motor
12. Load test on single phase induction motor

TOTAL: 45 PERIODS

SEMESTER – IV

BEI401 CONTROL SYSTEMS ENGINEERING

L	T	P	C
3	1	0	4

OBJECTIVES:

- To understand the use of transfer function models for analysis physical systems and introduce the
- Control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of
- Systems.
- To introduce stability analysis and design of compensators
- To introduce state variable representation of physical systems and study the effect of state feedback

After successful completion of this course, the students should be able to

CO1: Identify the mathematical model and find the transfer function of any system using various techniques such as block diagram reduction, signal flow graph etc

CO2: Identify any type of control system with respect to system stability in time domain as well as frequency domain

CO3: Give basic knowledge in obtaining the open loop and closed–loop frequency responses

CO4: Analyze whether the system is stable or not using various methods like Rout Hurwitz criterion, Root Locus, Bode plot, Nyquist plot

Co5: Design compensators for control systems

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S								M		
CO2		S	M									
CO3	S	M										
CO4	S	M	M									
CO5			S									

ASSESSMENT METHOD:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT- I INTRODUCTION 9

Control System-Open and Closed Loop-Effect of Feedback-System representations-Transfer functions, Block diagrams, signal flow graphs, gain formula of Mechanical and Electrical Systems.

UNIT-II STATE VARIABLE MODEL AND ANALYSIS 9

State variable Formulation – solution - state transition matrix – Eigen values – eigenvectors - controllability - observability.

UNIT-III TRANSFER FUNCTION MODEL AND ANALYSIS 9

Time response – damping ratio- natural frequency – effects of adding poles and zeros – dominant poles- Stability – Routh's Hurwitz criterion – Root locus plots of typical systems – Root locus analysis.

UNIT- IV FREQUENCY DOMAIN ANALYSIS OF TRANSFER FUNCTION MODELS 9

Frequency response – resonance peak – Bandwidth – effect of adding poles and zeros – Magnitude and phase plots of typical systems– Gain margin – Phase margin-Bode plot– Nyquist stability criterion

UNIT-V DESIGN OF CONTROL SYSTEMS 9

Design Specification – controller configurations – PID controller – Lag-Lead, Lag & Lead Compensator-Design using Root locus technique.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Benjamin C.Kuo, "Automatic Control Systems", PHI Learning Private Ltd, 2010
2. I.J.Nagrath, M.Gopal, Control Systems Engineering, New Age International Publishers Reprint 2008.

REFERENCES:

1. Richard C.Dorf Robert H.Bishop, “Modern Control Systems”, Education Pearson, Third Impression 2009.
2. John J.D’Azzo Constantine H.Houpis Stuart N.Sheldon, “Linear Control System Analysis and Design with MATLAB” CRC Taylor & Francis Reprint 2009.
3. Katsuhiko Ogata, “Modern Control Engineering”, PHI Learning Private Ltd, 5th Edition, 2010

BMA402 NUMERICAL METHODS

L	T	P	C
3	1	0	4

OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Solve a set of algebraic equations representing steady state models formed in engineering problems

CO2: Fit smooth curves for the discrete data connected to each other or to use interpolation methods over these data tables

CO3: Find the trend information from discrete data set through numerical differentiation and summary information through numerical integration

CO4: Predict the system dynamic behavior through solution of ODEs modeling the system

CO5: Solve PDE models representing spatial and temporal variations in physical systems through numerical methods

CO6: Have the necessary proficiency of using MATLAB for obtaining the above solutions

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S									
CO2	M		M									
CO3	S	M		M								

CO4	S	S	M		S							
CO5				M	S							
CO6	M	M	M	M	M							

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I SOLUTIONS OF EQUATIONS AND EIGEN VALUE PROBLEMS 12

Iterative method Newton - Rap son method for single variable. Solutions of Linear system by Gaussian Gauss – Jordan, Jacobi and Gauss – Seidel methods, Inverse of a matrix by Gauss – Jordan method. Eigen value of a matrix by power and Jacobi methods.

UNIT-II INTERPOLATION (FINITE DIFFERENCES) 12

Newton's Divided Difference Formula – Lagrange's Interpolation Newton forward and backward difference formulae – Sterling's Bessel's central difference formulae.

UNIT-III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Numerical Differentiation with interpolation polynomials, Numerical integration by Trapezoidal Simpson's (1/3" and 3/8") rules. Double Integrals using Trapezoidal and Simpson's rules.

UNIT-IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Single step methods – Taylor's series, Euler's and Modified Euler, Runge – Kutta method of first and second order differential equations. Multiple step methods – Milne and Adam's – Bash forth predicts and Corrected Method.

UNIT-V BOUNDARY VALUE PROBLEMS FOR ODE AND PDE 12

Finite difference for the second order ordinary differential equations. Finite difference solutions for one dimensional heat Equations. Finite difference solutions for one dimensional heat Equations (both implicit and explicit) one dimensional wave equation and two dimensional Laplace and Poisson Equation.

TOTAL: 60 PERIODS

TEXT BOOKS:

M.K. Venkataraman, Numerical Methods', NPC, Chennai

Grewal, B.S. “Higher Engineering Mathematics” (36th Edition) Khan Publisher. Delhi. 2001

REFERENCES:

1. JAIN M. K. LYENGER. S.R.K. and Jain. R.K., Numerical Methods for scientific and Engineering Pub. Cp., (1993)
2. Dr.A.Singaravelu, “Numerical Methods”, Meenakshi Agency, Edition Dec’2010.
3. P.Kandasamy, “Numerical Methods”, S.Chand and company limited, Edition 2008.

Course Outcomes After successful completion of this course, the students should be able to

L	T	P	C
3	0	0	3

BEI404 ELECTRONIC DEVICES AND CIRCUITS AND APPLICATION

OBJECTIVES:

- Be familiar with the structure of basic electronic devices.
- Be exposed to the operation and applications of electronic devices.

The student should be made to:

CO1: Acquire knowledge in identifying implementation areas of amplifiers for specific purpose

CO2: Design and construct circuit‘s depending upon applications

CO3: Analyze the circuits using modern simulation software

CO4: Design electrical circuits, devices, and systems to meet application requirements.

	CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak											
Cos	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S		W	W							
CO2	W		S	M	M	W	W	W				
CO3	W	W	W	S	S							
CO4	W	W	S	W	M		W	W	S	S	M	

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey

3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I MIDBAND ANALYSIS OF SMALL SIGNAL AMPLIFIERS 9

CE, CB and CC amplifiers - small-signal equivalent circuit diagram- Midband analysis of various types of single stage amplifiers to obtain gain, input impedance and output impedance - Miller's theorem - Comparison of CB, CE and CC amplifiers and their uses. Basic emitter coupled differential amplifier circuit - Bisection theorem. Differential gain – CMRR - Use of constant current circuit to improve CMRR - Derivation of transfer characteristic.

UNIT II FREQUENCY RESPONSE OF AMPLIFIERS` 9

General shape of frequency response of amplifiers - Definition of cutoff frequencies and bandwidth - Low frequency analysis of amplifiers to obtain lower cutoff frequency Hybrid – π equivalent circuit of BJTs - High frequency analysis of BJT amplifiers to obtain upper cutoff frequency – Gain Bandwidth Product - High frequency equivalent circuit of FETs - High frequency analysis of FET amplifiers - Gain-bandwidth product of FETs.

UNIT III LARGE SIGNAL AMPLIFIERS 9

Classification of amplifiers, Class A large signal amplifiers, transformer-coupled class A audio power amplifier – efficiency of Class A amplifiers. Class B amplifier – efficiency - push-pull amplifier - complementary-symmetry (Class B) push-pull amplifier, Class AB, Class C, Introduction to Class D amplifier

UNIT IV FEEDBACK & TUNED AMPLIFIERS 9

Block diagram, Loop gain, Gain with feedback, Effects of negative feedback -Basic concepts of feedback, four types of negative feedback - effect of feedback on input resistance, output resistance, voltage gain and current gain, characteristics of negative feedback amplifiers , single tuned amplifiers - Analysis of single tuned amplifier – double tuned amplifier - – Stagger tuned amplifiers – Class C tuned amplifier

UNIT V OSCILLATORS 9

Classification, Barkhausen Criterion - Mechanism for start of oscillation and stabilization of

amplitude, General form of an Oscillator, Analysis of LC oscillators - Hartley, Colpitts, Clapp, Tuned collector oscillators, RC oscillators - phase shift – Wien bridge - Frequency range of RC and LC Oscillators, Quartz Crystal Construction, Electrical equivalent circuit of Crystal, Miller and Pierce Crystal oscillators, frequency stability of oscillators.

Total:45 Hours

TEXT BOOKS:

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 9th Edition, Pearson Education / PHI, 2007.
2. Salivahanan S., Suresh Kumar. N. and Vallavaraj A., Electronic Devices and Circuits, 2nd Edition, TMH, 2007.

REFERENCE BOOKS:

1. Millman J and Halkias .C. Integrated Electronics, TMH, 2007.
2. David A. Bell," Electronic Devices & Circuits", 4th Edition, PHI, 2007
3. Floyd, "Electronic Devices, Sixth Edition", Pearson Education, 2002.
4. Nagrath I.J.,"Electronic Devices and Circuits", PHI, 2007.
5. Anwar A. Khan and Kantian K. Dye," A First Course on Electronics", PHI, 2006.
6. Singh B.P. And Rekha Singh, "Electronic Devices and Integrated Circuits", Pearson Education, 2006.
7. Rashid M, "Microelectronics Circuits", Thomson Learning, 2000

BEI404 DIGITAL LOGIC CIRCUITS & SYSTEM DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study various number systems , simplify the logical expressions using Boolean functions
- To study implementation of combinational circuits
- To design various synchronous and asynchronous circuits.
- To introduce asynchronous sequential circuits and PLCs
- To introduce digital simulation for development of application oriented logic circuits.

Course Outcomes After successful completion of this course, the students should be able to

CO1: Acquire knowledge in identifying implementation areas of amplifiers for specific purpose

CO2: Design and construct circuit‘s depending upon applications

CO3: Analyze the circuits using modern simulation software

CO4: Design electrical circuits, devices, and systems to meet application requirements.

CO5: Design a project as a team

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
Cos	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S		W	W							
CO2	W		S	M	M	W	W	W				
CO3	W	W	W	S	S							
CO4	W	W	S	W	M		W	W	S	S	M	
CO5	W	M	S	M	M			W	S	S	S	

ASSESSMENT METHODS:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES 9

Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code- Digital Logic Families, comparison of RTL, DTL, TTL, ECL and MOS families -operation, characteristics of digital logic family.

UNIT-II COMBINATIONAL CIRCUITS 9

Combinational logic - representation of logic functions-SOP and POS forms, K-map representations minimization using K maps, queen Mc cluskey method - simplification and implementation of combinational logic – multiplexers and de-multiplexers - code converters, adders, subtractor.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters - Asynchronous and synchronous type - Modulo counters - Shift registers - design of synchronous Sequential circuits – Moore and delay models- Counters, state diagram; state reduction; state Assignment .

UNIT-IV ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABLE LOGIC DEVICES 9

Asynchronous sequential logic circuits-Transition table, flow table-race conditions, hazards &errors in digital circuits; analysis of asynchronous sequential logic circuits-introduction to Programmable Logic Devices: PROM – PLA –PAL.

UNIT-V VHDL 9

RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages – Subprograms – Test bench. (Simulation /Tutorial Examples: adders, counters, flip-flops, FSM, Multiplexers /Demultiplexer). 45 Hours

TEXT BOOKS:

1. Raj Kamal, 'Digital systems-Principles and Design', Pearson Education 2nd edition, 2007.
2. M. Morris Manor, 'Digital Design with an introduction to the VHDL', Pearson Education, 2013.
3. Comer "Digital Logic & State Machine Design, Oxford, 2012.

REFERENCES:

1. Mandal,"Digital Electronics Principles & Application, McGraw Hill Edu, 2013.
2. William Keitz, Digital Electronics-A Practical Approach with VHDL, Pearson, 2013.
3. Floyd and Jain, 'Digital Fundamentals', 8th edition, Pearson Education, 2003.
4. An and Kumar, Fundamentals of Digital Circuits, PHI, 2013.
5. Charles H.Roth, Jr, Lizy Lazy Kurian John, 'Digital System Design using VHDL, Cengage, 2013.
6. John M.Yarbrough, 'Digital Logic, Application & Design', Thomson, 2002.

BME401 APPLIED THERMODYNAMICS AND FLUID MECHANICS

L	T	P	C
3	1	0	4

OBJECTIVES:

- To explain the various laws of thermodynamics

- To explain the operation of boiler
- To explain the different types of pumps and turbines
- To explain the concept of flow through the closed conduit.

Course outcomes after successful completion of the course, the student would be able to

CO 1: Explain the concepts of thermodynamics and mechanisms of heat transfer.

CO 2: Discuss the working of engines, turbines and boilers.

CO 3: Describe the working of compressors and air conditioning.
CO 4: Apply the concept of Euler and Bernoulli‘s equation for solving fluid flow problem

	CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak											
Cos	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S		W	W							
CO2	W		S	M	M	W	W	W				
CO3	W	W	W	S	S							
CO4	W	W	S	W	M		W	W	S	S	M	

ASSESSMENT METHODS:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I LAWS OF THERMODYNAMICS AND BASIC IC ENGINE CYCLES 9

Systems zeroth law, first law of thermodynamics – concept of internal energy and enthalpy applications to closed and open systems – second law of thermodynamics – concept of entropy – clausius inequality and principles of increase in irreversible processes. Basic IC engine and gas turbine cycles-- single and multistage reciprocating compressors.

UNIT-II THERMODYNAMICS OF REFRIGERATORS AND PUMPS 9

Properties of steam – Ranking cycle—Boilers and its accessories– Basic thermodynamics of refrigerators and heat pumps.-Basics of Heat transfer.

UNIT-III BASIC CONCEPT OF FLUID MECHANICS &FLOW OF FLUIDS 9

Introduction – classification – types of fluids – properties – laws of pressure – atmospheric, gauge, absolute pressure, pressure measurement – manometers – mechanical gauges. Types of fluid flow –velocity – rate equation of continuity – energy of a liquid in motion – head of a liquid – Bernoulli's theorem – orifice and mouthpiece.

UNIT- IV DIMENSIONAL AND MODEL ANALYSIS 9

Introduction – dimensions – dimensional analyses – Rayleigh's and Buckingham's method-similitude - dimensionless numbers and their significance – similarity laws – model studies.

UNIT- V PUMPS AND TURBINES 9

Introduction – types of pumps – reciprocating pump – construction details – co-efficient of discharge –slip – power required – centrifugal pump – classification – working principle – specific speed – turbines– classification – working principle.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Nag, P.K., Engineering Thermodynamics, Tata McGraw-Hill Co. Ltd., 2007.
2. BANSAL.R.K, 'Fluid Mechanics and Hydraulic Machines', Laxmi Publications' (P) Ltd, 2005.
3. Yunus A. Çengel, Michael A. Boles, Thermodynamics: An Engineering Approach, McGraw-Hill Higher Education, 2006.

REFERENCES:

1. Reynolds, Thermodynamics, Int. Student Edition, McGraw-Hill Co. Ltd., 1990.
2. Ramalingam. K.K." Thermodynamics", Sci-Tech Publications, 2006.
3 Holman. J.P, 3rd Ed, McGraw-Hill, 2007.
4. Shames, I.H., 'Mechanics of fluids', Kogakusha, Tokyo, 1998.
5. Kumar, K.L., 'Fluid Mechanics', Eurasia publishers, 1990.

BCE406 ENVIRONMENTAL STUDIES

L	T	P	C
3	0	0	3

OBJECTIVES:

To the study of nature and the facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface

- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

Course Outcomes After successful completion of this course, the students should be able to

CO 1: Play a important role in transferring a healthy environment for future generations
CO 2: Analyze the impact of engineering solutions in a global and societal context
CO 3: Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems
CO 4: Ability to consider issues of environment and sustainable development in his personal and professional undertakings
CO 5: Highlight the importance of ecosystem and biodiversity
CO 6: Paraphrase the importance of conservation of resources

	CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak											
Cos	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S		W	W							
CO2	W		S	M	M	W	W	W				
CO3	W	W	W	S	S							
CO4	W	W	S	W	M		W	W	S	S	M	
CO5	W	W	S	W	M		W	W	S	M	M	

ASSESSMENT MENTHODS:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I **9**

THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, scope and importance. Need for public awareness. Natural resources: renewable and non renewable resources Natural resources and associated problems. Forest resources: Use amiof over exploitation, deforestation, case studies, timber extraction, mining, dams and their effects on forests and tribal people. Water resources: Use and over utilization of surface and ground water, floods, drought, conflicts over water, dams – benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case study. Food resources: World food crisis, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies. Land resources: Land as resources, land degradation, man induced landslides, soil erosion and desertification. Role of individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT-II

ECOSYSTEM **9**

Concepts of an ecosystem-structure and function of and ecosystem-producers, composers and decomposers-energy flow in ecosystem-ecological-Succession-Food chains, food webs and ecological pyramids-introduction, types, characteristics features, structure and function of the following ecosystem – Forest ecosystem Grass land ecosystem, Desert ecosystem, Aquatics ecosystem(Ponds, stream, lakes, rivers, oceans, estuaries)

UNIT-III

BIODIVERSITY AND ITS CONSERVATION **9**

Introduction – Definition: genetic, species and ecosystem diversity- Biogeographically classification of India- Value of Biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national, local levels –India as a mega diversity nation –Hotspots of wildlife conflicts- Endangered and endemic species of India- Conservation of biodiversity In-Situ and Ex-Situ conservation of biodiversity.

ENVIRONMENTAL POLLUTION

Definition, causes, effects and control measures of – Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, and Nuclear hazards. Solids waste Management: causes effects and control measures of urban and industrial wastes –Role of an individual in earth quake, cyclone and landslides.

UNIT-IV

SOCIAL ISSUES AND THE ENVIRONMENT **9**

From unsustainable to sustainable development, urban problems related to energy. Water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people, its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, holocaust case studies. Water land reclamation- Environment

Protection Act- Air (Prevention and control of pollution Act) –Wildlife protection act- Forest conservation Act- Issues involved in enforcement of environmental legislation – Public awareness.

UNIT-V

HUMAN POPULATION AND THE ENVIRONMENT 9

Population growth, variation among nations- population explosion- family welfare Programme- Environment and human health. Human values- value Education –HIV/AIDS.

Women and child welfare- Role of Information Technology in Environment and Human health – Case studies.

Total: 45 Hours

TEXT BOOKS:

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

REFERENCES:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

BEI4L1 CONTROL SYSTEM ENGINEERING LABORATORY

L	T	P	C
0	0	3	3

OBJECTIVES:

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of Systems.
- To introduce stability analysis and design of compensators
- To introduce state variable representation of physical systems and study the effect of state Feedback

After successful completion of this course, the students should be able to

CO1: Identify the mathematical model and find the transfer function of any system using various techniques such as block diagram reduction, signal flow graph etc

CO2: Identify any type of control system with respect to system stability in time domain as well as frequency domain

CO3: Give basic knowledge in obtaining the open loop and closed–loop frequency responses

CO4: Analyze whether the system is stable or not using various methods like Rout Hurwitz criterion, Root Locus, Bode plot, Nyquist plot

Co5: Design compensators for control systems

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S								M		
CO2		S	M									
CO3	S	M										
CO4	S	M	M									
CO5			S									

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1	Observation Books	**1.**	Students Exit Survey
2	Lab Records Book	**2.**	Faculty Survey
3	Model Examination	**3.**	Industry
4	Viva Voce	**4.**	Alumni
5	End Semester Exam		

1. Transfer function of separately excited DC Generator
2. Transfer function of Armature Controlled DC Motor
3. Transfer function of Field Controlled DC Motor
4. Transfer function of Amplidyne.
5. Transfer function of Networks
6. Compensating Networks
7. Study of Synchors.
8. DC stepper Motor
9. DC position control System
10. AC position Control system
11. Digital Control of first order system.
12. Digital Control (State variable feedback) of second order liquid level system
13. Study of transducers. **TOTAL: 45 PERIODS**

BEI4L2 ANALOG AND DIGITAL CIRCUIT LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

To enable the students to understand the behavior of semiconductor device based on experimentation

Course Outcomes After successful completion of this course, the students should be

able to

CO1: Acquire knowledge in identifying implementation areas of amplifiers for specific purpose

CO2: Design and construct circuit‘s depending upon applications

CO3: Analyze the circuits using modern simulation software

CO4: Design electrical circuits, devices, and systems to meet application requirements.

CO5: Design a project as a team

	CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak											
Cos	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S		W	W							
CO2	W		S	M	M	W	W	W				
CO3	W	W	W	S	S							
CO4	W	W	S	W	M		W	W	S	S	M	
CO5	W	M	S	M	M			W	S	S	S	

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1	Observation Books	**1.**	Students Exit Survey
2	Lab Records Book	**2.**	Faculty Survey
3	Model Examination	**3.**	Industry
4	Viva Voce	**4.**	Alumni
5	End Semester Exam		

1. Fixed Bias amplifier circuit using BJT

   Waveforms at input and output without bias.

   Determination of bias resistance to locate Q-point at center of load line.
2. Design and construct BJT Common Emitter Amplifier using voltage divider bias (self-bias) with and without bypassed emitter resistor.

   Measurement of gain.

   Plot the frequency response & Determination of Gain Bandwidth Product
3. RC Phase shift oscillator, Wien Bridge Oscillator
4. Integrators, Differentiators, Clippers and Clampers
5. Power Supply circuit - Half wave rectifier with simple capacitor filter.

   Measurement of DC voltage under load and ripple factor, Comparison with calculated values.

Plot the Load regulation characteristics using Zenger diode

6. Design and Implementation of Adders and subtractor using logic gates.

7. Design and Implementation of code converters using logic gates
   (i) BCD to excess-3 code and vice versa
   (ii) Binary to gray and vice versa
8. Design and Implementation of Multiplexer and Demultiplexer using logic gates.
9. Design an inverting and non-inverting amplifier.
10. Design a wave generator using op amp & voltage follower circuit.
11. Design multivibrators using 555 timers.

TOTAL: 45 PERIODS

BEI4L3 ENGLISH LANGUAGE LABORATORY

L	T	P	C
0	0	3	2

After successful completion of this course, the students should be able to

CO1: Imparting the role of communicative ability as one of the soft skills needed for placement

CO2: Developing communicative ability and soft skills needed for placement

CO3: Making students Industry-Ready through inculcating team-playing capacity

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				M							M	
CO2				W						M	S	
CO3				S						W	S	

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1	Observation Books	**1.**	Students Exit Survey
2	Lab Records Book	**2.**	Faculty Survey
3	Model Examination	**3.**	Industry
4	Viva Voce	**4.**	Alumni
5	End Semester Exam		

1. Listening: **(10)**

Recognizing English sounds – accents - listening & answering questions - gap filling - listening & note making - listening to telephonic conversations - listening to speeches.

2. Speaking: **(10)**

Pronouncing words & sentences correctly - word stress - conversation practice.

3. Reading: **(5)**

Cloze test - Reading and answering questions - sequencing of sentences.

4. Writing: **(5)**

Correction of errors - Blogging.

TOTAL: 45 PERIODS

TEXTBOOK

1. Department of Humanities & Social Sciences, Anna University. English for Engineers and Technologists, Combined edition Vols. I & II. Chennai: Orient Longman, Pvt. Ltd. 2006, Themes 5 to 8 (for Units 1 – 4)
2. Sunita Mishra & C. Muralikrishna, Communication Skills for Engineers, Pearson Education, Second Impression, 2007. (for Unit 5)

REFERENCES

1. Ashraf, R.M, Effective Technical Communication, New Delhi: Tata McGraw Hill, 2007.
2. Thorpe, E & Thorpe, S, Objective English, New Delhi : Pearson Education, 2007.
3. Joan Van, Emden, A Handbook of writing for Engineers, Cambridge University Press, 1997
4. Website: www.englishclub.com

LAB REQUIREMENTS

1. Teacher – Console and systems for students
2. English Language Lab Software
3. Tape Recorders

V SEMESTER

BEI501 DIGITAL SIGNAL PROCESSING

L	T	P	C
3	1	0	4

OBJECTIVES:

- To classify signals and systems & their mathematical representation.
- To analyze the discrete time systems.

- To study various transformation techniques & their computation.
- To study about filters and their design for digital implementation.
- To study about a programmable digital signal processor & quantization effects.

After successful completion of this course, the students should be able to

CO 1: Understand the characteristics of discrete-time signals and discrete systems
CO 2: Analyze signal / system properties using mathematical tools
CO 3: Apply and develop algorithms for digital systems
CO 4: Illustrate efficient computation of DFT
CO 5: Discuss advanced features and architecture of generic P-DSP

	CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak											
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M											
CO2		S										
CO3			S									
CO4	S											
CO5				S								

Course Assessment methods:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I INTRODUCTION 9

Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect.

UNIT-II DISCRETE TIME SYSTEM ANALYSIS 9

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response – Convolution –Discrete Time Fourier transform , magnitude and phase representation.

UNIT-III DFT AND COMPUTATION 9

Discrete Fourier Transform- properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT &DIF using radix 2 FFT – Butterfly structure.

UNIT-IV DESIGN OF DIGITAL FILTERS 9

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. Analog filter design – Butterworth and Chebyshev approximations; IIR Filters, digital design using impulse invariant and bilinear transformation -Warping, pre warping.

UNIT-V DIGITAL SIGNAL PROCESSORS 9

Introduction – Architecture – Features – Addressing Formats – Functional modes - Introduction to Commercial Digital signal Processors.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, PHI. 2003.
2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', McGraw Hill Edu, 2013.
3. Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using Matlab", Cengage Learning, 2014.

REFERENCES:

1. Poorna Chandra S, Sasikala. B ,Digital Signal Processing, Vijay Nicole/TMH, 2013.
2. B.P.Lathi, 'Principles of Signal Processing and Linear Systems', Oxford University Press, 2010.
3. Taan S. ElAli, 'Discrete Systems and Digital Signal Processing with Mat Lab', CRC Press, 2009.
4. Sen M.kuo, woonseng…s.gan, "Digital Signal Processors, Architecture, Implementations & Applications, Pearson, 2013.
5. Dimitris G.Manolakis, Vinay K. Ingle, applied Digital Signal Processing, Cambridge, 2012.
6. Lonnie C.Ludeman,"Fundamentals of Digital Signal Processing", Wiley, 2013.

BEI502 PROCESS DYNAMICS AND CONTROL

L	T	P	C
3	1	0	4

OBJECTIVES:

- To introduce dynamics of various processes
- To educate on the effect of various control actions
- To impart knowledge on the final control elements

- To introduce the evaluation criteria and tuning techniques of controllers
- To introduce the concept of multi loop control techniques

Course Outcomes After successful completion of this course, the students should be able to

CO1: Identify the basic components of a Process Control & Distinguish between the servo and Regulatory operations & Self Regulation and Integrating Process.

CO2: Compute the Mathematical Model for different process.

CO3: Distinguish the characteristics of different types of Control Strategies.

CO4: Analyze the behavior of different control loops.

CO5: Identify the basic components of a final control element and distinguish the different Characteristics of control valve.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			M						W		
CO2		S		M					W			
CO3			S							M		
CO4						S	M					M
CO5		S	M					W				

ASSESSMENT METHOD:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		

6.	End Semester Exam		

UNIT-I PROCESS DYNAMICS 9

Need for process control – Mathematical model of Flow, Level, Pressure and Thermal processes – Interacting and non-interacting systems – Degrees of freedom – Continuous and batch processes – Self regulation – Servo and regulatory operations – Lumped and Distributed parameter models – Heat exchanger – CSTR – Linearization of nonlinear systems.

UNIT-II CONTROL ACTIONS 9

Characteristic of on-off, proportional, single speed floating, integral and derivative controllers – PI, PD and PID control modes – Electronic PID controller – Auto/manual transfer - Reset windup – Practical forms of PID Controller.

UNIT-III FINAL CONTROL ELEMENTS 9

I/P converter - Pneumatic and electric actuators – Valve Positioner – Control Valves – Characteristic of Control Valves: - Inherent and Installed characteristics – Modeling of pneumatic control valve – Valve body:-Commercial valve bodies – Control valve sizing – Cavitations and flashing – Selection criteria.

UNIT-IV CONTROLLER TUNING 9

Evaluation criteria – IAE, ISE, ITAE and ¼ decay ratio - Tuning:- Process reaction curve method, Continuous cycling method and Damped oscillation method – Determination of optimum settings for mathematically described processes using time response and frequency response approaches – Auto tuning.

UNIT-V MULTILOOP CONTROL 9

Feed-forward control – Ratio control – Cascade control – Inferential control – Split-range and introduction to multivariable control – Examples from distillation column and boiler systems – IMC– Model Predictive Control – Adaptive control – P&ID diagram.

TEXT BOOKS:

1. Bequette, B.W., “Process Control Modeling, Design and Simulation”, Prentice Hall of India, 2004.
2. Stephanopoulos, G., “Chemical Process Control - An Introduction to Theory and Practice”, Prentice Hall of India, 2005.
3. Seborg, D.E., Edgar, T.F. and Mellichamp, D.A., “Process Dynamics and Control”, Wiley John and Sons, 2nd Edition, 2003

REFERENCES:

1. Coughanowr, D.R., “Process Systems Analysis and Control”, McGraw - Hill International Edition, 2004.
2. D. P. Eckman, “Automatic Process control”, 7th Edition, John Wiley, New York, 1990.
3. Considine, D.M., Process Instruments and *Controls* Handbook, Second Edition, McGraw,
4. Bela.G.Liptak., “Process Control and Optimization”. Instrument Engineers’ Handbook., Volume 2, CRC press and ISA, 2005.
5. Curtis D. Johnson Process Control Instrumentation Technology, 8th Edition, Pearson, 2006.

BEI503 INDUSTRIAL INSTRUMENTATION – I

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the measurement techniques of force, torque and speed
- To introduce the measurement techniques of acceleration, Vibration and density
- To introduce the pressure measurement techniques
- To introduce the temperature measurement techniques
- To introduce the high temperature measurement techniques

Course Outcomes After successful completion of this course, the students should be able to

CO1: Understand the Basic construction, principle and working of various type of transducers/sensor to measure physical quantities like temperature, vibration, velocity, Humidity**.**

CO2: Equip to analyze, formulate and select suitable sensor and how to calibrate also knows to apply for the given applications.

CO3: Understand technical terms and nomenclature used in industrial measurement, industrial processes, process measurement and industrial process control

CO4Demonstrate a working knowledge of safety practices used in the measurement and control of industrial processes

CO5: Demonstrate skills in trouble shooting problems with the measurement and control of industrial processes

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			M						W		
CO2		S		M					W			
CO3			S							M		
CO4						S	M					M
CO5		S	M					W				

assessment methods:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey

2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I MEASUREMENT OF FORCE, TORQUE AND SPEED 9

Electric balance - Different types of load cells - Hydraulic, Pneumatic, strain gauge-Magneto elastic and Piezoelectric load cells - Different methods of torque measurement:- Strain gauge-Relative angular twist-Speed measurement:-Capacitive taco, Drag cup type taco-D.C and A.C tacho generators - Stroboscope.

UNIT-II MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY

Accelerometers :- LVDT, Piezoelectric, Strain gauge and Variable reluctance type accelerometers - Mechanical type vibration instruments - Seismic instruments as accelerometer - Vibration sensor - Calibration of vibration pickups - Units of density and specific gravity - Baume scale and API scale - Pressure type densitometers - Float type densitometers - Ultrasonic densitometer – gas densitometer.

UNIT-III PRESSURE MEASUREMENT 9

Units of pressure - Manometers, different types, Elastic type pressure gauges, Bourdon tube, bellows and diaphragms - Electrical methods:- Elastic elements with LVDT and strain gauges - Capacitive type pressure gauge - Piezo resistive pressure sensor-Resonator pressure sensor - Measurement of vacuum-McLeod gauge-Thermal conductivity gauge-Ionization gauges – Cold cathode type and hot cathode type - calibration of pressure gauges - Dead weight tester.

UNIT-IV TEMPERATURE MEASUREMENT - I 9

Definitions and standards - Primary and secondary fixed points - Calibration of thermometers - Different types of filled in system thermometers - Sources of errors in - filled in systems and their compensation - Bimetallic thermometers - RTD characteristics and signal conditioning-3 lead and 4 lead RTDs - Thermistors.

UNIT-V TEMPERATURE MEASUREMENT - II 9

Thermocouples - Laws of thermocouple - Fabrication of industrial thermocouples – Signal conditioning for thermocouple - isothermal block reference junctions - Commercial circuits for cold junction compensation - Response of thermocouple - Special techniques for measuring high temperature using thermocouple - Radiation fundamentals - Radiation methods of temperature measurement - Total radiation pyrometers - Optical pyrometers - Two color radiation pyrometers - Fiber optic sensor for temperature measurement.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Doebelin, E.O and Manik D.N., Measurement systems Application and Design, Special Indian Edition, Tata McGraw Hill Education Pvt. Ltd, 2007.
2. Jones. B.E, Instrument Technology, Vol.2, Butterworth-Heinemann, International Edition, 2003.

3. A. K. Shawnee, Puneet Sawhney Course in Mechanical Measurements and Instrumentation and Control Dhanpat Rai & Sons, New Delhi, 1997.

REFERENCES:

1. Liptak, B.G., Instrumentation Engineers Handbook (Measurement), CRC Press, 2005
2. Patranabis,D., Principles of Industrial Instrumentation, 3rd Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2010.
3. Eckman D.P., Industrial Instrumentation, Wiley Eastern Limited, 1990.
4. S.K.Singh., Industrial Instrumentation and Control, 3rd Edition, Tata McGraw - Hill Education,2008.
5. Jain, R.K., Mechanical and Industrial Measurements, Khanna Publishers, Delhi, 1999.

ELECTIVE I

L	T	P	C
3	0	0	3

BEI505 MICROPROCESSOR AND MICROCONTROLLER

L	T	P	C
3	1	0	4

OBJECTIVES:

- To study the Architecture of uP8085 & uC 8051
- To study the addressing modes & instruction set of 8085 & 8051.
- To introduce the need & use of Interrupt structure 8085 & 8051.
- To develop skill in simple applications development with programming 8085 & 8051
- To introduce commonly used peripheral / interfacing

Course Outcomes After successful completion of this course, the students should be able to

CO1: Explain the architecture of 8085 microprocessor and 8051 microcontroller

CO2: Differentiate between microprocessor and microcontroller.

CO3: Use knowledge of architecture of 8085 and 8051 to write simple programs for arithmetic and logical operations

CO4: To write programs for memory interfacing, I/O devices and peripheral IC‘s to interface with 8085 and 8051

CO5: Understand and use the some of the latest microcontroller development boards

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M										

CO2		M		W								
CO3		S	M									
CO4		S	M									
CO5					M	M	M					

ASSESSMENT METHOD:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I 8085 PROCESSOR 9

Evolution of Microprocessors - Introduction to 8085 – Signals - Architecture - Addressing Modes –- Instruction format –Instruction set –Assembly Language Programming -Counters and Time delays - Interrupts - Timing diagrams - Memory and I/O Interfacing.

UNIT-II 8086 PROCESSOR 9

Introduction to 8086 - Architecture –Maximum mode - Minimum mode - Addressing Modes - Instruction format - Instruction set – Assembly Language Programming – Interrupt system - Memory and I/O interfacing - Strings - procedures and Macros.

UNIT- III PERIPHERAL INTERFACING 9

Programmable Peripheral Interface (8255) - keyboard display controller (8279) – ADC - DAC - Interface - Programmable Timer Controller (8254) - Programmable interrupt controller (8259)- Serial Communication Interface (8251)- DMA Controller(8257).

UNIT-IV MICROCONTROLLER 9

8051 Microcontroller- Architecture - Instruction Set –Addressing modes –Interrupts - Assembly Language Programming - Programming 8051 Timers- Serial Port Programming - Interrupts Programming - 8051 Programming in C.

UNIT V MICRO CONTROLLER BASED SYSTEM DESIGN 9

LCD & Keyboard Interfacing- Interfacing with 8255 - ADC, DAC interfacing - External Memory interfacing - I2C Standard- Motor Control- Relay – PWM - DC & Stepper Motor - Design of traffic light control and Washing machine control.

TOTAL: 45 PERIODS

TEXTBOOKS

1. Ramesh S. Gaonkar, Microprocessor Architecture Programming and Applications with 8085. Fourth edition, Penram International Publishing 2006.
2. Douglas V.Hall, Microprocessor and Interfacing, Programming and Hardware. Revised second Edition, Indian edition 2007. Tata McGraw Hill
3. MuhammadAli Mazidi, Janice Gillispie Mazidi, Rolin D.MCKinlay The 8051 Microcontroller and Embedded Systems, Second Edition, Pearson Education 2008.

REFERENCES

1. Krishna Kant, Microprocessor and Microcontroller Architecture, programming and system design using 8085, 8086, 8051 and 8096, PHI, 2007.
2. N.Senthil Kumar, M.Saravanan, S.Jeevananthan, Microprocessors and Microcontrollers, Oxford University Press, 2010.
3. A.K. Ray, K.M .Bhurchandi Advanced Microprocessor and Peripherals, Tata McGraw-Hill, 2007.
4. Kenneth J.Ayala., The 8051 Microcontroller, 3rd Edition, Thompson Delmar Learning, 2007.

BEI506 OBJECT ORINTED PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

• To get a clear understanding of object-oriented concepts.
• To understand object oriented programming through C++.

Course Outcomes After successful completion of this course, the students should be able to

CO1: Define principles of Object Oriented programming

CO2: Outline the differences between object oriented programming and structured programming

CO3: Develop solutions to a given problems using class object concepts

CO4: Make use of overloading and inheritance concepts to solve real world problems

CO5: Develop programs for all file and template related concepts

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak	
COs	Programme Outcomes(POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	W											
CO2	W											
CO3		M	M									
C04		M										
CO5		M	M									

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I OPP PARADIGM **9**

Data abstraction – encapsulation – class – inheritance – polymorphism – reusability.

UNIT-II C++ INTRODUCTION **9**

Classes – objects – dynamic memory allocation – constructor – destructor – friend function – operator overloading.

UNIT-III INHERITANCE AND POLYMORPHISM **9**

Derived class and base class – derived class constructor – modes of inheritance – multiple inheritance – virtual function – polymorphism – dynamic binding – abstract class.

UNIT-IV JAVA INTRODUCTION **9**

Class – objects – extending class – java features – interfaces – packages – multithreading.

UNIT-V PROGRAMMING **9**

Tokens – operators – expressions – control flow – programming with types – documentation comments – I/O package – applets – creating applets – some sample programs .

TOTAL: 45 PERIODS

TEXT BOOK

1. Bjame stroustrup, the c++ programming language, Addison Wesley, 2000.
Ken Arnold, James gosling, the JAVA language, II edition, Addison Wesley, 1998.
2. E.Balaguruswamy , object oriented programming with c++ , // edition TMH. 2001.

References:

1. Herber Schildt , C++ the complete refernce TMH , 1997.
2. Stanley B.Lippman Jore lajole , C++ Primer , III edition , Addison Wesley , 2000.
3. Barkakati No , Object Oriented programming in C++ , PHI , '995.
4. Kris Jarnsa , java Programming – A complete reference, Galgotia Publication.
5. Patrick nanghton , Herbert Shildt , Java The complete reference , TMH, 1997.

BEI5L1 PROCESS CONTROL LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES:

To experimentally verify the process control concepts on the selected process control loops.

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Understand the usage of various processes

CO2: Develop and test the control loop

CO3: Identify the type controller

CO4: understand and use the different microcontroller programming languages

CO5: write simple programs to find control parameters

	CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak											
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		S										
CO3	S	S	M									
CO4	S											
CO5	S				M							

ASSESSMENT METHOD

DIRECT		INDIRECT	
1	Observation Books	**1.**	Students Exit Survey
2	Lab Records Book	**2.**	Faculty Survey

3	Model Examination	**3.**	Industry
4	Viva Voce	**4.**	Alumni
5	End Semester Exam		

LIST OF EXPERIMENTS:

1. Study of Process Control Training Plant and Compact Flow Control Unit.
2. Characteristics of Pneumatically Actuated Control Valve (with and without Positioner).
3. Level Control and Pressure Control in Process Control Training Plant.
4. Design of ON/OFF Controller for the Temperature Process.
5. PID Implementation Issues.
6. Tuning of PID Controller for mathematically described processes
7. PID Enhancements (Cascade and Feed-forward Control Schemes)
8. Design and Implementation of Multi-loop PI Controller on the Three-tank system.
9. Analysis of Multi-input Multi-output system (Four-tank System).
10 Study of AC and DC drives.

TOTAL: 45 PERIODS

BEI 5L2 MICROPROCESSOR AND DSP LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

To provide training on programming of microprocessors and microcontrollers and understand the interface requirements

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Understand the usage of various instruction formats of 8085 and 8051

CO2: Develop and test the assembly language program for a given problem

CO3: Identify the type of peripherals to be interfaced to a processor/controller for a given design and write the instructions to execute the logic needed

CO4: understand and use the different microcontroller programming languages

CO5: write simple programs to interface LEDs and sensors to the development boards

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											

CO2		S										
CO3	S	S	M									
CO4	S											
CO5	S				M							

Assessment methods

DIRECT		INDIRECT	
1	Observation Books	**1.**	Students Exit Survey
2	Lab Records Book	**2.**	Faculty Survey
3	Model Examination	**3.**	Industry
4	Viva Voce	**4.**	Alumni
5	End Semester Exam		

List of Experiments

1. 8085 and 8051 assembly language programming exercises
2. Interfacing of switches and display devices
3. Interfacing of D/A and A/D converters
4. Interface of key board and display using programmable controllers
5. Interface of programmable timer
6. Stepper motor control using microprocessor
7. Interface of printer using UART
8. Simple 8086 assembly language programming exercises
9. . Programming with 16 bit processors I/O Programming/ Timers/ Interrupts/ Serial port programming/PWM Generation/ Motor Control/ADC/DAC/ LCD/ RTC Interfacing/Sensor Interfacing 16 bit Microcontrollers with peripherals.

DIGITAL SIGNAL PROCESS IMPLEMENTATION

10. Sampling a waveform generation
11. .FIR and IIR filter implementation
12. Fast Fourier Transform
13. Adaptive filters

14. Quantization noise

TOTAL: 45 PERIODS

BEI5L3 OBJECT ORIENTED PROGRAMMING LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

• To get a clear understanding of object-oriented concepts.
• To understand object oriented programming through C++ & JAVA.

Course Outcomes
After successful completion of this course, the students should be able to

CO1: Demonstrate class and object concepts

CO2: Demonstrate the significance of constructors and destructor.

CO3: Implement function and operator overloading concepts

CO4: Develop programs using inheritance and polymorphism

CO5: Develop programs using virtual function

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2	M											
CO3	M	W										
CO4	M		M									
CO5	M	M	M									

ASSESSMENT METHOD:

1. programs Using Functions
   - Functions with default arguments
   - Implementation of Call by Value, Call by Address and Call by Reference

2. Simple Classes for understanding objects, member functions and Constructors
   - Classes with primitive data members
   - Classes with arrays as data members
   - Classes with pointers as data members – String Class

DIRECT		INDIRECT	
1	Observation Books	**1.**	Students Exit Survey
2	Lab Records Book	**2.**	Faculty Survey
3	Model Examination	**3.**	Industry
4	Viva Voce	**4.**	Alumni
5	End Semester Exam		

   - Classes with constant data members
   - Classes with static member functions

3. Compile time Polymorphism
   - Operator Overloading including Unary and Binary Operators.
   - Function Overloading
4. Runtime Polymorphism
   - Inheritance
   - Virtual functions
   - Virtual Base Classes
   - Templates
5. File Handling
   - Sequential access
   - Random access

SEMESTER VI

BBA601 MANAGEMENT AND PROFESSIONAL ETHICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization

Course Outcomes After successful completion of this course, the students should be able to

CO1: Understand the ethical theories and concepts
CO2: Understand an engineer‘s work in the context of its impact on society
CO3: Understand and analyze the concepts of safety and risk
CO4: Understand the professional responsibilities and rights of Engineers

CO5: Understand the concepts of ethics in the global context.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M	M	S	M			
CO2						M	M	S	M			
CO3						M	M	S	M			
CO4						M	M	S	M			
CO5						M	M	S	M			

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I CONCEPTUAL HUMAN ISSUES AND HUMAN VALUES 9

Nature of Management- Management science or art- Management as profession-Universality of Management- Technical, human and conceptual- Manager Vs Entrepreneurs- Managers Vs Leaders- Guidelines for managerial success.

UNIT-II HISTORICAL EVOLUTION OF MANAGEMENT 9

Taylor and scientific Management- principles of Management- Contributions of Henry Fayol, Barnad, Herbet simon, Peter Drucker, Hawthorne Experiments and human relations.

UNIT-III PLANNING AND ORGANIZING 9

Planning- important steps- types and objects. MBO- SWOT- Concept and features of strategy- policy and strategy- Forecasting and decision making – creativity and decision making- Organizing- Organizing structure- Organization Chart- Span of management- Authority and responsibility- Measure for effective delegation- Centralization and decentralization- Line and staff relationships.

UNIT-IV DIRECTING AND CONTROLLING 9

Direction- concept of direction- effective supervision- concept of leadership- Control- concept of control- quantitative and qualitative measures of control- TQM- Quality circle- ISO 9000 quality systems- PCMM level.

UNIT-V CONTEMPORARY MANAGEMENT ISSUES AND HUMAN VALUES 9

Social responsibility of managers- benefits of professional ethics- Values, value system of Indian managers- Ethics- Business, nature, importance in organization- Managing ethical dilemmas- shaping and maintaining the ethical culture- protection of stake holders- Whistle blowing.

TOTAL: 45 PERIODS

BEI602 INDUSTRIAL INSTRUMENTATION- II

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce variable head type flow meters
- To introduce quantity meters , air flow meters and mass flow meters
- To educate on electrical type flow meters
- To educate on the level measurement techniques
- To educate on Viscosity, Humidity and Moisture content

Outcomes after successful completion of this course, the students should be able to

CO1: Understand the Basic construction, principle and working of various type of transducers/sensor to measure physical quantities like pressure, flow, level.

CO2: Equip to analyze, formulate and select suitable sensor and how to calibrate also knows to apply for the given applications.

CO3: Understand technical terms and nomenclature used in industrial measurement, industrial processes, process measurement and industrial process control

CO4Demonstrate a working knowledge of safety practices used in the measurement and control of industrial processes

CO5: Demonstrate skills in trouble shooting problems with the measurement and control of industrial processes.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			M						W		
CO2		S		M					W			
CO3			S							M		
CO4						S	M					M
CO5		S	M					W				

ASSESSMENT METHOD:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I MEASUREMENT OF VISCOSITY, HUMIDITY AND MOISTURE 12

Viscosity terms - say bolt viscometer - rotameters type viscometer - Industrial consistency meters - Humidity terms - Dry and wet bulb psychrometers - Hot wire electrode type hygrometer - Dew cell - Electrolysis type hygrometer - Commercial type dew point meter - Moisture terms - Different methods of moisture measurement - moisture measurement in granular materials, solid penetrable materials like wood, web type material.

UNIT-II MECHANICAL TYPE FLOWMETERS 12

Theory of fixed restriction variable head type flow meters - Orifice plate - Ventura tube - Flow nozzle - Dall tube - Installation of head flow meters - Piping arrangement for different fluids - Pilot tube.

UNIT-III QUANTITY METERS, AREA FLOW METERS AND MASS FLOW METER 12

Positive displacement flow meters - constructional details and theory of operation of mutating disc, reciprocation piston, oval gear and helix type flow meters - inferential meter turbine flow meter - Rota meter - Theory and installation - Angular momentum mass flow meter - Carioles mass flow meters - thermal mass flow meter - volume flow meter - plus density measurement - calibration of flow meters - dynamic weighing method.

UNIT-IV ELECTRICAL TYPE FLOW METER 12

Principle and constructional details of electromagnetic flow meter - Different types of excitation - schemes used - Different types of ultrasonic flow meters - Laser Doppler anemometer systems -

Rortex shedding flow meter - Target flow meter - Solid flow rate measurement - Guidelines for selection of flow meter.

UNIT-V LEVEL MEASUREMENT **12**

Gauge glass technique coupled with photo electric readout system - Float type level indication - Different schemes - Level switches - Level measurement using displacer and torque tube - Bubbler system - Boiler drum level measurement - Differential pressure method - Hydra step systems - Electrical types of level gauges using resistance, capacitance, nuclear radiation and ultrasonic sensors

TOTAL: 60 PERIODS

Text Books:

1. *D.Patranabis, Principles of Industrial Instrumentation Tata McGraw Hill Publishing Co., New Delhi, 1999.*
2. *R.K.Jain, Mechanical and Industrial Measurements, Khanna Publishers, Delhi 1999.*

References:

1. Ernest O. Doeblin, Measurement Systems Application and Design International Student Edition, Tata McGraw Hill Publishing Co., New Delhi, 1999.
2. A.K.Sawhney, A course in Electrical and Electronic Measurement and Instrumentation ,Dhanpat Rai and Sons, New Delhi, 1999
3. Eckman D.P. Industrial Instrumentation Wiley Eastern Limited, 1990.
4. Liptak B.G. Instrument Engineers Handbook (Measurement), Chilton Book Co., 1994.

BEI604 INDUSTRIAL DATA NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To educate on the basic concepts of data networks
- To introduce the basics of inter networking and serial communications
- To provide details on HART and Field buses
- To educate on MODBUS, PROFIBUS and other communication protocol
- To introduce industrial Ethernet and wireless communication

Course Outcomes After successful completion of this course, the students should be able to

CO 1: To describe the networks used in data communication.

CO 2: Get adequate knowledge about operator interface used in DCS.

CO 3: To describe the HART and field bus in DCS

CO 4: To understand the systems used in distributed control system.

CO 5: To get an adequate knowledge about MODBUS and Wireless instrumentation

CO/PO Mapping												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		S										
CO3			S				W					
CO4						S				M		
CO5					S				M			

ASSESSMENT METHOD:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I DATA COMMUNICATIONS 9

Components – Direction of Data flow – networks – Components and Categories – types of Connections – Topologies –Protocols and Standards – ISO / OSI model – Transmission Media – Coaxial Cable – Fiber Optics – Line Coding – Modems – RS232 Interfacing sequences.

UNIT-II DATA NETWOK FUNDAMENTAL 9

Objects on network-data communication fundamental-circuit switched-message switched-packed switched networks-OSI reference models-ARPA, SNA& other

UNIT-III NETWORK STANDARDS 9

IEEE 802, standardization in OSI model, IEEE 802.2 & Ethernet – IEEE standard 802.4 – token bus – IEEE standard 802.5 – token ring.

UNIT-IV NETWORK FOR CONTROL *9*

Requirements of communication network for control purpose – communication hierarchy – network access protocols – topologies – OSI layer, fiber optic LAN – MAP & TOP.

UNIT-V APPLICATION *9*

Domain Name Space (DNS) – SMTP, FDP, HTTP, WWW – Security – Cryptography in industry.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Behrouz A. Foruzan, “Data communication and Networking”, Tata McGraw-Hill, 2004.

REFERENCES

1. James .F. Kurouse& W. Rouse, “Computer Networking: A Topdown Approach Featuring”, Pearson Education.
2. Larry L.Peterson& Peter S. Davie, “COMPUTER NETWORKS”, Harcourt Asia Pvt. Ltd., Second Edition.
3. Andrew S. Tannenbaum, “Computer Networks”, PHI, Fourth Edition, 2003.
4. William Stallings, “Data and Computer Communication”, Sixth Edition, Pearson Education, 2000.

BEI605 EMBEDDED SYSTEM DESIGN

L	T	P	C
3	1	0	4

OBJECTIVES:

- To introduce the Building Blocks of Embedded System
- To Educate in Various Embedded Development Strategies
- To Introduce Bus Communication in processors, Input/output interfacing.
- To impart knowledge in various processor scheduling algorithms.
- To introduce Basics of Real time operating system and example tutorials to discuss on one real time operating system tool

Course Outcomes After successful completion of this course, the students should be able to

CO1: Acquire a basic knowledge about fundamentals of microcontrollers, programming and System control to perform a specific task.

CO2: Acquire knowledge about devices and buses used in embedded networking.

CO3: Develop programming skills in embedded systems for various applications.

CO4: Acquire knowledge about basic concepts of REAL Time Operating Systems.

CO5: Build complex embedded system with the use of RTOS.

	CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak											
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2	S	M										

CO3					S	M						
CO4	S						M					
CO5		S					M					

ASSESSMENT METHOD:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I EMBEDDED DESIGN WITH MICROCONTROLLERS 9

Product specification – Hardware / Software partitioning – Detailed hardware and software design – Integration – Product testing – Microprocessor Vs Micro Controller – Performance tools– RTOS Micro Controller -issues in selection of processors.

UNIT-II PARTITIONING DECISION 9

Hardware / Software duality – Hardware-Software portioning- coding for Hardware- software development – ASIC revolution – Managing the Risk – Co-verification – execution environment – memory organization –memory enhancement – Firmware-speed and code density -System startup.

UNIT-III FUNCTIONALITIES FOR SYSTEM DESIGN 9

Timers, Watch dog timers – RAM, Flash Memory basic toolset – Integration of Hardware & Firmware- in System Programming, in Application Programming, IDE-Target Configuration-Host based debugging – Remote debugging – ROM emulators – Logic analyzer.

UNIT-IV CIRCUIT EMULATORS 9

Buller proof run control – Real time trace – Hardware break points – Overlay memory – Timing constraints – Usage issues – Triggers.

UNIT-V EMBEDDED DESIGN LIFE CYCLE & TESTING 9

Objective, Need, different Phases & Modeling of the EDLC, choice of Target Architectures for Embedded Application Development-for Control Dominated-Data Dominated Systems-Software &Hardware Design, PCB Design, Manufacturing & PCB Assembly-Bug tracking – reduction of risks & costs – Performance – Unit testing – Regression testing – Choosing test cases – Functional tests – Coverage tests – Testing embedded software – Performance testing – Maintenance. **TOTAL: 45 PERIODS**

TEXT BOOKS

1. James K.Peckol, “Embedded system Design”, JohnWiley&Sons,2010
2. Elicia White, “Making Embedded Systems”, O’Reilly Series, SPD, 2011
3. Rajkamal,”Embedded Systems”, TMH, 2009.
4. Lyla B Das,” Embedded Systems-An Integrated Approach”, Pearson2013 5. Arnold S. Berger – “Embedded System Design”, CMP books, USA 2002.

ELECTIVE II

L	T	P	C
3	0	0	3

BEI606 MODERN ELECTRONIC INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce different types of electronic voltmeters and their applications.
- To provide knowledge on various types of cathode ray oscilloscopes, their applications and different types of signal analyzers.
- To introduce different types of waveform generators and analyzers and their applications.
- To educate on virtual instrumentation, its applications, programming and DAQ cards and modules.
- To give exposure to telemetry, modulation techniques and multiplexing.

After successful completion of this course, the students should be able to

CO1: Understand the interaction of electromagnetic radiations with matter and apply analytical techniques to accurately determine the elements present in the given sample.

CO2: Select an Instrument for a particular analysis with idea of its merits, demerits and diagnostic features

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				M							M	
CO2				W						M	S	
CO3				S						W	S	

ASSESSMENT METHODS:

DIRECT	INDIRECT

1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I ELECTRONIC INSTRUMENTS 9

Electronic Voltmeter and their advantages – Types, Differential amplifier, source follower, rectifier –True rms reading voltmeter – Electronic multimeter and ohmmeter – Current measurement – Power measurement - Microprocessor based DMM with auto ranging and self diagnostic features

UNIT-II CATHODE RAY OSCILLOSCOPE & SIGNAL ANALYZERS 9

General purpose cathode ray oscilloscope – Dual trace, dual beam and sampling oscilloscopes– Analog and digital storage oscilloscope - frequency selective and heterodyne wave analyzer – Harmonic distortion analyzer – Spectrum analyzer

UNIT-III FIBER OPTIC MEASUREMENTS 9

Sources and detectors – Fiber Optic Power measurements Stabilized, Calibrated light sources – End to end measurement of fiber Systems Loss - Optic time domain reflect meters – Q meter – Electronic Counters

UNIT-IV VIRTUAL INSTRUMENTATION 9

Virtual instrumentation (VI) – Definition, flexibility – Block diagram and architecture of virtual instruments – Virtual instruments versus traditional instruments – Software in virtual instrumentation -VI programming techniques – DAQ cards for VI applications – DAQ modules with serial communication

UNIT-V TELEMETRY 9

General telemetry system – voltage, current and position telemetry systems – Radio frequency telemetry – Frequency modulation, pulse-amplitude modulation and pulse-code modulation telemetry – Frequency and time multiplexing.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. A.K. Sawhney, A Course in Electrical & Electronic Measurements and Instrumentation, Dhanpat Rai and Co, New Delhi, 2010.

2. Jerome J., Virtual Instrumentation using Lab VIEW, Prentice Hall India Private Ltd., New Delhi,2010.
3. N. Mathivanan , PC based Instrumentation , Prentice Hall India Private Ltd., New Delhi, 2007.
REFERENCES:
1. David A Bell, " Electronic Instrumentation and Measurements", Ox for University Press,2013.
2. A.D. Helfrick and W.D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall India Private Ltd., New Delhi, 2010.
3. H.S. Kalsi, Electronic Instrumentation, Tata McGraw-Hill, New Delhi, 2010.
4. J.J. Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education India, New Delhi, 2011.
5. M.M.S. Anand, Electronics Instruments and Instrumentation Technology, Prentice Hall India, New Delhi, 2009.
6. Sanjay Gupta, Virtual Instrumentation using Lab view, Tata McGraw-Hill Education, 2010

BEI6L1 INDUSTRIAL INSTRUMENTATION LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:
The aim of this lab is to impart an adequate knowledge and expertise to handle equipment generally available in an industry.

Course Outcomes After successful completion of this course, the students should be able to

CO1: To get an adequate knowledge about selecting particular sensing elements for the measurement of physical parameters.

CO2: Analyze the measured value for displaying or controlling the physical variables and design a signal conditioning circuit for interfacing sensor with the controller**.**

CO3: Equip to calibrate the sensor also knows to apply for particular applications**.**

CO4: Demonstrate a working knowledge of safety practices used in the measurement and control of real time processes

CO5: Demonstrate skills in trouble shooting problems with the measurement and control of industrial processes.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			M						W		
CO2		S	M	M					W			
CO3				S						M		

CO4						S	M					M
CO5		S	M					W				

ASSESSMENT METHOD:

DIRECT		INDIRECT	
1	Observation Books	**1.**	Students Exit Survey
2	Lab Records Book	**2.**	Faculty Survey
3	Model Examination	**3.**	Industry
4	Viva Voce	**4.**	Alumni
5	End Semester Exam		

LIST OF EXPERIMENTS:
Discharge Co-efficient of orifice plate

2. Calibration of pressure gauge

3. Calibration of thermocouple

4. Calibration of flow meter

5. Torque measurement

6. Viscosity measurements

7. Vacuum pressure measurement

8. Level measurement using D/P transmitter

9. UV-Visible spectrophotometer

10. IR spectrophotometer

11. pH meter standardization and measurement of pH values of solutions

TOTAL: 45 PERIODS

BEI6L2 INSTRUMENTATION SYSTEM DESIGN LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

To obtain adequate knowledge in design of various signal conditioning circuits, instrumentation Systems, controller and control valve.

Course Outcomes After successful completion of this course, the students should be able to

CO1: To get an adequate knowledge about selecting particular filter elements for the measurement of physical parameters.

CO2: Analyze the measured value for displaying or controlling the physical variables and design

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				M							M	
CO2				W						M	S	
CO3				S						W	S	

ASSESSMENT METHODS:

DIRECT		INDIRECT	
1	Observation Books	**1.**	Students Exit Survey
2	Lab Records Book	**2.**	Faculty Survey
3	Model Examination	**3.**	Industry
4	Viva Voce	**4.**	Alumni
5	End Semester Exam		

LIST OF EXPERIMENTS:

1. Design of Instrumentation amplifier.
2. Design of active filters – LPF, HPF and BPF
3. Design of regulated power supply and design of V/I and I/V converters.
4. Design of linearizing circuits and cold–junction compensation circuit for thermocouples.
5. Design of signal conditioning circuit for strain gauge and RTD.
6. Design of Control valve (sizing and flow-lift characteristics)
7. Design of PID controller (using operational amplifier and microprocessor)
8. Design of multi range DP transmitter

9. Piping and Instrumentation Diagram – case study.

10. Preparation of documentation of instrumentation project and project scheduling for the above case study. (Process flow sheet, instrument index sheet and instrument specifications sheet, job scheduling, installation procedures and safety regulations).

11. Programmable Logic Controller – Case study.

TOTAL: 45 PERIODS

BEI6L3 EMPLOYABILITY SKILL

L	T	P	C
0	0	2	1

(LAB / PRACTICAL COURSE)

After successful completion of this course, the students should be able to

CO1: Imparting the role of communicative ability as one of the soft skills needed for placement

CO2: Developing communicative ability and soft skills needed for placement

CO3: Making students Industry-Ready through inculcating team-playing capacity

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				M							M	
CO2				W						M	S	
CO3				S						W	S	

ASSESSMENT METHOD

DIRECT		**INDIRECT**	
1	Observation Books	**1.**	Students Exit Survey
2	Lab Records Book	**2.**	Faculty Survey
3	Model Examination	**3.**	Industry
4	Viva Voce	**4.**	Alumni
5	End Semester Exam		

LIST OF EXERCISES:

1. Making presentations – introducing oneself – introducing a topic – answering questions – individual presentation practice
2. Creating effective PPTs – presenting the visuals effectively
3. Using appropriate body language in professional contexts – gestures, facial expressions, etc.

4. Preparing job applications - writing covering letter and résumé

5. Applying for jobs online - email etiquette

6. Participating in group discussions – understanding group dynamics - brainstorming the topic

7. Training in soft skills - persuasive skills – People skills - questioning and clarifying skills – mock GD

8. Writing Project proposals – collecting, analyzing and interpreting data / drafting the final report
9. Attending job interviews – answering questions confidently

10. Interview etiquette – dress code – body language – mock interview

TOTAL: 30 PERIODS

REFERENCE BOOKS:

1. Dhanavel, S.P. 2010. English and Soft Skills. Hyderabad: Orient BlackSwan Ltd.

2. Corneilssen, Joep. How to Prepare for Group Discussion and Interview. New Delhi: Tata-McGraw-Hill, 2009.

3. D'Abreo, Desmond A. Group Discussion and Team Building. Mumbai: Better Yourself Books, 2004.
4. Ramesh, Gopalswamy, and Mahadevan Ramesh. The ACE of Soft Skills. New Delhi: Pearson, 2010.
5. Gulati, Sarvesh. Corporate Soft Skills. New Delhi: Rupa and Co. 2006.

6. Van Emden, Joan, and Lucinda Becker. Presentation Skills for Students. New York: Palgrav Macmillan, 2004.

EXTENSIVE READERS

1. Covey, Stephen R. The 7 Habits of Highly Effective People. New York: Free Press, 1989.

2. Bagchi, Subroto. The Professional. New Delhi: Penguin Books India, 2009.

WEB RESOURCES

1. www.humanresources.about.com

2. www.careerride.com

SEMESTER VII

BEI701 LOGIC AND DISTRIBUTED CONTROL SYSTEM

L	T	P	C
3	1	0	4

OBJECTIVES:

- To give an introductory knowledge on Programmable Logic Controller (PLC) and their programming languages
- To give adequate knowledge about applications of PLC
- To give basic knowledge about Computer Controlled Systems
- To give basic knowledge on the architecture and local control unit of Distributed Control System (DCS)
- To give adequate information with respect to interfaces used in DCS

Course Outcomes After successful completion of this course, the students should be able to

CO 1: To describe the networks used in PLC and DCS.

CO 2: Get adequate knowledge about operator interface used in DCS.

CO 3: To describe the HART and field bus in DCS

CO 4: To understand the systems used in distributed control system.

CO 5: To get an adequate knowledge application of PLC

CO/PO Mapping

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		S										
CO3			S				W					
CO4						S				M		
CO5					S				M			

ASSESMENT METHOD:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I PROGRAMMABLE LOGIC CONTROLLER 9

Evolution of PLCs – Components of PLC – Architecture of PLC – Discrete and analog I/O modules – Programming languages -Ladder diagram – Function block diagram (FBD) - Programming timers and counters

UNIT-II APPLICATIONS OF PLC 9

Instructions in PLC – Program control instructions, math instructions, data manipulation Instructions, sequencer and shift register instructions – Case studies in PLC

UNIT-III COMPUTER CONTROLLED SYSTEMS 9

Basic building blocks of computer controlled systems – Data acquisition system – Supervisory control – Direct digital control- SCADA: - Hardware and software, Remote terminal units, Master
Station and Communication architectures.

UNIT-IV DISTRIBUTED CONTROL SYSTEM 9

DCS – Various Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities

UNIT V INTERFACES IN DCS 9

Operator interfaces - Low level and high level operator interfaces – Displays - Engineering interfaces – Low level and high level engineering interfaces – Factors to be considered in selecting DCS – Case studies in DCS

TOTAL: 45 PERIODS

TEXT BOOKS:

1. F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2010
2. Michael P. Lukas, Distributed Control Systems: Their Evaluation and Design, Van Nostrand Reinhold Co., 1986
3. D. Popovic and V.P.Bhatkar,' Distributed computer control for industrial Automation' Marcel Dekker, Inc., Newyork, 1990.

REFERENCES:

1. T.A. Hughes, Programmable Controllers, Fourth edition, ISA press, 2005
2. Krishna Kant, Computer Based Industrial Control, Second edition, Prentice Hall of India, New Delhi, 2010.
3. John W. Webb and Ronald A. Reis, 'Programmable Logic Controllers, Fifth edition, Prentice Hall of India, New Delhi, 2010.
4. John R. Hackworth and Frederick D. Hackworth Jr, Programmable Logic Controllers,

   Pearson, New Delhi, 2004.
5. Clarke, G., Reynders, D. and Wright, E., "Practical Modern SCADA Protocols: DNP3,4. 60870.5 and Related Systems", Newnes, 1st Edition, 2004.
6. E.A.Parr, Programmable Controllers, An Engineer's Guide, Elsevier, 2013.

BEI702 DIGITAL CONTROL SYSTEM

L	T	P	C
3	1	0	4

OBJECTIVES:

- To introduce the components of digital control system
- To provide knowledge on pulse transfer functions and their analysis
- To introduce stability concepts in discrete domain
- To educate on tuning of PID controllers in discrete domain
- To introduce state variable analysis in discrete domain

Course out Comes after successful completion of this course, the students should be able to

CO 1: To describe about steady and dynamic state.
CO 2: Get adequate knowledge Z-Transforms
CO 3: To describe stability
CO 4: To understand digital PID controller.
CO 5: To get an adequate knowledge application of state space analysis

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M	M	S	M			
CO2						M	M	S	M			
CO3						M	M	S	M			
CO4						M	M	S	M			
CO5						M	M	S	M			

ASSESSMENT METHOD:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I INTRODUCTION **9**

Introduction to digital control – Sampling Process – Sample and Hold Circuit – Zero and First Order hold – Z-Transform – Inverse Z- Transform – Region of convergence – Initial and Final Value Theorem

UNIT-II PULSE TRANSFER FUNCTION AND TIME RESPONSE **9**

Block diagram reduction methods – Reduction Rules- Multi-loop – MIMO Systems – Signal Flow Graph- steady state error – error transfer functions- Error Constants-Time-Domain Analysis of Second Order Systems-Time Response

UNIT-III STABILITY **9**

Introduction-Jury Stability Test- Schur-Cohn stability Test- Bilinear transformation- Stability by Pole Location – Root locus method- Bode Plot- Nyquist Plot.

UNIT- IV DIGITAL PID CONTROLLER **9**

Cascade Compensation- Digital Lag Lead Compensator by Bode method- Design of P,PI and PID Controller- Ziegler's- Nichols Method, Cohen-Coon Method

UNIT- V STATE SPACE ANALYSIS **9**

Realization of Pulse Transfer Function- Diagonalisation- discretisation of Continuous time systems- State Transition Matrix- Solution of Discrete-time state equations- Controllability and Observability

TOTAL: 45 PERIODS

TEXT BOOKS:

1. V.I.George and C.P.Kurien, Digital Control System, Cengage Learning, 2012.
2. B.C.Kuo, Digital Control System, 2nd Edition, Oxford University Press, 2010.
3. M.Sami Fadali, Antonio Visioli, Digital Control Engineering Analysis and Design, Academic Press, 2013.

REFERENCES:

1. M.Gopal, 'Digital Control and State Variable Methods', Tata McGraw Hill, 3rd Edition, 2009.
2. C.M. Houpis, G.B.Lamount, ' Digital Control Systems- Theory, Hardware, Software', International Student Edition, McGraw Hill Book Co., 1985.
3. Kannan M.Moddgalya, Digital Control, Wiley India, 2007.

4. C.L.Philips and J.M.Pan, “Feedback Control System, Pearson, 2013.

BEI703 NEURAL NETWORKS AND FUZZY LOGIC CONTROL

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Study the concepts of Artificial Intelligence.
- Learn the methods of solving problems using Artificial Intelligence.
- Introduce the concepts of Expert Systems and machine learning.

Course Outcomes After successful completion of this course, the students should be able to

CO1: Identify and describe soft computing techniques
CO2: Recognize the feasibility of applying a soft computing methodology for particular problems
CO3: Apply NN to pattern recognition and regression problems.
CO4: Apply FL and reasoning to handle uncertainty and solve engineering problems.
CO5: Apply NN to optimization

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M	M	S	M			
CO2						M	M	S	M			
CO3						M	M	S	M			
CO4						M	M	S	M			
CO5						M	M	S	M			

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		

6.	End Semester Exam		

UNIT-I INTRODUCTION AND DIFFERENT ARCHITECTURES OF NEURAL NETWORKS 9

Artificial neuron – MLP – Back propagation – Hope field networks – Cohen Self – organizing maps – adaptive resonance theory

UNIT-II NEURAL NETWORKS FOR CONTROL 9

Schemes of neuron-control – identification and control of dynamical systems – adaptive neuron controller – case study

UNIT-III INTRODUCITON TO FUZZY LOGIC 9

Fuzzy sets – fuzzy relation – fuzzy conditional statements – fuzzy rules – fuzzy algorithm

UNIT-IV FUZZY LOGIC CONTROL SYSTEM 9

Fuzzy logic controller – fuzzification interface – knowledge base – decision making logic – defuzzification interface design of fuzzy logic controller case study.

UNIT-V NEURO – FUZZY LOGIC CONTROL 9

Optimization of membership function and rules base of fuzzy logic controller using neural networks – genetic algorithm – fuzzy neuron adaptive fuzzy systems – case study

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Laurence Faucet, Fundamentals of Neural Networks, Prentice Hall, Englewood clifs, N.J. 1992
2. Zimmermann H.J., Fuzzy set theory and its applications. Allied Publication Ltd., 1996

REFERENCES:

1. Tsoukalas L.H, and Robert E. Uhrigh, Fuzzy and Neural approach in Engineering John Wiley and sons, 1997
2. Jacek M. Zurads, Introduction to artificial Neural System, Jaico Publication House Mumbai, 1997
3. Klir G. J. and Yuan 5.6, Fuzzy Sets and fuzzy logic. Prentice Hall of India, New Delhi.
4. Driankov D., Helendron, H. Rein frank M., An Introduction to Fuzzy control, Narosa publishing House, New Delhi, 1996
5. Million W. T., Sutton R. S. and Webrose P.J., Neural Networds for control, MIT Press, 1992

BEI704 VIRTUAL INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide knowledge on design of process control by using virtual instrumentation techniques
- To provide knowledge in process analysis by VI tools.
- To give basic knowledge in describing function analysis.
- Get adequate knowledge VI tool sets

Course Outcomes after successful completion of this course,

The students should be able to

CO 1: To describe about virtual instrumentation.
CO 2: Get adequate knowledge VI tool sets
CO 3: To describe data acquisition
CO 4: To understand VI programming techniques.
CO 5: To get an adequate knowledge application of virtual instrumentation

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M	M	S	M			
CO2						M	M	S	M			
CO3						M	M	S	M			
CO4						M	M	S	M			
CO5						M	M	S	M			

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		

6.	End Semester Exam		

UNIT-I INTRODUCTION 9

Virtual Instrumentation: Historical perspective - advantages - block diagram and Architecture of a virtual instrument - Conventional Instruments versus Traditional Instruments - data-flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT-II VI PROGRAMMING TECHNIQUES 9

VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence Structures, formula nodes, local and global variables, State machine, string and file I/O, Instrument Drivers, Publishing measurement data in the web.

UNIT-III DATA ACQUISITION 9

Introduction to data acquisition on PC, Sampling fundamentals, Input/output techniques And buses. Latest ADCs, DACs, Digital I/O, counters and timers, DMA, Software and Hardware installation, Calibration, Resolution, Data acquisition interface requirements – Issues involved in selection of Data acquisition cards – Data acquisition cards with serial Communication - VI Chassis requirements. SCSI, PCI, PXI system controllers, Ethernet Control of PXI. Networking basics for office & Industrial applications, VISA and IVI.

UNIT-IV VI TOOLSETS 9

Use of Analysis tools, Fourier transforms, power spectrum, correlation methods, Windowing and filtering. Application of VI in process control designing of equipments like oscilloscope, Digital multimeter, Design of digital Voltmeters with transducer input Virtual Laboratory, Web based Laboratory

UNIT-V APPLICATIONS 9

Distributed I/O modules- Application of Virtual Instrumentation: Instrument Control, Development of process database management system, Simulation of systems using VI, Development of Control system, Industrial Communication, Image acquisition and processing, Motion control. Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, HMI / SCADA software, Active X programming.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Gary Johnson, Lab VIEW Graphical Programming, Second edition, McGraw Hill, Newyork, 1997.
2. Lisa K. wells & Jeffrey Travis, Lab VIEW for everyone, Prentice Hall, New Jersey, 1997.

REFERENCES:

1. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newness, 2000.

BEI7E3 ELECTIVE III

L	T	P	C
3	0	0	3

ELECTIVE IV

L	T	P	C
3	0	0	3

BEI7L1 ADVANCE CONTROL SYSTEMS LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

To experimentally verify the process control concepts on the selected process control loops.

Outcomes after successful completion of this course, the students should be able to

CO1: Infer the effect of different control modes on different processes.

CO2: Evaluate the different controller parameters using different tuning process.

CO3: Analyze the different complex control systems in process industries

CO4: Analyze the behavior of different control loops.

CO5: Infer the basic components of a final control element and distinguish the different Characteristics of control valve.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S						W					
CO2		M	S									
CO3			M									
CO4			S							M		

CO5		S					M					

ASSESSMENT METHODS:

DIRECT		INDIRECT	
1.	Lab Records & Observation Books	**1.**	Students Exit Survey
2.	Model Exam	**2.**	Faculty Survey
3.	End Semester Exam	**3.**	Industry
		4.	Alumni

List of Experiments

1. To obtain the moment of inertia and then develop the transfer function of the given DC Motor for (a) Armature controlled case and (b) Field controlled case. Draw the relevant block diagrams.
2. To conduct experiments on the given amplidyne for (a) to obtain the transfer function
   (b) To obtain the load characteristics under different levels of compensation
   (c) To obtain the characteristics of a metadyne.
3. To design a Lag-Lead compensator and to obtain the characteristics by simulation using MATLAB®. Verify the performance using experiments with the compensator circuit made of passive elements.
4. To set up a system for closed loop voltage regulation for a dc separately excited generator using amplidyne and to obtain its characteristics
5. To conduct experiments on the Level Process Control Station and to study the working of a level control loop.
6. To set up an open loop control system using Micro-processor for controlling the stepper motor
7. To design a Lead compensator and to obtain the characteristics by simulation using MATLAB®. Verify the performance using experiments with the compensator circuit made of passive elements.
8. Effect of P, PD, PI, PID Controller on a second order systems
9. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor.

BEI7L2 VIRTUAL INSTRUMENTATION LAB ORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

To experimentally verify the use of VI tools on the selected process.

CO1: To learn about HDL

CO2: Evaluate the different simulation parameters using different process.

CO3: Analyze the different complex control systems in virtual instrumentation

CO4: Analyze the behavior of Xilinx

CO5: Infer the basic components of an IC design experiments.

	CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak											
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S						W					
CO2		M	S									
CO3			M									
CO4			S							M		
CO5		S					M					

ASSESSMENT METHODS:

DIRECT		INDIRECT	
1.	Lab Records & Observation Books	**1.**	Students Exit Survey
2.	Model Exam	**2.**	Faculty Survey
3.	End Semester Exam	**3.**	Industry
		4.	Alumni

LIST OF EXPERIMENTS

FPGA BASED EXPERIMENTS.

1. HDL based design entry and simulation of simple counters, state machines, adders (min 8 bit) and multipliers (4 bit min).
2. Synthesis, P&R and post P&R simulation of the components simulated in (I) above. Critical paths and static timing analysis results to be identified. Identify and verify possible

Conditions under which the blocks will fail to work correctly.

3. Hardware fusing and testing of each of the blocks simulated in (I). Use of either chip scope Feature (Xilinx) or the signal tap feature (Altera) is a must. Invoke the PLL and Demonstrate the use of the PLL module for clock generation in FPGAs.

IC DESIGN EXPERIMENTS: (BASED ON CADENCE / MENTOR GRAPHICS / EQUIVALENT)

4. Design and simulation of a simple 5 transistor differential amplifier. Measure gain, ICMR, And CMRR
5. Layout generation, parasitic extraction and reticulation of the circuit designed in (I)
6. Synthesis and Standard cell based design of a circuits simulated in 1(I) above. Identification of critical paths, power consumption.
7. for expt (c) above, P&R, power and clock routing, and post P&R simulation.
8. Analysis of results of static timing analysis.

TOTAL: 45 PERIODS

BEI7P1 MINI PROJECT

L	T	P	C
0	0	3	2

SEMESTER VIII

ELECTIVE V

L	T	P	C
3	0	0	3

ELECTIVE VI

L	T	P	C
3	0	0	3

ELECTIVE VII

L	T	P	C
3	0	0	3

BEI8P1 PROJECT WORK

L	T	P	C
0	0	12	6

ELECTIVES

BEI 001 BIOMEDICAL INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few examples
- To study measurement of certain important electrical and non-electrical parameters
- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

Course Outcomes after successful completion of this course,

The students should be able to

CO1: Choose the appropriate instrument required for measurement of any non-electrical, physiological parameter
CO2: Interpret the outcome of any instrument and analyze the stability of the quantity measured
CO3: Acquire knowledge in electro-physiological measurements and non-electrical parameters
CO4: Acquire knowledge in medical imaging, PMS, assisting and therapeutic equipments.
CO5: Design a project as a team

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M	M	S	M			
CO2						M	M	S	M			
CO3						M	M	S	M			
CO4						M	M	S	M			
CO5						M	M	S	M			

Assessment methods:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey

3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT – I

ANATOMY, PHYSIOLOGY AND TRANDUCERS 9

Brief review of human physiology and anatomy – cell and their structures – electrical mechanical and chemical activities – action and resting potential – different types of electrodes – sensors used in biomedicine – selection criteria for transducers and electrodes – necessity for low noise pre-amplifiers – difference amplifiers – chopper amplifiers – electrical safety – grounding and isolation.

UNIT II

ELECTRO-PHYSIOLOGICAL MEASUREMENT 9

ECG – EEG – EMG – ERG –led system and recording methods – typical waveforms.

UNIT III

NON-ELECTRICAL PARAMETER MEASUREMENTS 9

Measurement of blood pressure – blood flow cardiac output – cardiac rate – heart sound – measurement of gas volume – flow rate of CO 2 and O 2 in exhaust air –pH of blood – ESR and GSR measurements.

UNIT IV

MEDICAL IMAGING AND TELEMETRY 9

X-RAY machine – computer tomography – magnetic resonance imaging system – ultra zoography – endoscopy – different types of telemetry system – laser in biomedicine.

UNIT V

ASSISTING AND THERAPETIC DEVICES 9

Cardiac pacemakers – defibrillators ventilators – muscle stimulators – diathermy – introduction to artificial kidney artificial heart – heart lung machine – limb prosthetics – orthotics – elements of audio and visual aids.

Total Period 45

TEXT BOOKS

1. Webster J.G., Medical Instrumentation: Application and Design, 3 rd Edition, John Wiley and Son, 1999.

2. Khandpur R.S. Hand book of Biomedical Instrumentation and Measurements, Tata McGraw Hill New Delhi 1987.

REFERENCE

1. Geddes and Baker, Principles of Applied Biomedical Instrumentation, John Wiley and Sons, USA, 1975.

2. Well G, Biomedical Instrumentation and Measurements, Prentice Hall, New Jersey, 1980.

3. Koryla J., Medical and Biological Application of electro chemical devices John Wiley and Sons, Chic ester, 1980.

4. Wise D. L., Applied Bio- sensors, Butter worth USA, 1989.

5. Jackson and Webster, Medicine and Clinical Engineering Prentice Hall, New Delhi, 1979

BEI002 FIBER OPTICS AND LASER INSTRUMENTATIONS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To expose the basic concepts of optical fibers and their industrial applications.
- To provide adequate knowledge about Industrial application of optical fibres.
- To provide basic concepts of lasers.
- To provide knowledge about Industrial application of lasers
- To provide knowledge about Industrial application of Holography and Medical applications of
- Lasers.
- **Course Outcomes After successful completion of this course, the students should be able to**

CO 1: To describe about fiber optics.

CO 2: Get adequate knowledge fiber optics instrumentation

CO 3: To describe optical fiber properties

CO 4: To understand laser properties.

CO 5: To get an adequate knowledge hologram and medical application,

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M	M	S	M			
CO2						M	M	S	M			
CO3						M	M	S	M			
CO4						M	M	S	M			
CO5						M	M	S	M			

Assessment methods:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I

OPTICAL FIBERS AND THEIR PROPERTIES 9

Principles of light propagation through a fiber – different types of fibers and their properties transmission characteristics of optical fiber – absorption losses – scattering losses – dispersion – optical fiber measurement – optical sources – optical detectors – LED – LD – PIN and APD

UNIT II

INDUSTRIAL APPLICATION OF OPTICAL FIBERS 9

Fiber optic sensors – fiber optic instrumentation system – different types of modulators – detectors – application in instrumentation – interferometric method of measurement of length – moiré fringes – measurement of pressure, temperature, current, voltage liquid level and strain – fiber optic gyroscope – polarization maintaining fibers.

UNIT III

LASER FUNDAMENTALS 9

Fundamental characteristics of lasers – three level and four level lasers – properties of laser – laser modes – resonator configuration – Q-switching and mode locking – cavity dumping – types of lasers: gas lasers, solid lasers, liquid lasers and semi conductor lasers

UNIT IV

INDUSTRIAL APPLICATION OF LASERS 9

Laser for measurement of distance, length velocity, acceleration, current, voltage and atmospheric effect – material processing – laser heating, welding melting and trimming of materials – removal and vaporization.

UNIT V

HOLOGRAM AND MEDICAL APPLICATION 9

Holography – basic principle; methods; holographic interferometric and applications, holography for non – destructive testing – holographic components – medical applications of lasers; laser and tissue interaction – laser instruments for surgery, removal of tumors of vocal cords, brain surgery, plastic surgery, gynecology and oncology

Total Period 45

TEXT BOOKS

1. John and Harry, Industrial lasers and their applications, McGraw-Hill, 1974
2. **Senior J.M., Optical Fiber Communication Principles and Practice, Prentice Hall, 1985**

REFERENCES

1. John F Read, Industrial applications of lasers, Academic Press, 1978
2. Monte Ross, Laser applications, McGraw-Hill, 1968
3. Keiser G., Optical Fiber Communication, McGraw-Hill, 1991
4. Jasprit Singh, Semi conductor optoelectronics, McGraw-Hill, 1995
   Ghatak A.K and Thiagarajar K, Optical electronics foundation book, TMH, New Delhi, 1991.

BEI003 COMPUTER ORGANISATION AND ARCHITECTURE

L	T	P	C
3	0	0	3

OBJECTIVES:

- To make students understand the basic structure and operation of digital computer.
- To understand the hardware-software interface.
- To familiarize the students with arithmetic and logic unit and implementation of fixed point and Floating-point arithmetic operations.
- To expose the students to the concept of pipelining.
- To familiarize the students with hierarchical memory system including cache memories and Virtual memory.
- To expose the students with different ways of communicating with I/O devices and standard I/O Interfaces.

Course Outcomes After successful completion of this course, the students should be able to

CO 1: To describe about pipelines.

CO 2: Get adequate knowledge Evolution of computers

CO 3: To describe processor

CO 4: To understand programming techniques.

CO 5: To get an adequate knowledge memory organization and devices

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M	M	S	M			
CO2						M	M	S	M			
CO3						M	M	S	M			
CO4						M	M	S	M			
CO5						M	M	S	M			

ASSESSMENT METHOD:

DIRECT	INDIRECT

1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT 1

EVOLUTION OF COMPUTERS **9**

Evolution of computers, generation of computers, different types of computers, characteristics of Von-Neumann architecture, limitation of computer systems, parallel computer structures, micro programming instruction formats, addressing and instruction types of INTEL 8088/80286/80386, MOTOROLA 6800/68020/68030 architectures

UNIT II

PIPELINES **9**

Principles of linear pipelining, classification of pipeline processors, interleaved memory organizations instructions and arithmetic pipelines, design examples vector processing requirements, characteristics of vector processing.

UNIT III ` ``` `

MULTIPROCESSORS **9**

Multiprocessor architecture, function structures, loosely coupled multiprocessors, tightly coupled multiprocessors, processor characteristics for multiprocessing, interconnection networks, time shared, crossbar switch and multiport memories and multistage networks for multiprocessor classification of multiprocessor operating system, computer organization:
Arithmetic logic unit, control unit, memory, input output device and buses and interfaces.

UNIT IV ` ``

CENTRAL PROCESSING UNIT **9**

All unit construction integer representation binary half adder full adder parallel binary adder, addition and subtraction in a parallel arithmetic element, full adder design BCD adder, positive and negative number, shift operation, basic operations, logic operation, multiplexers, high speed arithmetic.

CONTROL UNIT

Construction of an instruction world, instruction cycle and execution cycle organization of control, registers, instruction formats, controlling arithmetic operations, typical sequence of operations, instruction set, register transfer language, microprogramming: micro instruction format, simple micro program,, microprogramming applications.

UNIT V `` ` ` ` `

MEMORY ORGANIZATION **9**

Memory- Random access memory, memory organization, memory operations comparisons, decoders, dimensions of memory access, connecting memory chips to computer bus, random access memories, static and dynamic ROM and PROM memories, mass storage, hard disk, floppy disk, magnetic tapes, tape cassettes, cartridges, magnetic bubbles, CCD and optical storage devices, computer world structure, storage hierarchies, digital recording techniques , virtual and cache memories.

I/O DEVICES

INPUT MEDIA: keyboard punched tapes, punched cards, character recognition (MICR & OCR), output devices, CRT flat panel dilplay, printers, teliprinters (TTY),
BUSES & INTERFACES: interconnecting system components, interrupts & DMA, interfacing, buses, i/o addressing techniques, memory mapped I/o, interrupts in i/o systems, standard buses, interfacing of keyboards & printers,

Total Hour 45

Text books

1: bartee .T.C. computer architecture and logic design. McGraw hill 1991

2: Andrew s. Tenanbaum structured computer organization, prentice hall of India 1990

References

1: bhujade m.r digital computer design principles, pitamber publishing 1989

2: malvino A.P, digital computer electronics, Tata McGraw hill 1991

3: Schneider .G.M., the principles of computer organization, john wiley sons 1985

4: Mano M.M, computer system architecture, prentice hall 1992

BEI004 PARALLEL AND DISTRIBUTED COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To expose the students to the concepts of parallel networks.
- To provide adequate knowledge about distributed networks
- To provide adequate knowledge about parallel systems
- To provide comprehensive knowledge of computing

Course Outcomes after successful completion of this course,

The students should be able to

CO 1: To describe about parallel architecture.

CO 2: Get adequate knowledge networks

CO 3: To describe algorithm and language

CO 4: To understand distributed systems

CO 5: To get an adequate knowledge application of interconnected networks

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M		M			M	M	S	M			
CO2	M		M			M	M	S	M			
CO3	M		M			M	M	S	M			
CO4	M		M			M	M	S	M			
CO5	M		M			M	M	S	M			

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I

PARALLEL ARCHITECTURE **12**

Pipelining, vector processors, array processors, multiprocessor architecture, data flow architecture systolic architecture –basic concepts – examples.

UNIT II
INTERCONNECTING NETWORKS **7**
Single stage, multistage interconnection networks, cube, mesh shuffle exchange, pyramid butterfly networks.

UNIT III **10**
PARALLEL ALGORITHMS AND LANGUAGES
Design of parallel algorithms, sorting, FFT, dictionary operation, graph algorithms, parallel, languages – features, constructs.

UNIT IV **10**
DISTRIBUTED SYSTEMS
Models, hardware concepts, communications, synchronization mechanism – case study: MPI and PVM.

UNIT V **6**
DISTRIBUTED FILE SYSTEMS
Design, implementation, trends in distributed file system.

Text books:

1. Hwang. K. Advanced computer architecture: parallelism, scalability, programmability, Tata McGraw hill, 1993.
2. Joel M. Crichlow, An Introduction to distributed and parallel computing. Prentice Hall of India , new delhi,1997

References:

1. Hwang. K. Briggs, F.A… Computer architecture and parallel processing, Tata McGraw Hill, 1995.
2. Huinn, M.J., designing efficient algorithms for parallel computers, McGraw Hill, 1995.
3. Tenanbaum A. S, Modem operating systems, Prentice Hall, N.J., 1999.
   Cutter, D.E., Parallel computer Architecture: A Hardware-software approach - Harcourt Asia Pvt., 1999.

BEI005 INSTRUMENTATION & CONTROL IN PETROCHEMICAL INDUSTRY

L	T	P	C
3	0	0	3

OBJECTIVES:
To provide sound knowledge about

- To introduce the methods of crude oil extraction, processing and refining

- To educate on Unit operations in petroleum refinery and petrochemical industry
- To introduce Production routes of important petrochemicals, and
- To provide knowledge on Control of selected petrochemicals production processes.
- To educate on the safety in instrumentation systems

After successful completion of this course, the students should be able to

CO1: Demonstrate the working of field instruments.

CO2: Explain the various control Schemes used in petrochemical industry industries.

CO3: Describe the operation of various measurements in petrochemical industries.

CO4: Explain the control loops in petrochemical industries.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					S		S		S		S	
CO2			S									
CO3		M	S		S				S			
CO4			S				W				W	

Assessment methods:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I
PETROLEUM PROCESSING **9**

Petroleum exploration, recovery techniques, oil gas separation processing, wet gases refining of crude oil.

UNIT II

OPERATIONS IN PETROLEUM INDUSTRY 9

Thermal cracking - catalytic cracking - catalytic reforming - polymerization – alkylation-isomerization- production of ethylene, acetylene and propylene from petroleum.

UNIT III

CHEMICALS FROM PETROLEUM PRODUCTS 9

Chemicals from petroleum - methane derivatives - acetylene derivatives- Ethylene derivatives - propylene derivatives - other products.

UNIT IV

MEASUREMENT IN PETROCHEMICAL INDUSTRY 9

Parameters to be measured in refinery and petrochemical industry – selection and maintenance of measuring instruments – intrinsic safety of instruments.

UNIT V

CONTROL LOOPS IN PETROCHEMICAL INDUSTRY 9

Process control of refinery and petrochemical industry – control of distillation column control of catalytic crackers and pyrolysis unit – automatic control of polyethylene production – control of vinyl chloride and PVC production.

Text Books:

1. Waddams A.L. Chemical from petroleum, Butter and Janner Ltd., 1968.
2. Balchand .J.G. and Mumme K. L. , Process control structures and Applications Van Nostrand Reinhold Company, New York. 1988.

Reference:

1. Austin G.T. Shreeves, Chemical process industries, McGraw Hill International student edition, Singapore, 1985.
2. Uptak B.G. Instrumentation in process industries, Chilton Book Company, 1994.

BEI006 POWER PLANT INSTRUMENTATION I

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide an overview on power generation through various methods
- To educate on the important power plant measurements and devices
- To educate on basic Boiler control techniques
- To educate on advanced Boiler control techniques

- To educate on the turbine control techniques

Course Outcomes after successful completion of this course,

The students should be able to

CO1: Outline the basics of power plant and power generation

CO2: Bring out the various measurements involved in power generation plants.

CO3: Understand the operation of traditional power plants and its Instruments

CO4: Impart knowledge about control in Boilers control loops.

CO5: Explain about boilers and turbines.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M				M	M	S	M			
CO2	S	M				M	M	S	M			
CO3	S	M				M	M	S	M			
CO4	S	M				M	M	S	M			
CO5	S	M				M	M	S	M			

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-1

SAFETY STANDARDS **9**

Electrical safety standards-Requirements for Instruments in Hazardous localities-determination and classification of area in instrument systems-Group of materials.

UNIT-II

EXPLOSION FUNDAMENTALS **9**

Ignition energy and flame velocity-Lower and upper explosion limits-Precaution in testing-Opening contacts in inductive, capacitive and resistive circuits-Principle of hazardous reduction and approach to safety-Explosion proof housing-Reduction of hazard by purging-Intrinsic safety code and safe systems-Flame ancestors-kind of arresters safe level of circuit voltage-Canella standards.

UNIT-III

POWER PLANTS **9**

Plant layout as process descriptions-Structure of power plants-Nuclear and thermal power station-Hydroelectric-Non conventional energy sources

UNIT-IV

INSTRUMENTS AND CONTROL SYSTEMS IN POWER PLANTS **9**

Boiler instruments and control-Turbine instruments and controls-Power house instruments and controls.

UNIT-V **9**

INSTRUMENTS AND CONTROL SYSTEMS IN NUCLEAR POWER PLANTS

Control loop in nuclear plants-heat exchangers, moderators-speed control vibration control.

REFERENCES:

1. Liptak.B.G., Instrumentation in processing industries 1st edition, Chiton book Co. Philadelphia 1973.
2. Wakil E.I., Power Plant tecnology.Mcgraw Hill, 1984.
3. Magison E.G., Electrical Instrument in hazardous locations, ISA, USA 1980

BEI007 VLSI DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- In this course, the MOS circuit realization of the various building blocks that is common to any microprocessor or digital VLSI circuit is studied.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed.
- The main focus in this course is on the transistor circuit level design and realization for digital operation and the issues involved as well as the topics covered are quite distinct from those encountered in courses on CMOS Analog IC design.

Course Outcomes after successful completion of this course,

The students should be able to

CO1: Describe the various fabrication technology used in developing logic gates.

CO2: Design combinational and sequential circuits using various MOS logic.

CO3: Design simple combinational and sequential logic using VHDL programming.

CO4: Explain about the structured design of combinational logic circuits.

CO5: Describe the structure and operation of Programmable logic devices.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		M	S			M	M	S	M			
CO2		M	S			M	M	S	M			
CO3		M	S			M	M	S	M			
CO4		M	S			M	M	S	M			
CO5		M	S			M	M	S	M			

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I **9**

BASIC DEVICE CHARACTERISTICS

NMOS, PMOS and CMOS devices characteristics, linear, saturation modes,
Bulk effect capacitances, device models for simulation CMOS device fabrication

Principles.

UNIT II **9**

BASIC CIRCUITS FOR DIGITAL SYSTEMS

CMOS Inverter Design Principles Design Layout rules,-Construction of multiplexers, transmission gates, latches, flip-flops -Timing and fan-out Considerations.

UNIT III **9**

BUILDING BLOCKS OF DIGITAL SYSTEMS

Combinational logic and Sequential logic circuits, Data path circuits, Adder multiplier architecture and accumulators.

UNIT IV

DIGITAL DESIGN USING VHDL **9**

Design concepts-Design Tools-Simulators-Introduction to VHDL-Sequential and Concurrent Descriptions-Signal port and Variable Statement-Case and Other Sequential Statements- Compilation and Simulation of VHDL, Code- VHDI. Functions-Procedures- Packages and libraries- Introduction to virology and brief comparison with VHDL.

UNIT V

FPGA DESIGN **9**

VHDI Model for combinational Networks- Routing Procedures in FPGA and CPLD-Programming Methods for FPGA and CPLD- Simulation and Synthesis issues- FPGA Architecture- FPGA Design Flow for Logic Gates, Multiplexer, Flip Flop Architecture- FPGA Design Flow for Logic Gates, Multiplexer, Flip Flop, Counter.

Text Books:

1. Rabey, J.M. Digital intergrated circuits: A Design Perspective, Prentice Hall, 1955.
2. Stephen Brown and zyonko Vranesis, Fundamentals of Digital Logic with VHDL. Tata McGraw Hill, New Delhi.

References:

1. Smith, M.J, Application specific Integrated Circuits Addison Wesley Press, 1999.
2. Waste. N.H.E and Ershingian, K.. Principles of CMOS VLST Design A Design Perspective, Addison Wesley, 1996.
3. Chales H Roth Jr., Roth Jr., Digital System Design using VHDL. Thomason Asia Pvt.
4. Bhasker J. VHDL Primer Prentice Hall 1995.

BEI008 ANALOG INTEGRATED CIRCUIT DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the meters used to measure current & voltage.
- To have an adequate knowledge in the measurement techniques for power and energy, power
- And energy meters are included.
- To provide elaborate discussion about potentiometer & instrument transformers.
- To provide detailed study of resistance measuring methods.
- To provide detailed study of inductance and capacitance measurement.

Course Outcomes after successful completion of this course,

The students should be able to

CO 1: To describe about single stage amplifier.

CO 2: Get adequate knowledge feedback amplifiers

CO 3: To describe operational amplifiers

CO 4: To understand stability and frequency compensation.

CO 5: To get an adequate knowledge application of amplifiers

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		M	S	M		M	M	S	M			
CO2		M	S	M		M	M	S	M			
CO3		M	S	M		M	M	S	M			
CO4		M	S	M		M	M	S	M			
CO5		M	S	M		M	M	S	M			

ASSESSMENT METHOD:

DIRECT	INDIRECT

1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I SINGLE STAGE AMPLIFIERS 12

Basic MOS physics and equivalent circuits and models, CS, CG and Source Follower cascade and folded cascade configurations, differential amplifiers and current mirror configurations.

UNIT II HIGH FREQUENCY AND NOISE OF CHARACTERISTICS AMPLIFIERS 9

Current mirrors, cascade stages for current mirrors, current mirror loads for differential pairs. Miller effect, association of poles with nodes, frequency response of CS, CG and source follower, cascade and differential pair stages Statistical characteristics of noise, noise in single stage amplifiers, noise in differential amplifiers.

UNIT III FEEDBACK AND OPERATIONAL AMPLIFIERS 9

Properties and types of negative feedback circuits, effect of loading in feedback networks, operational amplifier performance parameters, One-stage Op Amps, Two-stage Op Amps, Input range limitations, Gain boosting, slew rate, power supply rejection, noise in Op Amps.

UNIT IV STABILITY AND FREQUENCY COMPENSATION 9

General considerations, multiple systems, Phase Margin, Frequency Compensation, and Compensation of two stage Op Amps, Slewing in two stage Op Amps, and Other compensation techniques.

UNIT V BANDGAP REFERENCES 6

Supply independent biasing, temperature independent references, PTAT current generation, Constant-Gm Biasing.

TOTAL: 45 PERIODS

REFERENCES:

1. Behzad Razavi, “Design of Analog CMOS Integrated Circuits”, Tata McGraw Hill, 2001
2. Willey M.C. Sansen, “Analog Design Essentials”, Springer, 2006.
3. Grebene, “Bipolar and MOS Analog Integrated circuit design”, John Wiley & sons, Inc., 2003.
4. Phillip E.Allen, DouglasR.Holberg, “CMOS Analog Circuit Design”, Second edition, Oxford University Press, 2002
5. Recorded lecture available at http://www.ee.iitm.ac.in/~ani/ee5390/index.html

6. Jacob Baker “CMOS: Circuit Design, Layout, and Simulation, Third Edition”, Wiley IEEE Press 2010 3rd Edition

BEI009 ADVANCED DIGITAL SIGNAL PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To bring out the concepts related to stationary and non-stationary random signals
- To emphasize the importance of true estimation of power spectral density
- To introduce the design of linear and adaptive systems for filtering and linear prediction
- To introduce the concept of wavelet transforms in the context of image processing

Course Outcomes after successful completion of this course,

The students should be able to

CO1: Use a modern computer programming environment (e.g. Matlab) as an interactive problem solving tool and to visualize programming projects

CO2: Apply and Analyze image processing techniques in both spatial and frequency (Fourier) domains

CO3: Design image analysis techniques in the form of image segmentation and to evaluate the methodologies for segmentation

CO4 Conduct independent study and analysis of feature extraction techniques

CO5: Understand the various Image Compression methods

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S				M	M	S	M			
CO2	M	S				M	M	S	M			
CO3	M	S				M	M	S	M			
CO4	M	S				M	M	S	M			

CO5	M	S				M	M	S	M			

ASSESSMENT METHOD:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I DISCRETE-TIME RANDOM SIGNALS 9

Discrete random process – Ensemble averages, Stationary and erotic processes, Autocorrelation and Auto covariance properties and matrices, White noise, Power Spectral Density, Spectral Factorization, Innovations Representation and Process, Filtering random processes, ARMA, AR and MA processes.

UNIT II SPECTRUM ESTIMATION 9

Bias and Consistency, Period gram, modified period gram, Blackman-Tukey method, Welch method, parametric methods of spectral estimation, Levinson-Durbin recursion.

UNIT III LINEAR ESTIMATION AND PREDICTION 9

Forward and Backward linear prediction, Filtering - FIR Wiener filter- Filtering and linear prediction, non-causal and causal IIR Wiener filters, Discrete Kalman filter.

UNIT IV ADAPTIVE FILTERS 9

Principles of adaptive filter – FIR adaptive filter – Newton’s steepest descent algorithm – LMS algorithm – Adaptive noise cancellation, Adaptive equalizer, Adaptive echo cancellers.

UNIT V WAVELET TRANSFORM 9

Multiresolution analysis, Continuous and discrete wavelet transform, Short Time Fourier Transform, Application of wavelet transform, Cepstrum and Homomorphic filtering.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Monson H, Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons Inc., New York, Indian Reprint, 2007.
2. John G.Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Pearson, Fourth 2007.
3. Dwight F. Mix, "Random Signal Processing", Prentice Hall, 1995.

REFERENCE:

1. Sophocles J. Orfanidis, "Optimum Signal Processing, An Introduction", McGraw Hill, 1990.

BEI010 DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Learn digital image fundamentals.
- Be exposed to simple image processing techniques.
- Be familiar with image compression and segmentation techniques.
- Learn to represent image in form of features.

After successful completion of this course, the students will be able to

CO1: Use a modern computer programming environment (e.g Matlab) as an interactive problem solving tool and to visualize programming projects

CO2: Apply and Analyze image processing techniques in both spatial and frequency (Fourier) domains

CO3: Design image analysis techniques in the form of image segmentation and to evaluate the methodologies for segmentation

CO4 Conduct independent study and analysis of feature extraction techniques

CO5: Understand the various Image Compression methods

	CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak											
Cos	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	W	W		S							
CO2	S	S	S	M	S							
CO3	S	S	S	M	S				W			
CO4	S	W		S	M							
CO5	M				W		W					

Assessment method:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I DIGITAL IMAGE FUNDAMENTALS AND TRANSFORMS 9

Elements of visual perception – Image sampling and quantization Basic relationship between pixels – Basic geometric transformations-Introduction to Fourier Transform and DFT – Properties of 2D Fourier Transform – FFT – Separable Image Transforms -Walsh – Hadamard – Discrete Cosine Transform, Haar, Slant – Karhunen – Loeve transforms.

UNIT II IMAGE ENHANCEMENT TECHNIQUES: 9

Spatial Domain methods: Basic grey level transformation – Histogram equalization – Image subtraction – Image averaging –Spatial filtering: Smoothing, sharpening filters – Laplacian filters – Frequency domain filters: Smoothing – Sharpening filters – Homomorphic filtering.

UNIT III IMAGE RESTORATION: 9

Model of Image Degradation/restoration process – Noise models – Inverse filtering -Least mean square filtering – Constrained least mean square filtering – Blind image restoration – Pseudo inverse – Singular value decomposition.

UNIT IV IMAGE COMPRESSION 9

Lossless compression: Variable length coding – LZW coding – Bit plane coding- predictive coding-DPCM.

Lossy Compression: Transform coding – Wavelet coding – Basics of Image compression standards: JPEG, MPEG, Basics of Vector quantization.

UNIT V IMAGE SEGMENTATION AND REPRESENTATION 9

Edge detection – Thresholding - Region Based segmentation – Boundary representation: chair codes- Polygonal approximation – Boundary segments – boundary descriptors: Simple descriptors-Fourier descriptors - Regional descriptors –Simple descriptors- Texture

TOTAL: 45

TEXT BOOKS

1. Rafael C Gonzalez, Richard E Woods 2nd Edition, Digital Image Processing - Pearson Education 2003.

REFERENCES

1. William K Pratt, Digital Image Processing John Willey (2001)
2. Image Processing Analysis and Machine Vision – Millman Sonka, Vaclav hlavac, Roger Boyle, Broos/colic, Thompson Learniy (1999).
3. A.K. Jain, PHI, New Delhi (1995)-Fundamentals of Digital Image Processing.
4. Chanda Dutta Magundar – Digital Image Processing and Applications, Prentice Hall of India, 2000

BEI011 MICRO CONTROLLER BASED SYSTEM DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the architecture of PIC microcontroller
- To educate on use of interrupts and timers
- To educate on the peripheral devices for data communication and transfer
- To introduce the functional blocks of ARM processor
- To educate on the architecture of ARM processors

Course Outcomes after successful completion of this course,

The students should be able to

CO 1: To describe about virtual instrumentation.

CO 2: Get adequate knowledge VI tool sets

CO 3: To describe data acquisition

CO 4: To understand VI programming techniques.

CO 5: To get an adequate knowledge application of virtual instrumentation

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M	M	S	M			
CO2						M	M	S	M			
CO3						M	M	S	M			
CO4						M	M	S	M			
CO5						M	M	S	M			

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I
THE ROLE OF MO0CRO CONTROLLERS 6

Type and selection - Application example

UNIT II
MICRO – CONROLLER RESOURCES 9

Family members, bus widths program and data memory parallel ports, D/A and A/D converters, reset circuitry, watchdog timers, power - down consideration

UNIT III
REAL TIME CONTROL 9

Interrupt Structures programmable timers, real – time clock, latency, interrupt, density and interval constraints.

UNIT IV
PROGRAMMING FRAMEWORK FOR 8051 AND PIC 16F877 9

CPU register – m Structure - Addressing mode - Instruction sets – Assembly languages – Assemblers

UNIT V
SOFTWARE BUILDING BLOCKS 12

Queues, tables and strings, program organization microcontroller expansion methods, I/O hardware alternatives, development tools, RTOS, Motorola (MC68HC11) and Intel microcontroller *8051)

L = 45

Text Books:

1. John, B. Peatman, 'Design with Microcontroller'. McGraw |Hill International., 1989
2. Michael Slater, 'Microprocessor – Based design : A Comprehensive Guide to Effective Hardware Design', Prentice Hall, 1989

References:

1. S. Yeralsan and A. Ahiuwalia, ' Programming and Interfacing the 8051 Microcontroller', Addison Wesley, 1995
2. Intel Manual on 16 bit – embedded control users, 191
3. Motorola manual on 8 and 16 bit microcontroller
4. Myke Predko, Programming and Customizing the 8051 microcontroller, Tata McGraw Hill , New Delhi.
5. Kenneth J. Ayala, The 8051 Microcontroller Architecture, programming and applications, Pentram International Publishers, Mumbai, 1996
6. Peter Spasoy, Microcontroller Technology: The 68HC11, Prentice Hall.

BEI012 **ROBOTICS AND AUTOMATION**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the functional elements of Robotics
- To impart knowledge on the direct and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

Course Outcomes after successful completion of this course,

The students should be able to

CO 1: To describe about virtual instrumentation.

CO 2: Get adequate knowledge VI tool sets

CO 3: To describe data acquisition

CO 4: To understand VI programming techniques.

CO 5: To get an adequate knowledge application of virtual instrumentation

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M	M	S	M			
CO2						M	M	S	M			
CO3						M	M	S	M			
CO4						M	M	S	M			
CO5						M	M	S	M			

ASSESSMENT MAPPING:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		

6.	End Semester Exam		

UNIT – I **9**
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.

UNIT – II **9**
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.

UNIT – III **9**
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.

UNIT – IV **9**
KINEMATICS AND PATH PLANNING

Solutions of inverse kinematics problem – multiple solution jacobian work envelop – hilt climbing techniques – robot programming languages.

UNIT – V **9**
CASE STUDIES

Multiple robots – machine interface – robots in manufacturing and non – manufacturing applications – robot cell design – selection of robot.

L = 45

Text Books:

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

References:

1. Deb. S. R, Robotics technology and flexible Automation, John Wiley. USA 1992.
2. Agahl, C. R, Robots and manufacturing Automation, John Wiley, USA 1992.
3. Klafter P. O., Chimielewski T. A., Negin M, Robotic Engineering – An integrated approach. Prentice Hall of India, New Delhi, 1994
   McKerrow P. J, Introduction to Robotics, Addison Wesley, USA, 1991

BEI013 ADVANCED CONTROL SYSTEM

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide knowledge on design in state variable form
- To provide knowledge in phase plane analysis.
- To give basic knowledge in describing function analysis.
- To study the design of optimal controller.
- To study the design of optimal estimator including Kalman Filter

Course Outcomes After successful completion of this course, the students should be able to

CO1: Develop skills in mathematical modeling

CO2: Describe auto tuning, adaptive control and model predictive control techniques.

CO3: Develop mathematical model for different case studies.

CO4: Apply the knowledge gained in model identification and adaptive control to analyze case studies.

CO5: Implement advanced control techniques in modern software.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	W		W	S							
CO2		M	S	M	S							
CO3	S		M									
CO4	S	W	S	W	M							
CO5	W	W		M	S							

ASSESSMENT METHOD:

DIRECT	INDIRECT

1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I
STATE VARIABLE ANALYSIS AND DESIGN 10

State models – solution of state equation – controllability and observability - pole assignment by state feedback - full and reduced order observers.

UNIT II
NONLINEAR SYSTEMS **10**

Common types of non- linear phenomenal – Linearization – singular points - phase plane method - construction of phase trajectories – system analysis by phase plane method – describing function method – describing function of nonlinear elements - stability analysis by describing function method jump resonance Liapunov's and Popov's criteria.

UNIT III
OPTIMAL CONTROL 9

Problem formulation - necessary conditions of optimality - state regulator problem - Matrix Riccati equation – infinite time regulator problem - output regulator and tracking problem- Pontryagin's minimum principle – time- optimal control problem.

UNIT IV
ADAPTIVE CONTROL 8

Classification – MRAC systems - Different configuration, classification, mathematical descriptions – direct and indirect MRAC- self tuning regulators – different approach to self tuning, recursive parameter estimation, implicit and explicit STR.

UNIT V
DIGITAL CONTROL SYSTEM 8

Characteristics of sampling – Data extrapolation – Review of Z transform theory – characteristic response of a sample and ZOH combination- stability analysis by mathematical tests and root locus diagrams – design using root loci.

L = 45

References:

1. Nagrath I. J., and Gopal, M., Control system engineering , Wiley Eastern Reprint, 1995
2. Kirk D. E., Optimal control theory, an Introduction, Prentice Hall, N. J: PAD
3. Chalam V. V., Adaptive control systems Marcel Dekker, INC New York and Bassel. 1987
4. Gopal. M. , Modem control system Theory, Wiley Eastern Ltd., II Edition Reprint, 1995
5. Stanely M. Shinners, Modern Control System Theory and Design, John Wiley and sons, 1998

BEI014 POWER ELECTRONICS DEVICES AND CIRCUIT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To get an overview of different types of power semiconductor devices and their switching Characteristics.
- To understand the operation, characteristics and performance parameters of controlled Rectifiers
- To study the operation, switching techniques and basics topologies of DC-DC switching Regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to Understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations.

Course Outcomes After successful completion of this course, the students should be able to

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S			S							
CO2	S											
CO3				S								

CO4							M					
CO5				M								

ASSESSMENT METHOD:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I POWER SEMICONDUCTOR DEVICES AND CHARACTERISTICS 9

Operating principle and switching Characteristics - Power diodes - Power BJT, Power MOSFET, IGBT, SCR,TRIAC, GTO, IGCT, MCT, Power integrated circuits (PIC) – Drive and Protection circuits – Series and parallel operation of power devices – Commutation –Simulation tools.

UNIT II CONTROLLED RECTIFIERS 9

Single phase – Three phases – Half controlled – Fully controlled rectifiers – Dual converters - Effect of source and load inductance - AC voltage controllers – Phase control, Cycloconverters PWM control, Transformer tap changers, Matrix converters.

UNIT III CHOPPERS 9

Step up and Step down Chopper – Chopper classification - quadrant of operation – Switching mode Regulators - Buck, Boost, Buck-Boost, and Cuk Regulators.

UNIT IV INVERTERS 9

Voltage source Inverters - Bridge Inverters – Half bridge – Full bridge – Three Phase Bridge Inverters - Voltage control – PWM Techniques – Current Source Inverters: –Capacitor Commutated Inverter- Resonant inverters - Series, Parallel, Class E, ZVS, ZCS, DC link - Introduction to multilevel Inverters.

UNIT V APPLICATION 9

Introduction to D.C and A.C drives – Electrical breaking - Open loop and closed loop control of drives (Block diagram approach only) – Principle of vector control of AC drives - Stepper motor drives - Switched mode power supply - Introduction to HVDC and FACTS - Static VAR compensators.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Rashid, M.H., "Power Electronics – Circuits, Devices and Applications", PHI, 3rd Ed., 2004.

2. Mohan, Udeland and Robbins., "Power Electronics", John Wiley and Sons, New York, 1995.

REFERENCE BOOKS:

1. Singh, M.D. Khanchandani, K.B., "Power Electronics", 2nd Ed., Tata McGraw-Hill, 2011.
2. Bose, B.K., "Modern Power Electronics and AC Drives", Pearson Education, 2002.

3. Bimbra, P.S, "Power Electronics", Khanna Publishers, 2006.

4. Moorthi, V.R., "Power Electronics - Devices, Circuits and Industrial Applications", Oxford University Press, 2005

BEI015 DIGITAL VLSI DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- In this course, the MOS circuit realization of the various building blocks that is common to any microprocessor or digital VLSI circuit is studied.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed.
- The main focus in this course is on the transistor circuit level design and realization for digital operation and the issues involved as well as the topics covered are quite distinct from those encountered in courses on CMOS Analog IC design.

Course Outcomes After successful completion of this course, the students should be able to

CO1: Describe the various fabrication technology used in developing logic gates.

CO2: Design combinational and sequential circuits using various MOS logic.

CO3: Design simple combinational and sequential logic using VHDL programming.

CO4: Explain about the structured design of combinational logic circuits.

CO5: Describe the structure and operation of Programmable logic devices.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S										
CO2										M		
CO3		S			M							
CO4										M		
CO5		S										

ASSESSMENT METHOD

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Online Test	**4.**	Alumni
5.	End Semester Exam		

UNIT I MOS TRANSISTOR PRINCIPLES AND CMOS INVERTER 12

MOS(FET) Transistor Characteristic under Static and Dynamic Conditions, MOS Transistor Secondary Effects, Process Variations, Technology Scaling, CMOS Inverter - Static Characteristic, Dynamic Characteristic, Power, Energy, and Energy Delay parameters.

UNIT II COMBINATIONAL LOGIC CIRCUITS 9

Propagation Delays, Stick diagram, Layout diagrams, Examples of combinational logic design, Elmore's constant, Dynamic Logic Gates, Pass Transistor Logic, Power Dissipation, Low Power Design principles.

UNIT III SEQUENTIAL LOGIC CIRCUITS 9

Static Latches and Registers, Dynamic Latches and Registers, Timing Issues, Pipelines, Pulse and sense amplifier based Registers, Non bistable Sequential Circuits.

UNIT IV ARITHMETIC BUILDING BLOCKS AND MEMORY ARCHITECTURES 9

Data path circuits, Architectures for Adders, Accumulators, Multipliers, Barrel Shifters, Speed and Area Tradeoffs, Memory Architectures, and Memory control circuits.

UNIT V INTERCONNECT AND CLOCKING STRATEGIES 9

Interconnect Parameters – Capacitance, Resistance, and Inductance, Electrical Wire Models, Timing classification of Digital Systems, Synchronous Design, Self-Timed Circuit Design.

TOTAL: 45 PERIODS

REFERENCES:

1. Jan Rabaey, Anantha Chandrakasan, B Nikolic, "Digital Integrated Circuits: A Design Perspective". Second Edition, Feb 2003, Prentice Hall of India.

2. N.Weste, K. Eshraghian, "Principles of CMOS VLSI Design". Second Edition, 1993 Addision Wesley,
3. M J Smith, "Application Specific Integrated Circuits", Addisson Wesley, 1997
4. Jacob Baker "CMOS: Circuit Design, Layout, and Simulation, Third Edition", Wiley IEEE Press 2010 3rd Edition

BEI016 ASIC DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the Building Blocks of ASIC
- To Educate in Various ASIC Strategies
- To introduce programmable ASIC architecture.
- To impart knowledge in Various ASIC scheduling algorithms.
- To introduce Basics of Real time

Course Outcomes After successful completion of this course, the students should be able to

CO1: Describe the various fabrication technology used in developing logic gates.

CO2: Design combinational and sequential circuits using various ASIC logic.

CO3: Design simple combinational and sequential logic using ASIC programming.

CO4: Explain about the structured design of combinational logic circuits.

CO5: Describe the structure and operation of Programmable logic devices.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S				S						
CO2										M		
CO3		S			M	S			M			
CO4										M		
CO5		S				S						

Assessment method:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I INTRODUCTION TO ASICS, CMOS LOGIC AND ASIC LIBRARY DESIGN 9

Types of ASICs - Design flow - CMOS transistors - Combinational Logic Cell – Sequential logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance- Logical effort.

UNIT II PROGRAMMABLE ASICS, PROGRAMMABLE ASIC LOGIC CELLS AND ROGRAMMABLE ASIC I/O CELLS 9

Anti fuse - static RAM - EPROM and EEPROM technology - Actel ACT - Xilinx LCA –Altera FLEX - Altera MAX DC & AC inputs and outputs - Clock & Power inputs - Xilinx I/O blocks.

UNIT III PROGRAMMABLE ASIC ARCHITECUTRE 9

Architecture and configuration of Spartan / Cyclone and Virtex / Stratix FPGAs – Micro-Blaze / Nios based embedded systems – Signal probing techniques.

UNIT IV LOGIC SYNTHESIS, PLACEMENT AND ROUTING 9

Logic synthesis - ASIC floor planning- placement and routing – power and clocking strategies.

UNIT V HIGH PERFORMANCE ALGORITHMS FOR ASICS/ SOCS. SOC CASE STUDIES 9

DAA and computation of FFT and DCT. High performance filters using delta-sigma modulators. Case Studies: Digital camera, SDRAM, High speed data standards.

TOTAL: 45 PERIODS

REFERENCES:

1. M.J.S.Smith, “Application - Specific Integrated Circuits", Pearson, 2003
2. Steve Kilts “Advanced FPGA Design,” Wiley Inter-Science.
3. Roger Woods, John McAllister, Dr. Ying Yi, Gaye Lightbod, “FPGA-based Implementation of Signal Processing Systems”, Wiley, 2008
4. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing ", McGraw Hill, 1994.
5. Douglas J. Smith, HDL Chip Design, Madison, AL, USA: Doone Publications, 1996.
6. Jose E. France, Yannis Tsividis, "Design of Analog - Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, 1994.

BEI017 LINEAR INTEGRATED CIRCUITS AND ITS APPLICATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the IC fabrication procedure.
- To study characteristics; realize circuits; design for signal analysis using Op-amp ICs.
- To study the applications of Op-amp.
- To study internal functional blocks and the applications of special ICs like Timers, PLL
- Circuits, regulator Circuits, ADCs.

Course Outcomes After successful completion of this course, the students should be able to

CO1: Acquire knowledge in identifying implementation areas of op-amps for specific purpose.

CO2: Design and construct circuit‘s depending upon applications.

CO3: Analyze the circuits using modern simulation software

CO4: Design electrical circuits, devices, and systems to meet application requirements.

CO5: Design a project as a team

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
Cos	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S		W	W							
CO2	W		S	M	M	W	W	W				
CO3	W	W	W	S	S							
CO4	W	W	S	W	M		W	W	S	S	M	
CO5	W	M	S	M	M			W	S	S	S	

ASSESMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

V

UNIT- I FABRICATION OF IC AND OP-AMP SPECIFICATIONS 9

IC classification - fundamentals of monolithic IC technology - epitaxial growth, masking and etching, diffusion of impurities- Realization of monolithic ICs and packaging-Fabrication of diodes, capacitance, resistance - Operational amplifiers, specifications, frequency compensation - slew rate and methods of improving slew rate.

UNIT-II APPLICATIONS OF OPERATIONAL AMPLIFIERS 9

Linear and Nonlinear Circuits using operational amplifiers and their analysis - Inverting and Non inverting Amplifiers - Differentiator - Integrator - Voltage to Current converter - Instrumentation amplifier - Sine wave Oscillators - Low pass and band pass filters - Comparator - Multivibrator and Schmitt trigger - Triangular wave generator - Precision rectifier - Log and Antilog amplifiers - Non-linear function generator. Practice tutorial problems.

UNIT-III ANALOG MULTIPLIER AND PLL 9

Analysis of four quadrant and variable transconductance multipliers - Voltage controlled Oscillator - Closed loop analysis of PLL, AM, PM and FSK modulators and demodulators.

UNIT-IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTORS 9

Analog switches - High speed sample and hold circuits and sample and hold IC's - Types of D/A converter - Current driven DAC - Switches for DAC - A/D converter, Flash, Single slope, Dual slope, Successive approximation - DM and ADM converters.

UNIT-V SPECIAL FUNCTION IC'S 9

Timers - Voltage regulators - linear and switched mode types - Switched capacitor filter - Frequency to Voltage converters - Tuned amplifiers - Power amplifiers - Isolation Amplifiers - Opto couplers.

TOTAL: 45 PERIODS

TEXT BOOK:

1. D.Roy Choudhery,Sheil B.Jain, Linear Integrated Circuits, 2nd Edition, New Age Publishers, 2003

REFERENCES:

1. Ramakant A. Gayakwad, Op - Amp and Linear IC's, Prentice Hall, 2000.
2. Robert F.Coughlin and Ferderick F. Driscoll, Operational Amplifiers and Linear Integrated Circuits, Prentice Hall of India, 2001.
3. David A Bell, Op-amp and Linear ICs, Second Edition, Prentice Hall of India, 1997.

BEI018 ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

L	T	P	C
3	0	0	3

The student should be made to:

- Study the concepts of Artificial Intelligence.
- Learn the methods of solving problems using Artificial Intelligence.
- Introduce the concepts of Expert Systems and machine learning

After successful completion of this course, the students should be able

CO1: Identify and describe soft computing techniques

CO2: Recognize the feasibility of applying a soft computing methodology for a particular

Problem.

CO3: Apply NN to pattern recognition and regression problems.

CO4: Apply FL and reasoning to handle uncertainty and solve engineering problems.

CO5: Apply GA to optimization problems.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S				S					S		
CO2	S	M			S	M				S	M	
CO3	S	M			S	M				S	M	
CO4	S	M			S	M				S	M	
CO5	S	M			S	M				S	M	

ASSESMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I INTRODUCTION TO ARTIFICIAL INTELLIGENCE 9

Overview of AI-general concepts-problem spaces and search-search techniques-BFS, DFS-Heuristic search techniques.

UNIT-II KNOWLEDGE REPRESENTATION 9

Knowledge – general concepts-predicate logic-representing simple fact-instance and ISA relationships-resolution-natural deduction.

UNIT-III KNOWLEDGE EDGE ORGANISATION AND MANIPULATION 9

Procedural Vs declaration knowledge-forward Vs backward reasoning- matching techniques-control knowledge/strategies-symbol reasoning under uncertainty-introduction to non-monotonic reasoning-logic for monotonic reasoning.

UNIT-IV PERCEPTION – COMMUNICATION AND EXPERT SYSTEMS 9

Natural language processing pattern recognition- visual image understanding expert system architecture.

UNIT-V KNOWLEDGE ACQUISITION 9

Knowledge acquisition-general concepts-learning-learning buy induction-explanation based learning.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Elaine Rich and Kelvin knight, Artificial Intelligence, Tata McGraw Hill, New Delhi, 1991.
2. Stuart Russell and Peter Nerving. Artificial Intelligence: A Modern approach. Prentice hal, 1995.

REFERENCES:

1. Nilson N.I. Principles of Artificial Intelligence,Springer Variage, Berlin,1980. Patterson, Introduction to Artificial Intelligence and Expert Systems. Prentice Hall of India, New Delhi, 1990.

BEI019 ANALYTICAL INSTRUMENTS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand various techniques and methods of analysis which occur in the various regions of the spectrum?
- To study important methods of analysis of industrial gases.
- To understand the important radio chemical methods of analysis.

Course Outcomes after successful completion of this course,

The students should be able to

CO1: Ability to understand and analyze Instrumentation systems and their applications to various Industries

CO2: will study important methods of analysis of industrial gases

CO3: Ability to understand various techniques and methods of analysis

CO4: will analyze processes analysis which occur in the various regions of the spectrum.

CO5: Ability to understand various techniques

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M				M	M	S	M		S	M
CO2	S	M				M	M	S	M		S	M
CO3	S	M				M	M	S	M		S	M
CO4	S	M				M	M	S	M		S	M
CO5	S	M				M	M	S	M		S	M

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT-I pH CONDUCTIVITY & DISSOLVED COMPONENT ANALYSER 9

Sampling systems– ion selective electrodes– conductivity meters-
pH meters- dissolved oxygen analyzer– sodium analyzer -silica analyzer– moisture measurement

UNIT-II GAS ANALYSER 9

Oxygen analyzer– CO monitor – Knox analyzer– H2S analyzer– dust and smoke measurement-thermal conductivity – thermal analyzer– industrial analyzers.

UNIT-III CHROMATOGRAPHY 9

Gas chromatography – liquid chromatography, principles, types and applications – high-pressure liquid chromatography-detectors.

UNIT-IV SPECTRO PHOTOMETERS 9

Spectral methods of analysis– Beer's law UV– visible spectrophotometers – single beam and double beam instruments – source and detectors – IR spectrophotometers – sources and detectors– FTIR spectrometer – atomic absorption spectrophotometer – flame emission spectrophotometers – sources of flame photometry– applications.

UNIT-V NUCLEAR MAGNETIC RESONANCE AND RADIATION TECHNIQUES 9

NMR basic principle – NMR spectrometers applications– introduction to mass spectrophotometer– nuclear radiation detectors – GM counter – proportional counter – solid state detectors introduction – to x-ray spectroscopy.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Willard, H.H., Merrit L.L., Dean J.A Seattle F.L., 'Instrumental Methods of Analysis', CBS Publishing and Distribution, 1995
2...Skoog, D.A. and West D.M., Principles of Instrumental Analysis, Holt Sounder Publication, Philadelphia, 1985
3. S.K.Singh., Mechanical &Industrial Measurements, Tata McGraw Hill-New Delhi

REFERENCES:

1 .Liptak, B.G, Process Measurement and Analysis, Chilton Book Company, 1995 Frank A. Settle, Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall, New Jersey, 1997
2. Ewing G.W., Instrumental Methods of Analysis', McGraw Hill, 1992
3. Mann C.K. Vickers, T.J. and Guillick W.H Instrumental Analysis, Harper and Row Publishers, New York, 1974.
4. Robert D.Braun, Introduction to industrial Analysis, McGraw Hill, Singapore 1987

BEI020 COMPUTER CONTROL OF PROCESSES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce analysis of discrete time systems in state variable form
- To introduce system identification techniques
- To educate on direct discrete design techniques
- To introduce multi-loop regulatory control
- To introduce multivariable regulatory control

Outcomes after successful completion of this course, the students should be able to
Assessment methods:

CO1: Develop skills in mathematical modeling

CO2: Describe auto tuning, adaptive control and model predictive control techniques. CO3: Develop mathematical model for different case studies.

CO4: Apply the knowledge gained in model identification and adaptive control to analyze case studies.

CO5: Implement advanced control techniques in modern software's.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S						W					
CO2		M	S									
CO3			M									
CO4			S							M		
CO5		S					M					

Assessment method:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I DISCRETE STATE-VARIABLE TECHNIQUE 9

State equation of discrete data system with sample and hold – State transition equation – Methods of computing the state transition matrix – Decomposition of discrete data transfer functions – State diagrams of discrete data systems – System with zero-order hold – Controllability and observability of linear time invariant discrete data system–Stability tests of discrete-data system – State Observer - State Feedback Control.

UNIT II SYSTEM IDENTIFICATION 9

Non Parametric methods:-Transient analysis–Frequency analysis–correlation analysis– Spectral analysis – Parametric methods: - Least square method – Recursive least square method.

UNIT III DIGITAL CONTROLLER DESIGN 9

Review of z-transform – Modified of z-transform – Pulse transfer function – Digital PID controller – Dead-beat control and Dahlin's control – Smith predictor – Digital Feed-forward controller – IMC-State Feedback Controller - LQG Control

UNIT IV MULTI-LOOP REGULATORY CONTROL 9

Multi-loop Control - Introduction – Process Interaction – Pairing of Inputs and Outputs -The Relative Gain Array (RGA) – Properties and Application of RGA – Multi – loop PID Controller– Biggest Log Modulus Tuning Method – De coupler

UNIT V MULTIVARIABLE REGULATORY CONTROL 9

Introduction to Multivariable control –Multivariable PID Controller -Multivariable IMC– Multivariable Dynamic Matrix Controller – Multivariable Model Predictive Control – Generalized Predictive Controller – Implementation Issues

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Soderstorm.T. And Stoica, P., "System Identification", Prentice Hall International Ltd., UK, 1989.

2. Gopal, M., "Digital Control and State Variable Methods", Tata McGraw Hill, 2003.
3. Bequette,B.W., "Process Control Modeling, Design and Simulation", Prentice Hall of India, 2004.

REFERENCES:

1. Stephanopoulos, G., "Chemical Process Control -An Introduction to Theory and 87 Practices", Prentice Hall of India, 2005.
2. Seborg, D.E., Edgar, T.F. and Mellichamp, D.A., "Process Dynamics and Control", Wiley John and Sons, 2ndEdition, 2003.
3. E.Ikonen and K.Najim, "Advanced Process Identification and Control", Marcel Dekker, Inc. Newyork, 2002.
4. P.Albertos and S.Antonio, "Multi variable Control Systems An Engineering Approach", Springer Verlag, 2004.
5. Sigurd Skogestad, Ian Postlethwaite, "Multi variable Feedback Control: Analysis and Design", John Wiley and Sons, 2004.

BEI021 POWER PLANT INSTRUMENTATION -II

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide an overview on power generation through various methods
- To educate on the important power plant measurements and devices
- To educate on basic Boiler control techniques
- To educate on advanced Boiler control techniques
- To educate on the turbine control techniques

Course Outcomes after successful completion of this course,

The students should be able to

CO1: Outline the basics of power plant and power generation

CO2: Bring out the various measurements involved in power generation plants

CO3: Understand the operation of traditional power plants and its Instruments

CO4: Impart knowledge about control in Boilers control loops.

CO5: Explain about boilers and turbines.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M	M	S	M			
CO2						M	M	S	M			
CO3						M	M	S	M			
CO4						M	M	S	M			
CO5						M	M	S	M			

Assessment method:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey

3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I OVERVIEW OF POWER GENERATION 9

Survey of methods of power generation :– hydro, thermal, nuclear, solar and wind power – Importance of instrumentation in power generation – Thermal power plant – Building blocks – Combined Cycle System – Combined Heat and Power System – sub critical and supercritical boilers.

UNIT II MEASUREMENTS IN POWER PLANTS 9

Measurement of feed water flow, air flow, steam flow and coal flow – Drum level measurement – Steam pressure and temperature measurement – Turbine speed and vibration measurement – Flue gas analyzer – Fuel composition analyzer.

UNIT III BOILER CONTROL – I 9

Combustion of fuel and excess air – Firing rate demand – Steam temperature control – Control of desecrator – Drum level control – Single, two and three element control – Furnace draft control – implosion – flue gas dew point control – Trimming of combustion air – Soot blowing.

UNIT IV BOILER CONTROL – II 9

Burners for liquid and solid fuels – Burner management – Furnace safety interlocks – Coal pulverizer control – Combustion control for liquid and solid fuel fired boilers – air/fuel ratio control – fluidized bed boiler – Cyclone furnace.

UNIT V CONTROL OF TURBINE 9

Types of steam turbines – impulse and reaction turbines – compounding – Turbine governing system

– Speed and Load control – Transient speed rise – Free governor mode operation – Automatic Load Frequency Control – Turbine oil system – Oil pressure drop relay – Oil cooling system – Turbine run up system.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Sam Dukelow, Control of Boilers, Instrument Society of America, 1991.
2. Everett Woodruff , Herbert Lammers, Thomas Lammers, Steam Plant Operation,9th Edition McGraw Hill, 2012.

3. Rajput R.K., A Text book of Power plant Engineering. 5th Edition, Lakshmi Publications, 2013.

REFERENCES:

1. Liptak B.G., Instrumentation in Process Industries, Chilton Book Company, 2005.
2. Jain R.K., Mechanical and Industrial Measurements, Khanna Publishers, New Delhi, 1999.

3. P.K.Nag, Powerplant Engineering, Tata McGraw-Hill Education, 3rd edition, 2007.
4. Tamilmani, Power plant instrumentation, Sams Publishers, 2011.

5. Krishnaswamy.K and Ponnibala.M., Power Plant Instrumentation, PHI Learning Pvt.Ltd.,

BEI022 Optimization Techniques

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of linear programming
- To educate on the advancements in Linear programming techniques
- To introduce non-linear programming techniques
- To introduce the interior point methods of solving problems
- To introduce the dynamic programming method

Course Outcomes after successful completion of this course

CO1: To understand ethical issues, environmental impact and acquire management skills.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S			S				S			S
CO2	S							S				
CO3				S							S	

CO4							M					
CO5				M							M	

Assessment method:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I LINEAR PROGRAMMING 9

Introduction - formulation of linear programming model-Graphical solution–solving LPP using simplex algorithm – Revised Simplex Method

UNIT II ADVANCES IN LPP 9

Duality theory- Dual simplex method - Sensitivity analysis–-Transportation problems–Assignment problems-Traveling sales man problem -Data Envelopment Analysis

UNIT III NON LINEAR PROGRAMMING 9

Classification of Non Linear programming – Lagrange multiplier method – Karush – Kuhn Tucker conditions–Reduced gradient algorithms–Quadratic programming method – Penalty and Barrier method.

UNIT IV INTERIOR POINT METHODS 9

Karmarkar's algorithm–Projection Scaling method–Dual affine algorithm–Primal affine algorithm Barrier algorithm.

UNIT V DYNAMIC PROGRAMMING 9

Formulation of Multi stage decision problem–Characteristics–Concept of sub-optimization and the principle of optimality–Formulation of Dynamic programming–Backward and Forward

recursion– Computational procedure–Conversion of final value problem in to Initial value problem.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Hillier and Lieberman “Introduction to Operations Research”, TMH, 2000.

2. R.Panneerselvam, “Operations Research”, PHI, 2006.

3. Hamdy ATaha, “Operations Research –An Introduction”, Prentice Hall India, 2003.

REFERENCES:

1. Philips, Ravindran and Solberg, “Operations Research”, John Wiley, 2002.

2. Ronald L.Rardin, “Optimization in Operation Research” Pearson Education Pvt. Ltd. New Delhi, 2005.

BEI023 FUNDAMENTALS OF NANOSCIENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

To learn about basis of nanomaterial science, preparation method, types and application

Course Outcomes after successful completion of this course, The students should be able to

CO1: Will familiarize about the science of nanomaterial
CO2: Will demonstrate the preparation of nanomaterial
CO3: Will develop knowledge in characteristic nanomaterial
CO4: Will implement knowledge in characteristic nanomaterial
CO5: Will familiarize about nanomaterial

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M				M	M	S	M		S	M
CO2	S	M				M	M	S	M		S	M

CO3	S	M				M	M	S	M		S	M
CO4	S	M				M	M	S	M		S	M
CO5	S	M				M	M	S	M		S	M

Assessment method:

DIRECT		INDIRECT	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I INTRODUCTION 8

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thin films- multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications

UNIT IV CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nano indentation

UNIT V APPLICATIONS 7

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sun barrier products - In Photostat, printing, solar cell, battery

TOTAL: 45 PERIODS

TEXT BOOKS:

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.

2. N John Dinardo, "Nanoscale Characterization of Surfaces & Interfaces", 2nd Edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES

1. G Timp, "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia, "The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

BEI024 SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce Non parametric methods
- To impart knowledge on parameter estimation methods To impart knowledge on Recursive identification methods To impart knowledge on Adaptive control schemes
- To introduce stability, Robustness and Applications of adaptive control method

Course Outcomes after successful completion of this course, The students should be able to

CO1: Ability to apply advanced control theory to practical engineering problems.
CO2: will able to introduce Non parametric methods
CO3: will get knowledge on Adaptive control schemes
CO4: will design Recursive identification methods
CO5: will get knowledge on parameter estimation methods

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M				M	M	S	M		S	M
CO2	S	M				M	M	S	M		S	M
CO3	S	M				M	M	S	M		S	M
CO4	S	M				M	M	S	M		S	M
CO5	S	M				M	M	S	M		S	M

Assessment method:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I NON PARAMETRIC METHODS 9

Non parametric methods: Transient analysis–frequency analysis–Correlation analysis–Spectral analysis.

UNIT II PARAMETER ESTIMATION METHODS 9

Least square estimation – best linear unbiased estimation under linear constraints – updating the parameter estimates for linear regression models–prediction error methods: description of prediction methods – optimal prediction – relation between prediction error methods and other identification methods – theoretical analysis - Instrumental variable methods: Description of instrumental variable methods – Input signal design for identification.

UNIT III RECURSIVE IDENTIFICATION METHODS 9

The recursive least square method – the recursive instrumental variable methods- the recursive prediction error methods – Maximum likelihood. Identification of systems operating in closed loop: Identifiability considerations – direct identification – indirect identification.

UNIT IV ADAPTIVE CONTROL SCHEMES 9

Introduction – Types of adaptive control–Gain scheduling controller–Model reference adaptive control schemes–Self tuning controller–MRAC and STC: Approaches–The Gradient approach – Lyapunov functions – Passivity theory – pole placement method – Minimum variance control – Predictive control.

UNIT V ISSUES INADAPTIVE CONTROL AND APPLICATIONS 9

Stability – Convergence – Robustness –Applications of adaptive control.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Soder storm T and Peter Stoica, System Identification, Prentice Hall International,1989.

2. Astrom, K.J. and Wittenmark, B., "Adaptive Control", Pearson Education, 2 Editions, 2001.
3. Sastry,S. and Bodson, M.," Adaptive Control– Stability, Convergence and Robustness", Prentice Hall inc., New Jersey, 1989.

REFERENCES:

1. Ljung L, System Identification: Theory for the user, Prentice Hall, Engle wood Cliffs, 1987.

2. Bela.G.Liptak., "Process Control and Optimization". Instrument Engineers' Handbook., volume 2, CRC press and ISA, 2005.
3. William S.Levine, "Control Systems Advanced Methods, the Control Handbook, CRC Press 2011.

BEI025 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To facilitate the understanding of Quality Management principles and process.

Course Outcomes after successful completion of this course,

The students should be able to

CO1: The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.
CO2: will facilitate the understanding of Quality Management principles and process.
CO3: will obtain Quality Management principles and process.
CO4: will get knowledge on apply the tools and techniques of quality management

CO5: will obtain Quality Management principles

	CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak											
Cos	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	W	W		S							
CO2	S	S	S	M	S							
CO3	S	S	S	M	S				W			
CO4	S	W		S	M							
CO5	M				W		W					

Assessment method:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, and Customer retention - Costs of quality.

UNIT II TQM PRINCIPLES 9

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II 9

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Dale H. Besterfiled, et at., "Total quality Management", Pearson Education Asia, Third Edition, Indian Reprint, 2006.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

BEI026 OPERATING SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- The student should be made to:
- Study the basic concepts and functions of operating systems Understand the structure and functions of OS
- Learn about Processes, Threads and Scheduling algorithms Understand the principles of concurrency and Deadlocks
- Learn various memory management schemes Study I/O management and File systems

- Learn the basics of Linux system and perform administrative tasks on Linux Servers

After successful completion of this course, the students will be able to

CO1: At the end of the course, the student should be able to:
CO2: Design various Scheduling algorithms apply the principles of concurrency
CO3: Design deadlock, prevention and avoidance algorithms.
CO4: Compare and contrast various memory management schemes Design and Implement a prototype file systems
CO5: Perform administrative tasks on Linux Servers

	CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak											
Cos	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	W	W		S							
CO2	S	S	S	M	S							
CO3	S	S	S	M	S				W			
CO4	S	W		S	M							
CO5	M				W		W					

Assessment method:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Students Exit Survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Quiz	**4**	Alumni
5.	Online Test		
6.	End Semester Exam		

UNIT I OPERATING SYSTEMS OVERVIEW 9

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicourse Organization. Operating system overview-objectives and functions, Evolution of Operating System. - Computer System Organization-Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

UNIT II PROCESS MANAGEMENT 9

Processes-Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication; Threads- Overview, Multicore Programming, Multithreading Models; Windows 7 - Thread and SMP Management. Process Synchronization - Critical Section Problem, Mutex Locks, Semophores, Monitors; CPU Scheduling and Deadlocks.

UNIT III STORAGE MANAGEMENT 9

Main Memory-Contiguous Memory Allocation, Segmentation, Paging, 32 and 64 bit architecture Examples; Virtual Memory- Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

UNIT IV I/O SYSTEMS 9

Mass Storage Structure- Overview, Disk Scheduling and Management; File System Storage-File Concepts, Directory and Disk Structure, Sharing and Protection; File System Implementation-File System Structure, Directory Structure, Allocation Methods, Free Space Management; I/O Systems.

UNIT V CASE STUDY 9

Linux System- Basic Concepts; System Administration-Requirements for Linux System Administrator, Setting up a LINUX Multifunction Server, Domain Name System, Setting Up Local Network Services; Virtualization- Basic Concepts, Setting Up Xen,VMware on Linux Host and Adding Guest OS.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 9th Edition, John Wiley and Sons Inc., 2012.

REFERENCES:

1. William Stallings, “Operating Systems – Internals and Design Principles”, 7th Edition, Prentice Hall, 2011.
2. Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Addison Wesley, 2001.
3. Charles Crowley, “Operating Systems: A Design-Oriented Approach”, Tata McGraw Hill Education”, 1996.
4. D M Dhamdhere, “Operating Systems: A Concept-Based Approach”, Second Edition, Tata McGraw-Hill Education, 2007.
5. http://nptel.ac.in/