DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
B.TECH-Electronics And Instrumentation And Engineering
Curriculum and Syllabus
2018 Regulation

I SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEN18001	Technical English - I	Ty	1	0/0	2/0	2
2	BMA18001	Mathematics - I	Ty	3	1/0	0/0	4
3	BPH18001	Engineering Physics - I	Ty	2	0/1	0/0	3
4	BCH18001	Engineering Chemistry - I	Ty	2	0/1	0/0	3
5	BES18001	Basic Electrical and Electronics Engineering	Ty	2	0/1	0/0	3
6	BES18002	Basic Mechanical and Civil Engineering	Ty	2	0/1	0/0	3
PRACTICALS*							
1	BES18L01	Basic Engineering Workshop	Lb	0	0/0	2/0	1
2	BES18ET1	Orientation to Entrepreneurship and Project Lab	ETL	0	0/0	2/0	1

Credits Sub Total: 20

II SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BMA18003	Mathematics – II	Ty	3	1/0	0/0	4
2	BPH18002	Engineering Physics –II	Ty	2	0/1	0/0	3
3	BCH18002	Engineering Chemistry – II	Ty	2	0/1	0/0	3
4	BES18003	Environmental Science*	Ty	NON CREDIT COURSE			
PRACTICALS*							
1	BEN18ET1	Communication Lab	ETL	1	0/0	2/0	1
2	BES18ET2	Basic Engineering Graphics	ETL	1	0/0	2/0	2
3	BES18L02	Integrated Physical Science Lab	Lb	0	0/0	2/0	1
4	BES18ET3	C Programming And Lab	ETL	1	0/0	2/0	2

Credits Sub Total: 16

TOTAL CREDITS: 36

C: Credits L: Lecture T: Tutorial S.Lr: Supervised Learning P: Problem / Practical R: Research
Ty/Lb/ETL: Theory /Lab/Embedded Theory and Lab * Internal Evaluation

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

III SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEI18001	Analytical Instruments	Ty	3	1/0	0/0	4
2	BEI18002	Circuit Theory	Ty	3	1/0	0/0	4
3	BEI18003	Electrical Machines	Ty	3	0/0	0/0	3
4	BEI18004	Industrial Instrumentation-I	Ty	3	0/0	0/0	3
5	BME18I03	Thermodynamics and Fluid Mechanics	Ty	3	0/0	0/0	3
PRACTICALS*							
1	BEI18L01	Electrical Technology Lab	Lb	0	0/0	3/0	1
2	BEI18L02	Electric Circuits Lab	Lb	0	0/0	3/0	1
3	BME18IL2	Fluid Mechanics and IC Engine Lab	Lb	0	0/0	3/0	1

Credits Sub Total: 20

IV SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BMA18011	Numerical Methods for Electrical Engineers	Ty	3	1/0	0/0	4
2	BEI18005	Transducer Engineering	Ty	3	1/0	0/0	4
3	BEI18006	Digital Electronics	Ty	3	0/0	0/0	3
4	BCS18I06	Introduction to OOPS with C++ and JAVA	Ty	3	0/0	0/0	3
5	BHS18NC1/ BHS18NC2	The Indian Constitution*/ The Indian Traditional Knowledge*	Ty	2	0/0	0/0	NC
PRACTICALS*							
1	BEI18ET1	Measurements and Instrumentation	ETL	1	0/1	3/0	3
2	BEI18L03	Transducer Lab	Lb	0	0/0	3/0	1
3	BEI18L04	Digital Design Lab	Lb	0	0/0	3/0	1
4	BCS18IL6	OOPS Lab Using C++	Lb	0	0/0	3/0	1
5	BEI18TS1	Technical Skill 1	Lb	0	0/0	3/0	1
6	BEN18SK1	Soft Skill I (Career and Confidence Building)	ETL	0	0/0	3/0	1

Credits Sub Total: 22

C: Credits L: Lecture T: Tutorial S.Lr: Supervised Learning P: Problem / Practical R: Research
Ty/Lb/ETL: Theory /Lab/Embedded Theory and Lab * Internal Evaluation

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

V SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEI18007	Industrial Instrumentation-II	Ty	3	1/0	0/0	4
2	BEI18008	Control Engineering	Ty	3	0/0	0/0	3
3	BXX18EXX	Elective I	Ty	3	0/0	0/0	3
4	BXX18OEX	Open Elective I	Ty	3	0/0	0/0	3
PRACTICALS*							
1	BEI18ET2	Power Electronics	ETL	1	0/1	3/0	3
2	BEI18L05	Microprocessor, Microcontroller and its Applications Lab	Lb	0	0/0	3/0	1
3	BEI18L06	Industrial Instrumentation Lab	Lb	0	0/0	3/0	1
4	BEE18L10	Microgrid Lab	Lb	0	0/0	3/0	1
5	BEI18TS2	Technical Skill 2	Lb	0	0/0	3/0	1

Credits Sub Total: 20

VI SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEI18009	Computer Network and Distributed Control System	Ty	3	1/0	0/0	4
2	BEI18010	Process Control	Ty	3	1/0	0/0	4
3	BXX18EXX	Elective II	Ty	3	0/0	0/0	3
4	BXX18OEX	Open Elective	Ty	3	0/0	0/0	3
PRACTICALS*							
1	BEI18ET3	Virtual Instrumentation	ETL	1	0/1	3/0	3
2	BEI18L07	Process Control Lab	Lb	0	0/0	3/0	1
3	BEI18L08	Digital Control Lab	Lb	0	0/0	3/0	1
4	BEN18SK2	Soft Skill II (Qualitative and Quantitative Skills)	ETL	0	0/0	3/0	1
5	BEI18L09	Mini Project/Inplant Training/Industrial Training	Lb	0	0/0	3/0	1
6	BEI18TS3	Technical Skill 3	Lb	0	0/0	3/0	1

Credits Sub Total: 22

C: Credits L: Lecture T: Tutorial S. Lr : Supervised Learning P : Problem / Practical
R : Research Ty/Lb/ETL: Theory/Lab/Embedded Theory and Lab *Internal evaluation

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VII SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEI18011	Introduction to Biomedical Instrumentation	Ty	3	1/0	0/0	4
2	BXX18EXX	Elective III	Ty	3	0/0	0/0	3
3	BXX18EXX	Elective IV	Ty	3	0/0	0/0	3
4	BMG18002	Management Concepts and Organization Behavior	Ty	3	0/0	0/0	3
PRACTICALS*							
1	BEI18ET4	Industrial Automation	ETL	1	0/1	3/0	3
2	BBI18L03	Biomedical Instrumentation Lab	Lb	0	0/0	3/0	1
3	BEI18L10	Embedded System Lab	Lb	0	0/0	3/0	1
4	BEI18L11	Project Phase – I	Lb	0	0/0	3/3	2
5	BHS18FLX	Foreign Language	Lb	0	0/0	3/0	1
6	BXX18OLX	Open Lab	Lb	0	0/0	3/0	1

Credits Sub Total: 22

VIII SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEI18012	Computer Control Process	Ty	3	1/0	0/0	4
2	BEI18013	Power Plant Instrumentation	Ty	3	0/0	0/0	3
3	BXX18EXX	Elective V	Ty	3	0/0	0/0	3
PRACTICALS*							
1	BEI18L12	Project Phase – II	Lb	0	0/0	12/12	8

Credits Sub Total: 18

C: Credits L: Lecture T: Tutorial S.Lr: Supervised Learning P: Problem / Practical R: Research
Ty/Lb/ETL: Theory /Lab/Embedded Theory and Lab * Internal Evaluation

CREDIT SUMMARY

Semester: 1 : 20 Credits
Semester: 2 : 16 Credits
Semester: 3 : 20 Credits
Semester: 4 : 22 Credits
Semester: 5 : 20 Credits
Semester: 6 : 22 Credits
Semester: 7 : 22 Credits
Semester: 8 : 18 Credits
TOTAL CREDITS - 160

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ELECTIVE -I							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEI18E01	Fibre Optics and Laser Instruments	Ty	3	0/0	0/0	3
2	BEI18E02	PC Based Instrumentation	Ty	3	0/0	0/0	3
3	BEI18E03	Control System Design	Ty	3	0/0	0/0	3
4	BEI18E04	Nano Technology	Ty	3	0/0	0/0	3

ELECTIVE -II							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEI18E05	Embedded System	Ty	3	0/0	0/0	3
2	BEI18E06	Systems Theory	Ty	3	0/0	0/0	3
3	BEI18E07	System Identification and Adaptive control	Ty	3	0/0	0/0	3
4	BEI18E08	Neural and Fuzzy Logic Control	Ty	3	0/0	0/0	3

ELECTIVE –III							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEI18E09	Instrumentation in Petrol Chemical Industry	Ty	3	0/0	0/0	3
2	BEI18E10	Intelligent Controllers	Ty	3	0/0	0/0	3
3	BEI18E11	Advanced Process control	Ty	3	0/0	0/0	3
4	BEI18E12	Artificial Intelligence and Expert Systems	Ty	3	0/0	0/0	3

ELECTIVE –IV							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEI18E13	Digital Image Processing	Ty	3	0/0	0/0	3
2	BEI18E14	Digital Instrumentation	Ty	3	0/0	0/0	3
3	BEI18E15	Digital Control Systems	Ty	3	0/0	0/0	3
4	BEI18E16	Principles of Robotics	Ty	3	0/0	0/0	3

ELECTIVE -V							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEI18E17	Modern Control Systems	Ty	3	0/0	0/0	3
2	BEE18E03	Mechatronics	Ty	3	0/0	0/0	3
3	BEI18E19	Instrumentation in Paper and Pulp Industries	Ty	3	0/0	0/0	3
4	BEI18E20	Instrumentation in Iron and Steel Industries	Ty	3	0/0	0/0	3

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OPEN ELECTIVE							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb / ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEE18OE1	Electrical Safety for Engineers	Ty	3	0/0	0/0	3
2	BEE18OE2	Energy Conservation Techniques	Ty	3	0/0	0/0	3
3	BEE18OE3	Electric Vehicle Technology	Ty	3	0/0	0/0	3
4	BEE18OE4	Biomedical Instrumentation	Ty	3	0/0	0/0	3
5	BEE18OE5	Introduction to Power Electronics	Ty	3	0/0	0/0	3
6	BEE18OE6	Industrial Instrumentation	Ty	3	0/0	0/0	3
7	BEE18OE7	Solar Energy Conversion System	Ty	3	0/0	0/0	3
8	BEE18OE8	Wind Energy Conversion System	Ty	3	0/0	0/0	3
9	BEE18OE9	Energy Storage Technology	Ty	3	0/0	0/0	3
OPEN LAB							
1	BEE18OL1	Transducer Laboratory	Lb	0	0/0	3/0	1
2	BEE18OL2	PLC and SCADA Laboratory	Lb	0	0/0	3/0	1
3	BEE18OL3	Electrical Maintenance Laboratory	Lb	0	0/0	3/0	1
4	BEE18OL4	Power Electronics Laboratory	Lb	0	0/0	3/0	1
5	BEE18OL5	Bio Medical Instrumentation Laboratory	Lb	0	0/0	3/0	1

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

DEPARTMENT OF ENGLISH

Subject Code: **BEN18001**	**Subject Name :TECHNICAL ENGLISH - I**	Ty/Lb/ETL	L	T/SLr	P/R	C
	Prerequisite : None	**Ty**	**1**	**0/0**	**2/0**	**2**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- Use appropriate vocabulary and structure in academic communication
- Use structural and functional grammar in academic writings.
- Give instructions, suggestions and recommendations.
- Interpret Charts, diagrams, advertisements, etc
- Take notes, summarize and make power point presentations.

COURSE OUTCOMES (Cos) : (3 – 5)

Students completing the course would be able to

CO1	Use appropriate vocabulary and structure in academic communication
CO2	Use structural and functional grammar in academic writings.
CO3	Give instructions, suggestions and recommendations.
CO4	Interpret Charts, diagrams, advertisements, etc
CO5	Take notes, summarize and make power point presentations.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1										**H**		
CO2										**H**		
CO3										**H**		
CO4										**H**		
CO5										**H**		

H/M/L indicates strength of correlation H – High, M – Medium, L – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives		Open Electives	Practical / Project	Internship	Soft Skills
			√							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEN18001 TECHNICAL ENGLISH - I 1 0/0 2/0 2

UNIT I VOCABULARYBUILDING 6

The concept of Word Formation-Root words and affixes from foreign languages and their use in English to form derivatives.-Homophones- Words often confused-Verbal analogy

UNIT II BASIC WRITING SKILLS 6

Using Idioms and phrases in sentences-Sentence structures: statements, interrogative and imperative-Use of Conditional/if' clauses in sentences-Importance of proper punctuation-Creating coherence with sentence markers-Organizing coherent paragraphs in essays

UNIT III IDENTIFYING COMMON ERRORS IN WRITING 6

Subject-verb agreement-Noun-pronoun agreement- Misplaced modifiers-Articles-Prepositions-Redundancies and Clichés

UNIT IV WRITING PRACTICE- NATURE AND STYLE OF TECHNICAL WRITING 6

Describing Gadgets- Defining Concepts-Classifying data-Comprehension-Essay Writing-Informal and Formal Letter Writing:

UNIT V ORAL COMMUNICATION AND INTERACTIVE LEARNING 6

(This unit involves interactive practice sessions in Language Lab)
Activities to develop knowledge in Word formation, Vocabulary and analytical thinking-Instructions and –Recommendations-Formal and Informal Registers in Speech-Listening and taking notes

Total No of Periods: 30

TEXT BOOK :

Quest : A Textbook of Communication Skills, Vijay Nicole, 2017.
Pushkala, R, Padmasani Kannan S, Anuradha V, Chandrasena M Rajeswaran

SUGGESTED READINGS:

(i) Practical English Usage. Michael Swan. OUP. 1995.
(ii) Remedial English Grammar. F.T. Wood. Macmillan.2007
(iii)On Writing Well. William Zinsser. Harper Resource Book. 2001
(iv) Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(v) Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
(vi) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
(vi) Pronunciation in Use ,Mark Hancock. Cambridge University Press. 2012

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

DEPARTMENT OF MATHEMATICS

Subject Code: **BMA18001**	**Subject Name :MATHEMATICS – I**	Ty/Lb/ETL	L	T/SLr	P/R	C
	Prerequisite: None	**Ty**	**3**	**1/0**	**0/0**	**4**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- Apply the Basic concepts in Algebra
- Use the Basic concepts in Matrices
- Identify and solve problems in Trigonometry
- Understand the Basic concepts in Differentiation
- Apply the Basic concepts in Functions of Several variables

COURSE OUTCOMES (Cos) : (3 – 5)
Students completing the course were able to

CO1	Find the summation of the given series of binomial, exponential & logarithmic
CO2	Transform a non – diagonal matrix into an equivalent diagonal matrix using orthogonal transformation.
CO3	Find expansion of trigonometric function into an infinite series and to separate a complex function into real and imaginary parts.
CO4	Apply knowledge and concepts in finding the derivative of given function and to find the maxima / minima of the given function.
CO5	Evaluate the partial / total differentiation and maxima / minima of a function of several variables.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**H**			**M**	**M**			**H**	**H**		**H**
CO2	**H**	**H**			**H**	**L**						**H**
CO3	**H**	**H**			**M**				**M**	**H**		**L**
CO4	**H**	**H**			**L**				**M**	**H**		**M**
CO5	**H**	**H**				**M**			**M**	**M**		**H**

H/M/L indicates strength of correlation H – High, M – Medium, L – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
	√								

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BMA18001 MATHEMATICS – I 3 1/0 0/0 4

UNIT I ALGEBRA 12

Binomial, Exponential, Logarithmic Series (without proof of theorems) – Problems on Summation, Approximation and Coefficients.

UNIT II MATRICES 12

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values – Cayley - Hamilton theorem(without proof) – Orthogonal reduction of a symmetric matrix to Diagonal form.

UNIT III TRIGONOMETRY 12

Expansions of Sin nθ, Cos nθ in powers of Sinθ and Cosθ – Expansion of Tan nθ – Expansions of $\text{Sin}^n\theta$ and $\text{Cos}^n\theta$ in terms of Sines and Cosines of multiples of θ – Hyperbolic functions – Separation into real and imaginary parts.

UNIT IV DIFFERENTIATION 12

Basic concepts of Differentiation – Elementary differentiation methods – Parametric functions – Implicit function –Leibnitz theorem(without proof) – Maxima and Minima – Points of inflection.

UNIT V FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives – Total differential – Differentiation of implicit functions – Taylor's expansion – Maxima and Minima by Lagrange's Method of undetermined multipliers – Jacobians.

Total No of Periods: 60

TEXT BOOKS:

1. Kreyszig E., Advanced Engineering Mathematics (10 th ed.), John Wiley & Sons, (2011).
2. Veerarajan T., Engineering Mathematics (for first year), Tata McGraw Hill Publishing Co., (2008).

REFERENCE BOOKS:

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, (2012).
2. John Bird, Basic Engineering Mathematics (5th ed.), Elsevier Ltd, (2010).
3. P.Kandasamy, K.Thilagavathy and K. Gunavathy, Engineering Mathematics Vol. I (4th Revised ed.), S.Chand& Co., Publishers, New Delhi (2000).
4. John Bird, Higher Engineering Mathematics (5th ed.), Elsevier Ltd, (2006).

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
DEPARTMENT OF PHYSICS

Subject Code: **BPH18001**	**Subject Name :ENGINEERING PHYSICS - I**	**TY/ Lb/ ETL**	L	T/S Lr	P/R	C
	Prerequisite : None	**Ty**	**2**	**0/1**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- Outline the relation between Science, Engineering & Technology.
- Demonstrate competency in understanding basic concepts.
- Apply fundamental laws of Physics in Engineering & Technology.
- To identify & solve problems using physics concepts.
- Produce and present activities associated with the course through effective technical communication

COURSE OUTCOMES (Cos) : (3 – 5)

Students completing this course were able to

CO1	Demonstrate competency in understanding basic concepts.
CO2	Utilize scientific methods for formal investigations & demonstrate competency with experimental methods and verify the concept to content knowledge.
CO3	Identify and provide solutions for engineering problems.
CO4	Relate the technical concepts to day to day life and to practical situations.
CO5	Think analytically to interpret concepts.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**H**		**M**	**M**	**M**						
CO2	**H**	**H**	**M**	**M**	**M**	**M**			**M**	**M**		
CO3	**H**	**H**	**H**	**M**	**M**	**M**				**M**		**M**
CO4	**H**	**H**	**M**	**M**		**M**			**M**	**M**		**M**
CO5	**H**	**H**	**M**			**M**		**M**				**L**

H/M/L indicates strength of correlation H – High, M – Medium, L – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
	√								

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BPH18001 ENGINEERING PHYSICS - I 2 0/1 0/0. 3

UNIT I MECHANICS & PROPERTIES OF MATTER 9

Mechanics : Introduction- scalar and vector quantities - rigid body - moment of inertia - forces in nature - Newton's laws of motion - derivation of Newton's second law of motion - motion of rocket – dynamical concepts - kinematics - conservation of energy and momentum - conservative and non-conservative forces - mechanics of continuous media - friction and its applications.

Properties of Matter: Elasticity - stress, strain and Hook's law - Poisson's ratio - three moduli of elasticity - twisting couple on a wire - viscosity - flow of liquid through a narrow tube: Poiseuille's law - Ostwald`s viscometer - flow of blood in human body.

UNIT II SHM AND ACOUSTICS 9

SHM: Simple harmonic motion - differential equation of SHM - graphical representation of SHM - average kinetic energy of vibration - total energy of vibration - free and forced vibrations - damped and undamped vibrations - resonance - transverse wave on a string - law of transverse vibration of string - verification of the laws of transverse vibration of string - standing waves.

Acoustics : Fundamentals of acoustics - reverberation- reverberation time - factors affecting acoustics Ultrasonics -Production of ultrasonic waves - detection of ultrasonic waves - acoustic grating - application of ultrasonic waves.

UNIT III WAVE OPTICS 9

Huygen`s principle - interference of light - wavefront splitting and amplitude - airwedge - Newton`s rings - Michelson interferometer and its applications - Fraunhofer diffraction from a single slit - Rayleigh criterion for limit of resolution - diffraction grating and resolving power of a telescope.

UNIT IV ELECTROMAGNETIC THEORY 9

Electric field - coulomb`s law - alternating emf - rms and average value of an alternating current & voltage - resistors, capacitors and inductor - energy stored in a capacitor - LCR circuit & resonance – magnetism-definition - types - Biot Savart law - energy stored in a magnetic field - Domain theory - electromagnetic induction - self and mutual inductance - Faraday`s law of electromagnetic induction -Lenz law.

UNIT V LASER 9

Laser principle and characteristics - amplification of light by population inversion - properties of laser beams: mono-chromaticity, coherence, directionality and brightness - different types of lasers - Ruby laser-Nd-YAG laser-He-Ne laser-CO_2 laser - semiconductor laser - applications of lasers in science, engineering and medicine.

Total No of Periods : 45

TEXT BOOKS :

1. Brijlal, M. N. Avadhanulu& N. Subrahmanyam, Text Book of Optics, S. Chand Publications, 25th edition, 2012
2. R. Murugeshan, Electricity and Magnetism, S.Chand Publications, 10th edition, 2017
3. R. Murugeshan & Kiruthiga Sivaprasath, Modern Physics, S.Chand Publications, 2016

REFERENCE BOOKS:

1. Dr. Senthil Kumar Engineering Physics I VRB Publishers, 2016
2. N Subrahmanyam & Brijlal, Waves and Oscillations, Vikas Publications, New Delhi,1988
3. N Subrahmanyam & Brijlal, Properties of Matter, S. Chand Co., New Delhi, 1982
4. N Subrahmanyam & Brijlal, Text book of Optics, S. Chand Co., New Delhi, 1989
5. R. Murugeshan, Electricity and Magnetism, S. Chand & Co., New Delhi, 1995
6. Thygarajan K & Ajay Ghatak, Laser Theory and Applications, Macmillan, New Delhi, 1981

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

DEPARTMENT OF CHEMISTRY

Subject Code: **BCH18001**	**Subject Name :ENGINEERING CHEMISTRY – I**	Ty/ Lb/ ETL	L	T/S Lr	P/R	C
	Prerequisite : None	**Ty**	**2**	**0/1**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- Providing an insight into basic concepts of chemical thermodynamics.
- To create awareness about the water quality parameters, water analysis and softening of water from industrial perspective.
- Imparting fundamentals of emf, storage and fuel cells.
- Creating awareness about corrosion and its control methods.
- Introducing modern materials such as composites along with basic concepts of polymer chemistry and plastics.

COURSE OUTCOMES (Cos) : (1– 5)

CO1	Gain a clear understanding of the basics of chemical thermodynamics which include concepts such as Enthalpy, Entropy and Free energy.
CO2	Obtain an overall idea of Water quality parameters, Boiler requirements, problems, Water softening and Domestic Water treatment.
CO3	Improving the basic knowledge in electrical conductance and emf and also understand the chemical principles of storage devices.
CO4	Observe the information about corrosion and understand the mechanisms of corrosion and the methods of corrosion control.
CO5	Articulate the science of polymers and composites.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**H**										**M**
CO2	**H**	**H**	**M**	**H**		**H**	**H**					**M**
CO3	**H**	**M**	**H**				**L**					**L**
CO4	**H**		**L**	**H**								**L**
CO5	**H**											**M**

H/M/L indicates strength of correlation H – High, M – Medium, L – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
	√								

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BCH18001 ENGINEERING CHEMISTRY – I 2 0/1 0/0 3

UNIT I CHEMICAL THERMODYNAMICS 8

Introduction, Terminology in thermodynamics –System, Surrounding, State and Path functions, Extensive and intensive properties. Laws of thermodynamics – I and II laws-Need for the II law. Enthalpy, Entropy, Gibbs free energy, Helmholtz free energy - Spontaneity and its criteria. Maxwell relations, Gibbs - Helmholtz equation (relating E & A) and (relating H & G), Van't Hoff equations.

UNIT II TECHNOLOGY OF WATER 9

Water quality parameters – Definition and expression. Analysis of water – alkalinity, hardness and its determination (EDTA method only). Boiler feed water and Boiler troubles-Scales and sludges, Caustic embrittlement, Priming and Foaming and Boiler corrosion. Water softening processes – Internal and external conditioning – Lime soda, Zeolite, Demineralisation methods. Desalination processes-RO and Electrodialysis .Domestic water treatment.

UNIT III ELECTROCHEMISTRY AND ENERGY STORAGE DEVICES 10

Conductance – Types of conductance and its Measurement. Electrochemical cells – Electrodes and electrode potential, Nernst equation – EMF measurement and its applications. Types of electrodes-Reference Books electrodes-Standard hydrogen electrode- Saturated calomel electrode-Quinhydrone electrode – Determination of P^H using these electrodes. Reversible and irreversible cells– Fuel cells- H_2–O_2 fuel cell, Batteries-Lead storage battery,Nickel– Cadmium and Lithium-Battery.

UNIT IV CORROSION AND PROTECTIVE COATING 9

Introduction–Causes of Corrosion–Consequences- Factors affecting corrosion. Theories of corrosion-Chemical corrosion and Electrochemical corrosion. Methods of corrosion control – corrosion inhibitors, Sacrificial anode and Impressed current cathodic protection.

Protective coatings- Metallic coatings- Chemical conversion coatings-paints-Constituents and functions.

UNIT V POLYMERS AND COMPOSITES 9

Monomers – Functionality – Degree of polymerization-Tacticity.Polymers – Classification, Conducting Polymers,Biodegradable polymers- Properties and applications.Plastics – Thermoplastics and thermosetting plastics,Compounding of plastics – Compression moulding, injection moulding and extrusion processes. Polymer composites-introduction-Types of composites-particle reinforced-fiber reinforced-structural composites-examples. Matrix materials, reinforcement materials-Kevlar, Polyamides, fiber glass, carbon fibers, ceramics and metals .

Total No of Periods: 45

TEXTBOOKS:

1. P.Udhayakala., S.Dinakar&L.Sankar., "Chemistry for Engineers", Charulatha Publications(2018).
2. C.SreekuttanUnnithan, "Applied Chemistry", Sreelakshmi Publications, (2007).
3. Dr.R.Sivakumar, Dr.R.Jayaprakasam and Dr.N.Sivakumar, "Engineering Chemistry – I & II", Tata McGraw Hill Publishing Company Ltd, Reprint 2013.

REFERENCE BOOKS:

1. P.C. Jain & Monika Jain, "Engineering Chemistry", Dhanpat Rai publishing Co., (Ltd.) (2013).
2. J. C. Kuriacose& J. Rajaram, "Chemistry in Engineering & Technology", Tata Mc Graw Hill (1996).
3. B.R.Puri, L.R.Sharma&M.S.Pathania, "Principles of Physical Chemistry", Vishal publishing co., (2013).

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Subject Code: **BES18001**	**Subject Name :BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	Ty/ Lb/ ETL	L	T/S Lr	P/R	C
	Prerequisite : None	**Ty**	**2**	**0/1**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- Understand the concepts of circuit elements, circuit laws and coupled circuits.
- Acquire knowledge on conventional &non conventional energy production.
- Gain information on measurement of electrical parameters.
- Identify basic theoretical principles behind the working of modern electronic gadgets.
- Demonstrate digital electronic circuits and assemble simple devices.

COURSE OUTCOMES (Cos) : (3 – 5)

CO1	Students understand Fundamental laws and theorems and their practical applications
CO2	Predict the behavior of different electric and magnetic Circuits.
CO3	Identify conventional and Non-conventional Electrical power Generation, Transmission and Distribution.
CO4	Identify & Apply schematic symbols and understand the working principles of electronic devices
CO5	Analyze basics of digital electronics and solving problems and design combinational circuits

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**H**	**H**	**H**							**M**	**L**
CO2	**H**	**H**	**H**	**M**	**M**		**M**				**M**	
CO3	**H**	**M**	**H**	**M**	**H**		**M**		**M**			**L**
CO4	**H**	**M**		**M**			**M**				**M**	**L**
CO5	**H**	**M**	**H**	**M**	**H**				**M**		**M**	**L**

H/M/L indicates strength of correlation H – High, M – Medium, L – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
		√							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BES18001 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING 2 0/1 0/0 3

UNIT I ELECTRIC CIRCUITS 9

Electrical Quantities – Ohms Law – Kirchhoff's Law – Series and Parallel Connections – Current Division and Voltage Division Rule - Source Transformation – Wye (Y) – Delta (Δ) , Delta (Δ) – Wye (Y) Transformation – Rectangular to Polar and Polar to Rectangular.

UNIT II MACHINES & MEASURING INSTRUMENTS 9

Construction & Principle of Operation of DC motor & DC Generator – EMF equation of Generator – Torque Equation of Motor – Construction & Principle of operation of a Transformer – PMMC – Moving Iron types of meter – Single Phase Induction Type Energy Meter.

UNIT III BASICS OF POWER SYSTEM 9

Generation of Electric Power (Thermal, Hydro, Wind and Solar) – Transmission & Distribution of Electric Power – Types of Transmission & Distribution Schemes – Representation of Substation.

UNIT IV ELECTRON DEVICES 9

Passive Circuit Components-Classification of Semiconductor-PN Junction Diode-Zener diode-Construction and Working Principle –Applications--BJT-Types of configuration-JFET.

UNIT V DIGITAL SYSTEM 9

Number System – Binary, Decimal, Octal, Hexadecimal – Binary Addition Subtraction, Multiplication & Division– Boolean Algebra – Reduction of Boolean Expressions – Logic Gates - De-Morgan's Theorem , Adder – Subractor.

Total No of Periods: 45

TEXT BOOKS:

1. D P Kothari, I J Nagrath, Basic Electrical Engineering, Second Edition, , Tata McGraw-Hill Publisher
2. A Course In Electrical And Electronic Measurements And Instrumentation,A.K. Sawhney, publisher DHANPAT RAI&CO
3. Text Book of Electrical Technology: Volume 3: Transmission, Distribution and Utilization,B.L.Theraja, A.K.Theraja, publisher S.CHAND
4. Morris Mano, M. (2002) Digital Logic and Computer Design. Prentice Hall of India
5. Millman and Halkias1991, Electronic Devices and Circuits , Tata McGraw Hill,

REFERENCE BOOKS:

1. R.Muthusubramanian, S.Salivahanan, K A Muraleedharan, Basic Electrical, Electronics And Computer Engineering, Second Edition, ,Tata McGraw-Hill publisher.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

DEPARMENT OF MECHANICAL ENGINEERING

Subject Code: **BES18002**	**Subject Name : BASIC MECHANICAL AND CIVIL ENGINEERING**	Ty/ Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite : None	**Ty**	**2**	**0/1**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- Learn Basics of Internal Combustion Engines, power plants and boilers
- Demonstrate How metals are formed, joined, using machining operations Lathe, Milling and Drilling machines
- To identify & solve problems in Engineering Mechanics
- Learn basics of Building materials and construction
- Know the basic process of concrete, types of masonry Construction of Roads , Railways, Bridges and Dams

COURSE OUTCOMES (Cos) : (3 – 5)

Students completing the course were able to

CO1	Demonstrate the working principles of power plants, IC Engines and boilers..
CO2	Utilize the concept of metals forming, joining process and apply in suitable machining process
CO3	Identify and provide solutions for problems in engineering mechanics
CO4	Utilize the concept of Building materials and construction able to perform concrete mix and masonry types
CO5	Demonstrate how Roads, Railways, dams, Bridges have been constructed

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**					**M**		**H**	**H**	**H**		**H**
CO2	**H**				**L**	**M**		**M**	**M**	**M**		**M**
CO3	**H**	**H**			**L**	**L**		**M**	**M**	**M**		**M**
CO4	**H**				**L**	**L**			**M**	**M**		**M**
CO5	**H**				**L**	**L**		**M**	**M**	**M**		**M**

H/M/L indicates strength of correlation H – High, M – Medium, L – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
		√							

BES18002 BASIC MECHANICAL AND CIVIL ENGINEERING 2 0/1 0/0 3

UNIT I THERMAL ENGINEERING 9

Classification of internal combustion engine – two stroke, four stroke petrol and diesel engines. Classification of Boilers – Cochran boiler – Locomotive boilers – Power plant classification – Working of Thermal and Nuclear power plant

UNIT II MANUFACTURING PROCESS 13

Metal forming processes – Rolling, forging, drawing, extrusion and sheet metal operations- fundamentals only. Metal Joining processes – Welding - arc and gas welding, Soldering and Brazing. Casting process – Patterns -Moulding tools - Types of moulding - Preparation of green sand mould -Operation of Cupola furnace.

Basics of metal cutting operations – Working of lathe- parts-Operations performed. Drilling machine – Classification – Radial drilling machine - Twist drill nomenclature

UNIT III MECHANICS 9

Stresses and Strains – Definition – Relationship – Elastic modulus – Centre of gravity – Moment of Inertia – Problems. (Simple Problems Only).

UNIT IV BUILDING MATERIALS AND CONSTRUCTION 7

Materials:Brick - Types of Bricks - Test on bricks - Cement – Types, Properties and uses of cement – Steel - Properties and its uses – Ply wood and Plastics.

Construction:Mortar – Ingredients – Uses – Plastering - Types of mortar - Preparation – Uses – Concrete – Types – Grades – Uses – Curing – Introduction to Building Components (foundation to roof) – Masonry – Types of masonry (Bricks & Stones)

UNIT V ROADS, RAILWAYS, BRIDGES & DAMS 7

Roads – Classification of roads – Components in roads – Railways -Components of permanent way and their function – Bridges – Components of bridges – Dams – Purpose of dams – Types of dams.

Total No of Periods : 45

TEXT BOOKS:

1. S. Bhaskar, S. Sellappan, H.N.Sreekanth,, (2002), “Basic Engineering” –Hi-Tech Publications
2. K. Venugopal, V. Prabhu Raja, (2013-14), “Basic Mechanical Engineering”, Anuradha Publications.
3. K.V. Natarajan (2000), Basic Civil Engineering,Dhanalakshmi Publishers
4. S.C. Sharma(2002),Basic Civil Engineering,Dhanpat Raj Publications

REFERENCE BOOKS:

1. PR.SL. Somasundaram, (2002), “Basic Mechanical Engineering” –, Vikas Publications.
2. S.C. Rangawala(2002), Building Material and Construction, S. Chand Publisher

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

DEPARTMENT OF ENGINEERING SCIENCES

Subject Code: **BES18L01**	Subject Name :**BASIC ENGINEERING WORKSHOP**	Ty / Lb/ ETL	L	T/ SLr	P/ R	C
	Prerequisite : None	**Lb**	**0**	**0/0**	**2/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- Familiarize the plumbing tools, fittings, carpentry tools, etc.
- Identify basic electrical wiring and measurement of electrical quantities.
- Identify Electronic components ,logic gates and soldering process
- Display simple fabrication techniques
- Execute a project independently and make a working model

COURSE OUTCOMES (Cos) : (3 – 5)

Students completing the course were able to

CO1	Demonstrate fitting tools and carpentry tools, & Perform the process of Filing, Chipping, Cutting.
CO2	Perform the process of fabrication of tray, cones and funnels, Tee Halving Cross, Lap Joint Martise& Joints
CO3	Demonstrate various types of wirings and other equipments.
CO4	Measure fundamental parameters using the electronic instruments

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**H**	**H**	**M**	**M**			**L**	**M**			**L**
CO2	**H**		**H**	**L**	**M**			**L**	**L**			
CO3	**H**		**M**	**L**				**L**	**L**			
CO4	**H**	**H**	**M**	**L**				**L**	**L**			**M**
CO5												

H/M/L indicates strength of correlation H – High, M – Medium, L – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical /	Internships / Technical Skills	Soft Skills
							√		

BES18L01 BASIC ENGINEERING WORKSHOP 0 0/0 2/0 1.

MEP PRACTICE

1. **FITTING :**
   Study of fitting tools and Equipments – Practicing, filing, chipping and cutting – making V-joints,
   half round joint, square cutting and dovetail joints.

2. **CARPENTRY:**
   Introduction – Types of wood – Tools – Carpentry processes – Joints – Planning practice – Tee Halving Joint – Cross Lap Joint – Maritse and Tenon Joint – Dovetail Joint

3. **SHEET METAL:**
   Study of tools and equipments – Fabrication of tray, cones and funnels.

CIVIL ENGINEERING PRACTICE

1. Study of Surveying and its equipments
2. Preparation of plumbing line sketches for water supply and sewage lines
3. Basic pipe connection using valves, laps, couplings, unions, reduces and elbows in house hold fittings

ELECTRICAL ENGINEERING PRACTICE

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

ELECTRONIC ENGINEERING PRACTICE

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak- peak, rms period, frequency) using CRO

2. Soldering practice – Components Devices and Circuits – Using general purpose P

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Abdul Kalam CoE for Innovation & Entrepreneurship

Subject Code : BES18ET1	**Subject Name : ORIENTATION TO ENTREPRENEURSHIP AND PROJECT LAB**	Ty / Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite : None	**ETL**	**0**	**0/0**	**2/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- Understand how entrepreneurship Education transforms individuals into successful leaders.
- Identify individual potential &S have career dreams
- Understand difference between ideas & opportunities
- Identify components & create action plan.
- Use brainstorming in a group to generate ideas.

COURSE OUTCOMES (Cos) : (3 – 5)

CO1	Develop a Business plan & improve ability to recognize business opportunity
CO2	Do a self analysis to build a entrepreneurial career.
CO3	Articulate an effective elevator pitch.
CO4	Analyze the local market environment & demonstrate the ability to find an attractive market
C05	Identify the required skills for entrepreneurship & develop

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		**M**	**M**	**H**	**M**	**M**	**M**		**M**	**M**	**M**	**L**
CO2	**H**	**M**		**H**	**M**	**H**	**M**	**H**	**H**	**H**	**M**	**M**
CO3		**M**	**M**	**M**		**H**		**H**	**H**	**H**		
CO4		**H**	**M**	**M**	**M**	**M**		**H**	**M**	**M**	**H**	
CO5		**M**	**M**	**H**	**M**	**M**	**H**	**H**	**M**	**M**	**H**	**L**

H/M/L indicates strength of correlation H – High, M – Medium, L – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
							√		

BES18ET1 ORIENTATION TO ENTREPRENEURSHIP AND PROJECT LAB 0 0/0 2/0 1

UNIT I CHARACTERISTICS OF A SUCCESSFUL ENTREPRENEUR 3

Introduction to entrepreneurship education – Myths about entrepreneurship – How has entrepreneurship changed the country – Dream it. Do it - Idea planes - Some success stories – Global Legends – Identify your own heroes.

UNIT II ENTREPRENEURIAL STYLE 3

Entrepreneurial styles – Introduction, concept & Different types - Barrier to Communication – Body language speaks louder than words

UNIT III DESIGN THINKING 3

Introduction to Design thinking – Myth busters – Design thinking Process - Customer profiling – Wowing your customer – Personal selling – concept & process – show & tell concept – Introduction to the concept of Elevator Pitch

UNIT IV RISK MANAGEMENT 3

Introduction to risk taking & Resilience – Managing risks (Learning from failures, Myth Buster) – Understanding risks through risk takers – Why do I do? – what do I do ?

UNIT V PROJECT 3

How to choose a topic – basic skill sets necessary to take up a project – creating a prototype – Pitch your project – Project presentation.

Total No of Periods : 15

REFERENCE BOOKS & WEBSITE:

1. Encyclopedia of small Business (2011) – (e book)
2. Oxford Handbook of Entrepreneurship (2014) (ebook)
3. lms.learnwise.org

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

DEPARTMENT OF MATHEMATICS

Subject Code : BMA18003	**Subject Name : MATHEMATICS – II**	Ty / Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite : None	**Ty**	**3**	**1/0**	**0/0**	**4**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- Understand the Basic concepts in Integration
- Identify the Basic concepts in Multiple integrals
- Use the Basic concepts in Ordinary Differential equations
- Apply the Basic concepts of Analytical Geometry
- Analyze the Basic concepts of Vector Calculus

COURSE OUTCOMES (Cos) : (3 – 5)

CO1	Integrate given function by using methods of integration and to find the area under curve and the volume of a solid by revaluation.
CO2	Evaluate the multiple integrals / area /volume and to change the order of integration.
CO3	Solve the ordinary differential equation and to solve Eulers differential equation.
CO4	Find the equation of planes, lines and sphere and to find the shortest distance between to skew lines.
CO5	Find the gradient, maximum directional derivative and work done by a force and to verify Green/ Stokes/ Gauss divergence theorem

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**H**			**M**	**M**			**M**	**M**		**H**
CO2	**H**	**H**			**M**	**H**			**H**	**H**		**M**
CO3	**H**	**H**			**M**	**H**			**H**	**H**		**M**
CO4	**H**	**H**			**L**	**M**			**M**	**H**		**M**
CO5	**H**	**H**			**M**	**M**			**M**	**H**		**M**

H/M/L indicates strength of correlation H – High, M – Medium, L – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships /	Soft Skills
	√								

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BMA18003 MATHEMATICS – II 3 1/0 0/0 4

UNIT I INTEGRATION 12

Basic concepts of Integration – Methods of Integration– Integration by substitution – Integration by parts – Definite integrals– Properties of definite integrals – Problems on finding Area and Volume using single integrals (simple problems).

UNIT II MULTIPLE INTEGRALS 12

Double integral in Cartesian and Polar Co-ordinates – Change of order of integration – Triple integral in Cartesian Co-ordinates – Spherical Polar Co-ordinates – Change of variables (simple problems).

UNIT III ORDINARY DIFFERENTIAL EQUATIONS 12

First order differential equations – Second and higher order linear differential equations with constant coefficients and with RHS of the form: e^{ax}, x^n, Sin ax, Cos ax, $e^{ax}f(x)$, x f(x) where f(x) is Sin bx or Cos bx – Differential equations with variable coefficients (Euler's form) (simple problems).

UNIT IV THREE DIMENSIONAL ANALYTICAL GEOMETRY 12

Direction Cosines and Ratios – Equation of a straight line – Angle between two lines – Equation of a plane – Co-planar lines – Shortest distance between skew lines – Sphere – Tangent plane.

UNIT V VECTOR CALCULUS 12

Scalar and Vector functions – Differentiation – Gradient, Divergence and Curl – Directional derivatives – Irrotational and Solenoidal fields– Line, Surface and Volume integrals – Green's, Stoke's and Gauss divergence theorems (statement only) – Verification.

Total No of Periods : 60

TEXTBOOKS:

1. Kreyszig E., Advanced Engineering Mathematics (10th ed.), John Wiley & Sons, (2011).
2. Veerarajan T., Engineering Mathematics (for first year), Tata McGraw Hill Publishing Co., (2008).

REFERENCE BOOKS:

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, (2012).
2. John Bird, Basic Engineering Mathematics (5th ed.), Elsevier Ltd, (2010).
3. P.Kandasamy, K.Thilagavathy and K. Gunavathy, Engineering Mathematics Vol. I (4th Revised ed.), S.Chand& Co., Publishers, New Delhi (2000).
4. John Bird, Higher Engineering Mathematics (5th ed.), Elsevier Ltd, (2006).

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

DEPARTMENT OF PHYSICS

Subject Code : BPH18002	**Subject Name : ENGINEERING PHYSICS –II**	Ty / Lb/ ETL	L	T/ SLr	P/R	C
	Prerequisite : None	**Ty**	**2**	**0/1**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- Design, conduct experiment and analyze data.
- Develop a Scientific attitude at micro and nano scale of materials
- Understand the concepts of Modern Physics
- Apply the science of materials to Engineering & Technology

COURSE OUTCOMES (Cos) : (3 – 5)

Students completing the course were able to

CO1	Demonstrate skills necessary for conducting research related to content knowledge and laboratory skills.
CO2	Apply knowledge and concepts in advanced materials and devices.
CO3	Acquired Analytical, Mathematical skills for solving engineering problems.
CO4	Ability to design and conduct experiments as well as function in a multi disciplinary teams.
CO5	Generate analytical thought to interpret results & place them within a broader context

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO 4**	**PO 5**	**PO 6**	**PO7**	**PO8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**
CO1	**H**	**H**	**M**	**M**	**M**	**L**				**M**		**L**
CO2	**H**	**H**		**M**	**M**							**L**
CO3	**H**	**H**	**H**	**H**	**M**					**M**		
CO4	**H**	**H**	**H**	**H**	**M**				**H**	**M**		**L**
CO5	**H**	**M**	**M**	**M**	**M**	**L**			**M**	**M**		**L**

H/M/L indicates strength of correlation H – High, M – Medium, L – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships /	Soft Skills
	√								

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BPH18002 ENGINEERING PHYSICS - II 2 0/1 0/0 3

UNIT I QUANTUM PHYSICS 9

Quantum free electron theory - deBroglie waves - derivation of deBroglie waves - Davisson and Germer experiment - uncertainty principle - electron microscope - scanning electron microscope - physical significance of wave function - Schrodinger wave equation and its applications - Fermi energy- effective mass - phonons - Fermi function-density of states - origin of bandgap in solids - 1D scattering of electrons in periodic potential.

UNIT II SEMICONDUCTORS 9

Introduction - properties of semiconductors - classification of semiconductor - effect of temperature in semiconductor - hole current - carrier concentration in intrinsic semiconductor (electron and hole density) - variation of Fermi energy level and carrier concentration with temperature in an intrinsic semiconductor - carrier transport - diffusion - drift - mobility - Hall effect - determination of Hall coefficient and its applications - diodes.

UNIT III LIGHT SEMICONDUCTOR INTERACTION 9

Types of electronic materials: metals, semiconductors and insulators - qualitative analysis of extrinsic semiconductor & its applications - optical transition in bulk semiconductors: absorption, spontaneous and stimulated emission - exciton and its types - traps and its types - colour centers and its types and importance - luminescence - classifications of luminescence based on excitation - optical loss and gain - Photovoltaic effect - Photovoltaic potential - spectral response - solar energy converters - solar cells.

UNIT IV OPTO ELECTRONIC DEVICES 9

Photodetectors - photoconductors - photodiodes principle, construction, working and characteristics - Phototransistors - Laser diodes - LED theory, construction and working - seven segment display, advantages of LED - LCD theory, construction and working.

UNIT V ENGINEERED MATERIALS 9

Classification of engineered materials - nano phase materials - its synthesis and properties - shape memory alloys and its applications - biomaterials - non linear materials - metallic glasses - metamaterials - homo and hetero junction semiconductors - semiconducting materials for optoelectronic devices - quantum wells, wires and dots.

Total No of Periods: 45

TEXT BOOKS :

1. P.K. Palanisamy, Semiconductor Physics and Optoelectronics, Scitech Publications, 2010
2. Jyoti Prasad Bandyopadhyay, Semicoductor Devices, S. Chand Publications, 2014
3. Charles Kittal, Introduction to Solid State Physics, Wiley Publications, 2012

REFERENCE BOOKS:

1. S. Shubhashree, S. Bharathi Devi & S. ChellammalMadhusudanan, Engineering Physics, Sree Lakshmi Publications, 2004
2. G. Senthil Kumar, N. Iyandurai, & G. Vijayakumar, Material Science, VRB Publishers, 2017
3. R.Murugeshan&Kiruthigasivaprakash, Modern Physics, 14th edition, S. Chand & Co, 2008
4. Pallab Bhattacharya, Semiconductor optoelectronic devices, second edition, Pearson Education, 2003
5. V Rajendran & A. Marikani, Materials Science, Tata McGraw- Hill, New Delhi, 2004

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
DEPARTMENT OF CHEMISTRY

Subject Code : BCH18002	**Subject Name: ENGINEERING CHEMISTRY – II**	Ty / Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite : None	**Ty**	**2**	**0/1**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- Imparting the basic concepts of phase rule and apply the same to one and two component systems.
- Introducing the chemistry of engineering materials such as cement, lubricants,abrasives, refractories, alloys and nano materials.
- To impart a sound knowledge on the principles of chemistry involving different application-oriented topics
- Introducing salient features of fuels and combustion.
- To give an overview on modern analytical techniques

COURSE OUTCOMES (Cos) : (1 – 5)

CO1	Understand the science of phase equilibria and apply the phase rule to different systems.
CO2	Gain an overview of Engineering Materials such as Lime, Cement, Lubricants, Abrasives, Refractories,Alloys and Nanomaterials.
CO3	Recognize the essential information about consumer products such as Soaps and Detergents,also gaining the basic knowledge about Explosives and Propellants.
CO4	Discover the fuel Chemistry and Combustion process.
CO5	Inferring few important Analytical Techniques and their applications.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**											**L**
CO2	**H**		**H**			**L**	**H**					**L**
CO3	**H**					**H**						**L**
CO4	**H**	**M**	**H**	**H**			**H**					**M**
CO5	**H**				**M**							**H**

H/M/L indicates strength of correlation H – High, M – Medium, L – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
	√								

BCH18002 ENGINEERING CHEMISTRY – II 2 0/1 0/0 3

UNIT I PHASE EQUILIBRIA 8

Introduction – Definition of terms involved in phase rule. Derivation of Gibbs phase rule – Applications to one component system – water system. Binary system – Eutectic system – Pb – Ag system, Bi – Cd system.Thermal analysis – Cooling curves

UNIT II MATERIAL CHEMISTRY 10

Cement – Manufacture, Chemistry of setting and hardening. Lubricants – Requirements of good lubricants, Mechanism, Properties of lubricants, Classification – Examples. Abrasives–Classification –Moh's scale-Hard and soft abrasives, Preparation of artificial abrasives (silicon carbide, boron carbide), Applications of abrasives. Refractories – Classification, Properties-Refractoriness, RUL, Porosity, Thermal spalling Alloys Classification of alloys – Purpose of making alloys - Ferrous and non-Ferrous alloys - Heat treatment Nano materials – properties, carbon nano tubes – properties, fabrication – carbon arc method, laser vapourization method

UNIT III APPLIED CHEMISTRY 9

Soaps and detergents : Soaps – Saponification of oils and fats, manufacture of soaps, classification of soap – soft soap, medicated soap, herbal soap, shaving soap and creams.
Detergents – Anionic detergents – manufacture and applications, Comparison of soaps and detergents.
Rocket propellants and explosives: Rocket propellants – characteristics, solid and liquid propellants – examples. Explosives- Introduction, characteristics, classification, Oxygen balance , preparation, properties and uses of detonators, low explosives and high explosives, Dynamites, Gun cotton, Cordite.
Food adulterants- Common adulterants in different foods – milk and milk products, vegetable oils, and fats, spices and condiments, cereals, pulses, sweetening agents and beverages, Contamination with toxic chemicals – pesticides and insecticides.

UNIT IV FUELS & COMBUSTION 9

Introduction to Fuels – classification – Calorific value – GCV, LCV. Solid Fuels–Coal-Proximate Analysis, Metallurgical Coke–Manufacture of Metallurgical Coke – Liquid Fuel–Refining of Petrol, Synthetic Petrol–Manufacturing Process–Hydrogenation of Coal, Polymerization, Cracking–Knocking–Octane Number–Leaded Petrol (or) Anti–knocking – Cetane Number–Ignition Lag–Gaseous fuels–CNG–LPG–Water Gas, Producer gas–Biogas- Combustion– Flue Gas analysis– Orsat's method.

UNIT V ANALYTICAL AND CHARACTERIZATION TECHNIQUES 9

Electron microscopes: Scanning electron microscope & Transmission electron microscope, instrumentation and applications Absorption and Emission Spectrum - Beer - Lambert's law. Visible and UV Spectroscopy – instrumentation – Block diagram - working. IR Spectroscopy – instrumentation - Block diagram – molecular vibrations – stretching and bending – H_2O, CO_2. –Characterization of some important organic functional groups. Chromatographic techniques – column, thin layer and paper.

Total No of Periods : 45

TEXTBOOKS :

1. P.Udhayakala., S.Dinakar&L.Sankar., "Chemistry for Engineers". Charulatha Publications (2018).
2. Dr.R.Sivakumar and Dr.N.Sivakumar" Engineering Chemistry" Tata McGraw Hill Publishing Company Ltd, Reprint 2013.
3. C. S.Unnithan, T. Jayachandran& P. Udhayakala, "Industrial Chemistry", Sreelakshmi Publications (2009).

REFERENCE BOOKS:

1. P.C. Jain & Monika Jain, "Engineering Chemistry", DhanpatRai publishing Co., (Ltd.) (2013).
2. B. R. Puri ,L.R. Sharma &M.S.Pathania, "Principles of Physical Chemistry", Vishal publishing co., (2013).

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
DEPARTMENT OF ENGINEERING SCIENCES

Subject Code : BES18003	**Subject Name : ENVIRONMENTAL SCIENCE (Non- Credited)**	Ty / Lb/ ETL	L	T/S Lr	P/R	C
	Prerequisite : None	**Ty**	**-**	**-**	**-**	**-**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- To acquire knowledge of the Environment and Ecosystem & Biodiversity
- To acquire knowledge of the different types of Environmental pollution
- To know more about Natural Resources
- To gain understanding of social issues and the Environment
- To attain familiarity of human population and Environment

COURSE OUTCOMES (Cos) : (3 – 5)
Students completing the course were able to

CO1	To known about Environment and Ecosystem & Biodiversity
CO2	To clearly comprehend air, water, Soil, Marine, Noise, Thermal and Nuclear Pollutions and Solid Waste management and identify the importance of natural resources like forest, water, and food resources
CO3	To discover water conservation and watershed management
CO4	To identify its problems and concerns climate change, global warming, acid rain, ozone layer depletion etc.,
CO5	To explain family welfare programmes and role of information technology in human health and environment

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO 4**	**PO 5**	**PO 6**	**PO7**	**PO8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**
CO1						**M**	**H**	**M**				**M**
CO2						**M**	**H**			**M**		**M**
CO3						**M**	**H**	**M**				**M**
CO4						**M**	**H**	**M**		**M**		**M**
CO5						**M**	**H**			**M**		**M**

H/M/L indicates strength of correlation H – High, M – Medium, L – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
			√						

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BES18003 ENVIRONMENTAL SCIENCE

UNIT I ENVIRONMENT AND ECOSYSTEM

Definition, Scope and Importance of environment – need for public awareness – concept, structure and function of an ecosystem - producers, consumers and decomposers – energy flow in the ecosystem. Biodiversity at national and local levels – India

UNIT II ENVIRONMENT POLLUTION

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Nuclear hazards (g) E-Wastes and causes, effects and control measures

UNIT III NATURAL RESOURCES

Forest resources: Use and over-exploitation, deforestation. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

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 climate change, global warming, acid rain, ozone layer depletion, nuclear accidents ,central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

Population growth, variation among nations – population explosion, environment and human health – human rights – value education – HIV/AIDS – women and child welfare – role of information technology in environment and human health

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 McGrawHill,NewDelhi, (2006).

REFERENCE BOOKS:

1. Vairamani, S. and Dr. K. Sankaran. **Elements of Environmental and Health Science.**Karaikudi: KPSV Publications, 5th Edition, July, 2013.
2. Ifthikarudeen, Etal, **Environmental Studies**, Sooraj Publications,2005.
3. R.Murugesan, **Environmental Studies,** Millennium Publishers and Distributors, 2nd Edition, July, 2009.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

DEPARTMENT OF ENGLISH

Subject Code: BEN18ET1	**Subject Name :COMMUNICATION LAB**	Ty / Lb/ ETL	L	T/S Lr	P/R	C
	Prerequisite : None	**ETL**	**1**	**0/0**	**2/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

The student should be able to

- Use appropriate vocabulary and structure for effective interpersonal and academic communication.
- Interpret charts, diagrams, advertisements, etc..
- Participate in group discussions and present projects effectively.
- Present projects and ideas effectively
- Attend interviews

COURSE OUTCOMES (Cos) : (3 – 5)
Students completing the course were able to

CO1	Use appropriate vocabulary and structure for effective interpersonal and academic communication
CO2	Interpret charts, diagrams, advertisements, etc.
CO3	Participate in group discussions and present projects effectively
CO4	Present projects and ideas effectively
CO5	Attend interviews

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1										**H**		
CO2										**H**		
CO3										**H**		
CO4										**H**		
CO5										**H**		

H/M/L indicates strength of correlation H – High, M – Medium, L – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
			√						

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BET18ET1	**COMMUNICATION LAB**	**1**	**0/0**	**2/0**	**1**

UNIT I **6**
Listening and Speaking- Informal and Formal Contexts

UNIT II **6**
Interpretation of charts / Diagrams – Group Discussion

UNIT III **6**
Compeering -Anchoring -Group Discussion

UNIT IV **8**
Formal Presentation -Power point presentation of charts/ Diagrams

UNIT V **4**
Interview

SUGGESTED READINGS:

(i) *Practical English Usage.* Michael Swan. OUP. 1995.
(ii) *Remedial English Grammar*. F.T. Wood. Macmillan.2007
(iii)*Study Writing.* Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(iv) *Communication Skills*. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
(v) *Exercises in Spoken English.* Parts. I-III. CIEFL, Hyderabad. Oxford University Press
(vi) Pronunciation in Use ,Mark Hancock. Cambridge University Press. 2012

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

Subject Code: BES18ET2	**Subject Name : BASIC ENGINEERING GRAPHICS**	Ty / Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite : None	**ETL**	**1**	**0/0**	**2/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- Learn to know what kind of pencils to be used to sketch lines, numbers, Letters and Dimensioning in drawing sheet.
- Draw Projection of points, line, planes and solids using Drafters
- To identify the angle of projection and development of surfaces, isometric projection and Orthographic projection
- Know the basics of elevation and plan of building.
- Learn the basics of Drafting using AutoCAD Software

COURSE OUTCOMES (Cos) : (3 – 5)
Students completing the course were able to

CO1	Utilize the concept of Engineering Graphics Techniques to draft letters, Numbers, Dimensioning in Indian Standards
CO2	Demonstrate the drafting practice visualization and projection skills useful for conveying ideas in engineering applications.
CO3	Identify basic sketching techniques of engineering equipments
CO4	Demonstrate the projections of Points, Lines, Planes and Solids.
CO5	Draw the sectional view of simple buildings and utilize Auto CAD Software.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**H**	**H**	**M**	**M**	**M**			**H**	**H**		**H**
CO2	**H**	**H**	**H**	**M**	**M**	**M**			**H**	**H**		**H**
CO3	**H**	**H**	**H**	**L**		**M**			**M**	**M**		**M**
CO4	**H**	**H**	**M**	**M**		**H**		**M**	**H**	**H**		**H**
CO5	**H**	**H**	**H**	**M**	**H**	**L**		**M**	**H**	**H**		**H**

H/M/L indicates strength of correlation H – High, M – Medium, L – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
							√		

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BES18ET2 BASIC ENGINEERING GRAPHICS 1 0/0 2/0 2

CONCEPTS AND CONVENTIONS (Not for examination) 3

Introduction to drawing, importance and areas of applications – BIS standards – IS: 10711 – 2001 : Technical products Documentation – Size and layout of drawing sheets – IS 9606 – 2001: Technical products Documentation – Lettering – IS 10714 & SP 46 – 2003: Dimensioning of Technical Drawings – IS : 15021 – 2001 : Technical drawings – Projections Methods – drawing Instruments, Lettering Practice – Line types and dimensioning – Border lines, lines title blocks Construction of polygons – conic sections – Ellipse, Parabola, Hyperbola and cyloids.

UNIT I PROJECTION OF POINTS, LINES AND PLANE SURFACES 6

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – projection of polygonal surface and circular lamina in simple position only.

UNIT II PROJECTION OF SOLIDS 6

Projection of simple solids like prism, pyramid, cylinder and cone in simple position
Sectioning of above solids in simple vertical position by cutting plane inclined to one Reference Books plane and perpendicular to the other.

UNIT III DEVELOPMMENT OF SURFACES AND ISOMETRIC PROJECTION 6

Development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders, and cones.
Principles of isometric projection – isometric scale – isometric projections of simple solids, like prisms pyramids, cylinders and cones.

UNIT IV ORTHOGRAPHICS PROJECTIONS 6

Orthographic projection of simple machine parts – missing views

BUILDING DRAWING

Building components – front, Top and sectional view of a security shed.

UNIT V COMPUTER AIDED DRAFTING 3

Introduction to CAD – Advantages of CAD – Practice of basic commands – Creation of simple components drawing using CAD software.

Total No of Periods :30

Note:First angle projection to be followed.

TEXT BOOKS:

1. Bhatt, N.D. and Panchal, V.M. (2014) Engineering Drawing Charotar Publishing House
2. Gopalakrishnan, K.R. (2014) Engineering Drawing (Vol.I& II Combined) Subhas Stores, Bangalore.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: **BES18L02**	**Subject Name : INTEGRATED PHYSICAL SCIENCE LAB**	Ty / Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite : None	**Lb**	**0**	**0/0**	**2/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- Demonstrate the ability to make physical measurements & understand the limits of precision in measurements.
- Display the ability to measure properties of variety of electrical, mechanical, optical systems.
- To help learners measure conductivity and EMF using electrical equipment.
- To understand the analytical skills through chromatography &viscometry
- To familiarize the concepts of cheminformatics

COURSE OUTCOMES (Cos) : (3 – 5)
Students completing the course were able to

CO1	Recognize the correctness and precision in the results of measurements.
CO2	Construct and compare the properties of variety of mechanical, optical, electrical and electronic systems.
CO3	Familiarizing the titration methods using conductometry & potentiometry
CO4	Developing the Research spirit through the knowledge of Cheminformatics & Analytical skills.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**H**	**L**	**H**	**H**							
CO2	**H**	**H**	**M**	**H**	**H**					**M**		
CO3	**H**	**H**	**M**	**H**	**H**				**H**			
CO4	**H**	**H**	**H**	**H**	**H**				**H**		**H**	**M**

H/M/L indicates strength of correlation H – High, M – Medium, L – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical skill	Soft Skills
							√		

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BES18L02 INTEGRATED PHYSICAL SCIENCE LAB 0 0/0 2/0 1

LIST OF EXPERIMENTS

1. Determination of Coefficient of Viscosity of a given liquid by Poiseuille`s method.
2. Particle Size determination using Laser Source.
3. Determination of Numerical Aperture of an Optical Fiber.
4. Spectrometer- Refractive Index/Dispersive power/i-d curve.
5. Potentiometer - Resistance of a wire.
6. Transistor Characteristics - Input Resistance, Output Resistance and Gain .
7. Studies on acid-base conductometric titration.
8. Determination of redox potentials using potentiometry.
9. Determination of R_f values of various components using thin layer chromatography.
10. Viscosity studies using Digital capillary viscometer.
11. Compute the structures of the given polymers, drugs, biomolecules usingChem Draw.
12. Studies on potential energy surface of the given molecules.
13. Estimate NMR spectra from a Chem Draw structure.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
DEPARTMENT OF COMPUTER SCIENCE

Subject Code : BES18ET3	**Subject Name : C PROGRAMMING AND LAB**	Ty / Lb/ ETL	L	T/S Lr	P/R	C
	Prerequisite : None	**ETL**	**1**	**0/0**	**2/0**	**2**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- Outline the basics of C Language.
- Apply fundamentals in C programming.
- Produce and present activities associated with the course**.**

COURSE OUTCOMES (Cos) : (3 – 5)

Students completing the course were able to

CO1	Acquire knowledge how to write and execute c programs
CO2	Understand the fundamental expression and statements of C Language.
CO3	Work with arrays, functions, pointers, structures, Strings and Files in C.
CO4	Identify and provide solutions for engineering problems in C programming

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**H**			**M**	**M**		**H**	**M**			**H**
CO2	**H**	**M**			**H**	**M**		**M**	**H**			**M**
CO3	**H**			**H**		**M**		**M**	**H**			**M**
CO4	**H**			**M**		**M**		**H**	**M**			**M**

H/M/L indicates strength of correlation H – High, M – Medium, L – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
							√		

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BES18ET3 C PROGRAMMING AND LAB 1 0/0 2/0 2

UNIT I INTRODUCTION 6

Fundamentals, C Character set, Identifiers and Keywords, Data Types, Variables and Constants, Structure of a C Program, Executing a C Program.

UNIT II EXPRESSION AND STATEMENT 6

Operators, Types-Complex and Imaginary, Looping Statement-For, While, Do, Break, continue, Decision Statement-If, If else, Nested if, Switching Statement, Conditional Operator.

UNIT III ARRAYS AND FUNCTIONS 6

Defining an Array, Using Array elements as counters, Generate Fibonacci number, Generate Prime Numbers, Initializing Arrays, Multidimensional Arrays, Defining a Function, Function call -types of Function calls -Function pass by value -Function pass by Reference Books, Write a Program in Recursive Function.

UNIT IV STRUCTURES AND POINTERS 6

Working with Structures -Introduction -Syntax of structures -Declaration and initialization -Declaration of structure variable -Accessing structure variables, Understanding Pointers -Introduction -Syntax of Pointer.

UNIT V STRINGS AND FILE HANDLING 6

Strings -Syntax for declaring a string -Syntax for initializing a string -To read a string from keyboard, Files in C -File handling functions -Opening a File closing a file --example: fopen, fclose -Reading data from a File-Problem solving in C

Total No of Periods: 30

1. **www.spoken-tutorials.org**
2. **http://www.learn-c.org/**

REFERENCE BOOKS:

1. Stephen G. Kochen“ Programming in C- A complete introduction to the C Programming Language. Third Edition, Sams Publishing -2004
2. Ajay Mital, “ Programming in C: A Practical Approach”, Pearson Publication-2010

LIST OF PROGRAMS

1. Write a program to check 'a' is greater than 'b' or less than 'b' Hint: use if statement.
2. Write another program to check which value is greater 'a', 'b' or 'c'. Hint: use else-if statement. (Take values of a, b, c as user inputs)
3. Write a Program to find the sum of the series : $x + X^3/3! + X^5/5! + \ldots\ldots\ldots\ldots\ldots X^n/n!$
4. Write a C Program to solve a Quadratic Equation by taking input from Keyboard
5. Write a C Program to arrange 20 numbers in ascending and descending Order. Input the Numbers from Keyboard
6. Write a C Program to Multiply a 3 x 3 Matrix with input of members from Keyboard
7. Write a program that takes marks of three students as input. Compare the marks to see which student has scored the highest. Check also if two or more students have scored equal marks.
8. Write a program to display records of an employee. Like name, address, designation, salary.
9. Write a C program, declare a variable and a pointer. Store the address of the variable in the pointer. Print the value of the pointer.
10. Write a C program to concatenate String 'best' and String 'bus'. Hint: strcat(char str1, char str2);
11. Explore the other functions in string library.
12. Write a program to create a file TEST. Write your name and address in the file TEST. Then display it on the console using C program.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18001	Subject Name : ANALYTICAL INSTRUMENTS	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: None	**T**	**3**	**1/0**	**0/0**	**4**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- The capability to acquire knowledge on various techniques which occur in the various regions of the spectrum.
- The capability to acquire knowledge on various methods of analysis which occur in the various regions of the spectrum
- To understand Industrial Gas Analyzers And Pollution Monitoring Instruments
- To study important methods of analysis of industrial gases.
- Understanding the important radio chemical methods of analysis.

COURSE OUTCOMES (COs) : (3- 5)

CO1	The graduate gets knowledge on various techniques which occur in the various regions of the spectrum
CO2	The graduate gets knowledge on various methods of analysis which occur in the various regions of the spectrum
CO3	Understands Industrial Gas Analyzers And Pollution Monitoring Instruments
CO4	Students are capable of analysing important methods industrial gases analysis
CO5	Understands the important radio chemical methods of analysis.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	M	L	H	H	H	M	M	M	L	H
CO2	H	H	M	M	L	H	H	M	M	H	H	L
CO3	H	L	H	H	L	M	M	H	H	L	M	M
CO4	H	M	M	H	M	H	H	L	L	H	H	M
CO5	H	M	M	H	H	L	L	M	M	H	H	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	M	H	L	H			
CO2	H	H	M	M	L			
CO3	L	M	M	H	H			
CO4	L	H	H	M	M			
CO5	H	H	M	H	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
		✓										

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18001 ANALYTICAL INSTRUMENTS 3 1/0 0/0 4

UNIT I COLORIMETRY AND SPECTROPHOTOMETRY 12

Special methods of analysis – Beer-Lambert law – Colorimeters – UV-Vis spectrophotometers – Single and double beam instruments – Sources and detectors – IR spectrophotometers – Types – Attenuated total reflectance flame photometers – Atomic absorption spectrophotometers – Sources and detectors – FTIR spectrophotometers – Flame emission photometers.

UNIT II CHROMATOGRAPHY 12

Different techniques – Gas chromatography – Detectors – Liquid chromatographs – Applications – High-pressure liquid chromatographs – Applications.

UNIT III INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING INSTRUMENTS 12

Types of gas analyzers – Oxygen, NO2 and H2S types, IR analyzers, thermal conductivity analyzers, analysis based on ionization of gases. Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation - Dust and smoke measurements.

UNIT IV PH METERS AND DISSOLVED COMPONENT ANALYZERS 12

Principle of pH measurement, glass electrodes, hydrogen electrodes, reference electrodes, selective ion electrodes, ammonia electrodes, biosensors, dissolved oxygen analyzer – Sodium analyzer – Silicon analyzer.

UNIT V RADIO CHEMICAL AND MAGNETIC RESONANCE TECHNIQUES 12

Nuclear radiations – Detectors – GM counter – Proportional counter – Solid state detectors – Gamma cameras – X-ray spectroscopy – Detectors – Diffractometers – Absorption meters – Detectors.NMR – Basic principles – NMR spectrometer - Applications.Mass spectrometers – Different types – Applications

Total No of Periods: 60

TEXT BOOKS:

1. R.S. Khandpur, ‘Handbook of Analytical Instruments’, Tata McGraw Hill publishing Co. Ltd., 2003.
2. H.H.Willard, L.L.Merritt, J.A.Dean, F.A.Settle, ‘Instrumental methods of analysis’, CBS publishing & distribution, 1995.

REFERENCE BOOKS:

1. Robert D. Braun, ‘Introduction to Instrumental Analysis’, McGraw Hill, Singapore, 1987.
2. G.W.Ewing, ‘Instrumental Methods of Analysis’, McGraw Hill, 1992.
3. DA Skoog and D.M.West, ‘Principles of Instrumental Analysis’, Holt, Saunders Publishing, 1985.
4. C.K. Mann, T.J Vickers & W.H. Gullick, ‘Instrumental Analysis’, Harper and Row publishers, 1974

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18002	**Subject Name : CIRCUIT THEORY**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Basic Electrical and Electronics Engg	**T**	**3**	**1/0**	**0/0**	**4**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Enabling the students to acquire knowledge about the basic of circuit analysis, network theorems, ac circuits and transient analysis.
- The graduate will learn the analysis of complex circuits using mesh current and nodal voltage methods.
- Students to analyze complex circuits using network theorems.
- Understanding the concept of complex frequency & free and forced response of RL, RC & RLC circuits.
- Enabling to understand about different parameters of two networks.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands basics of circuit analysis, network theorems, ac circuits and transient analysis.
CO2	The graduate will be able to analysis complex circuits using mesh current and nodal voltage methods
CO3	Ability to analyze complex circuits using network theorems
CO4	Understands the concept of complex frequency & free and forced response of RL, RC & RLC circuits.
CO5	Acquire the knowledge about different parameters of two networks.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**M**	**L**	**H**	**L**	**M**	**H**	**M**	**L**	**H**	**H**	**M**	**L**
CO2	**M**	**H**	**H**	**L**	**M**	**M**	**H**	**H**	**L**	**L**	**H**	**M**
CO3	**M**	**H**	**H**	**L**	**M**	**M**	**H**	**H**	**L**	**M**	**H**	**M**
CO4	**H**	**H**	**M**	**M**	**H**	**H**	**L**	**H**	**H**	**M**	**L**	**L**
CO5	**H**	**H**	**M**	**M**	**H**	**H**	**M**	**H**	**L**	**M**	**H**	**L**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**H**	**L**	**L**	**L**	**M**			
CO2	**H**	**M**	**L**	**M**	**L**			
CO3	**H**	**M**	**M**	**L**	**L**			
CO4	**H**	**M**	**L**	**L**	**M**			
CO5	**H**	**M**	**M**	**L**	**L**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18002	**CIRCUIT THEORY**	**3**	**1/0**	**0/0**	**4**

UNIT I BASICS OF CIRCUIT ANALYSIS 12

Resistive elements - Ohm's Law Resistors in series and parallel circuits – Kirchhoff 's laws – Mesh current and node voltage - methods of analysis.

UNIT II NETWORK REDUCTION AND THEOREMS FOR DC AND AC CIRCUITS 12

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Norton Theorems – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem.

UNIT III TRANSIENT RESPONSE ANALYSIS 12

R, L and C elements -Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. sinusoidal input.

UNIT IV RESONANCE AND COUPLED CIRCUITS 12

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

UNIT V THREE PHASE CIRCUIT 12

A.C. circuits – Average and RMS value - Phasor Diagram – Power, Power Factor and Energy- Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced and unbalanced – phasor diagram of voltages and currents – power measurement in three phase circuits

Total No of Periods: 60

TEXT BOOKS:

1. William H. Hayt, Jr Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, 8th Edition, New Delhi, 2013
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", 5th Edition, McGraw Hill, 2013
3. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", 5th Edition ,Cengage Learning India, 2013.

REFERENCE BOOKS:

1. Chakrabarti A, Circuit Theory : Analysis and Synthesis , DhanpathRai& Sons, New Delhi, 2014
2. Jegatheesan R., Analysis of Electric Circuits," McGraw Hill, 2015
3. M Nahvi, Joseph Edminister, K Rao, Electric circuits,Schaum's Outline Series, McGraw- Hill, New Delhi, 2017
4. M E Van Valkenburg, "Network Analysis, Prentice-Hall of India Pvt Ltd, New Delhi, 2015.
5. Mahadevan, K., Chitra, C., "Electric Circuits Analysis," Prentice-Hall of India Pvt Ltd., New Delhi, 2015
6. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", McGraw Hill, 2015

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18003	Subject Name : ELECTRICAL MACHINES	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: None	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Providing fair knowledge on the working of various electrical machines
- Understanding the construction, working, characteristics and applications of DC generators & DC motors.
- To learn about the construction, working, characteristics and testing of single phase transformers.
- Enabling the students to understand the principle of operation, construction and characteristics of 3 phase induction motor.
- To understand the construction and characteristics of single phase induction motor and some special motors

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the basic concepts of the rotating circuits.
CO2	Designing the DC machines and understands the working principle of the DC machine
CO3	Capable to draw the circle diagram of Induction machine
CO4	Graduate understands the principle of operation, construction and characteristics of 3 phase induction motor
CO5	Understands the construction and characteristics of single phase induction motor and some special motors

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	H	M	L	L	M	L	H	H	M	L
CO2	H	M	H	H	M	M	L	L	M	H	H	L
CO3	H	H	M	M	M	L	L	H	M	H	H	L
CO4	H	M	H	H	H	L	L	H	M	M	H	H
CO5	M	H	L	H	H	M	L	H	H	M	L	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	H	M	L	M			
CO2	H	H	M	H	M			
CO3	H	H	M	M	L			
CO4	H	H	M	L	M			
CO5	H	H	M	M	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEI18003	**ELECTRICAL MACHINES**	**3**	**0/0**	**0/0**	**3**

UNIT I D.C. MACHINES **9**

Constructional details-EMF and Torque-Circuit model-Methods of Excitation- Characteristics of Generators- Characteristics of motors-Starting and speed control Methods-Testing and Efficiency-Losses in D.C machines-Applications.

UNIT II TRANSFORMER **9**

Constructional details-Principle of operation-EMF equation-Equivalent circuit-Losses and efficiency-Voltage regulation-Auto transformers-Three phase transformers-Constructional details-Types of connections.

UNIT III INDUCTION MOTORS **9**

Constructional details-types-Principle of operation-Torque equation-Equivalent circuit-Characteristics-Performance calculations-Starting methods-Speed control methods.

UNIT IV SYNCHRONOUS MACHINES **9**

Construction of synchronous machines-Classification-Induced EMF equation-Voltage regulation-EMF method-Parallel operation-Synchronous motor-Principle of operation-Methods of starting-Hunting-Effect of change of excitation of a synchronous motor.

UNIT V SINGLE PHASE INDUCTION MOTORS & MACHINES **9**

Single phase induction motors-Construction &Principle of working-Types-Universal motor-Reluctance motor-Stepper motor-Two phase servo motor-Tachogenerator-Linear induction motor (Qualitative Treatment

Total No of Periods: 45

TEXT BOOKS:

1. Mulukutla.S.Sarma, “Electric Machines, Stead state theory and dynamic Performance", 2nd Edition Thomson Learning 1997
2. S.K Bhattacharya, “Electrical Machines”, 3rd Edition Tata McGraw Hill Publications 2008.

REFERENCE BOOKS:

1. I.J. Nagrath & D.P. Kothari, “Electrical Machines”, Tata McGraw Hill Publications, Second Edition 1997.
2. Nasar S.A, “Electrical Machines & Power Systems”, TMH Publications
3. Ian McKenzie Smith, “Hughes Electrical Technology”, Revised Low price Edition, Pearson Education, Seventh edition.
4. Irving I.Kosow, “Electric Machinery and Transformers”, PHI, Second Edition, 2001.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18004	Subject Name : INDUSTRIAL INSTRUMENTATION – I	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: None	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To acquire familiarity about various industrial instrumentation types, their parameters and different types of measurement techniques.
- To understand the basics in measurement techniques of force, torque and speed and
- To learn about techniques of acceleration, Vibration and density
- To gain knowledge about pressure measurement techniques.
- To gain extensive knowledge about temperature measurement techniques.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Students acquire familiarity about various industrial instrumentation types, their parameters and different types of measurement techniques.
CO2	Students understand the basics in measurement techniques of force, torque and speed
CO3	Acquires knowledge on techniques of acceleration, Vibration and density
CO4	Acquire extensive knowledge about pressure measurement techniques
CO5	Acquire extensive knowledge about temperature measurement techniques

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	H	L	M	H	M	L	M	H	M	L
CO2	H	M	H	M	H	M	H	M	L	H	M	H
CO3	M	H	L	M	H	M	H	L	H	M	H	L
CO4	M	M	H	M	H	M	H	L	L	M	M	H
CO5	L	L	H	M	H	M	H	L	L	H	M	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO 5			
CO1	H	L	H	M	L			
CO2	M	L	H	H	M			
CO3	M	H	M	H	L			
CO4	M	H	H	M	L			
CO5	L	M	M	L	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18004 INDUSTRIAL INSTRUMENTATION – I 3 0/0 0/0 3

UNIT I MEASUREMENT OF FORCE, TORQUE AND VELOCITY 9

Electric balance – Different types of load cells – Magnets – Elastic load cells - Strain gauge load cell – Different methods of torque measurement – Strain gauge, relative regular twist – Speed measurement – Revolution counter – Capacitive tacho-drag cup type tacho – D.C and A.C tacho generators – Stroboscope.

UNIT II MEASUREMENT OF ACCELERATION, VIBRATION, DENSITY AND VISCOSITY 9

Accelerometers – LVDT, piezoelectric, strain gauge and variable reluctance type accelerometers – Mechanical type vibration instruments – Seismic instrument as an accelerometer and vibrometer – Calibration of vibration pick-ups – Units of density, specific gravity and viscosity used in industries – Baume scale, API scale – Pressure head type densitometer – Float type densitometer – Ultrasonic densitometer – Bridge type gas densitometer – Viscosity terms – Saybolt viscometer – Rotameter type.

UNIT III PRESSURE MEASUREMENT 9

Units of pressure - Manometers – Different types – Elastic type pressure gauges – Bourdon type bellows – 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 gauges – Ionization gauge, cold cathode and hot cathode types – Testing and calibration of pressure gauges – Dead weight tester.

UNIT IV TEMPERATURE MEASUREMENT 9

Definitions and standards – Primary and secondary fixed points – Calibration of thermometer, different types of filled in system thermometer – Sources of errors in filled in systems and their compensation – Bimetallic thermometers – Electrical methods of temperature measurement – Signal conditioning of industrial RTDs and their characteristics – Three lead and four lead RTDs.

UNIT V THERMOCOUPLES AND PYROMETERS 9

Thermocouples – Laws of thermocouple – Fabrication of industrial thermocouples – Signal conditioning of thermocouples output – Thermal block reference functions – Commercial circuits for cold junction compensation – Response of thermocouple – Special techniques for measuring high temperature using thermocouples – Radiation methods of temperature measurement – Radiation fundamentals – Total radiation & selective radiation pyrometers – Optical pyrometer – Two colour radiation pyrometers.

Total No of Periods: 45

TEXT BOOKS:

1. E.O. Doebelin, ‘Measurement Systems – Application and Design’, Tata McGraw Hill publishing company, 2003.
2. R.K. Jain, ‘Mechanical and Industrial Measurements’, Khanna Publishers, New Delhi,1999.

REFERENCE BOOKS:

1. D. Patranabis, ‘Principles of Industrial Instrumentation’, Tata McGraw Hill Publishing Company Ltd, 1996.
2. A.K. Sawhney and P. Sawhney, ‘A Course on Mechanical Measurements, Instrumentation and Control’, DhanpathRai and Co, 2004.
3. B.C. Nakra & K.K.Chaudary, ‘Instrumentation Measurement & Analysis’, Tata McGraw Hill Publishing Ltd, 2004.
4. S.K. Singh, ‘Industrial Instrumentation and Control’, Tata McGraw Hill, 2003.
5. D.P. Eckman’, Industrial Instrumentation’, Wiley Eastern Ltd

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BME18I03	Subject Name : THERMODYNAMICS AND FLUID MECHANICS	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: None	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand the basic Laws of Thermodynamics and the working principle of IC Engines.
- To understand the design of Turbines and boilers.
- To understand the properties of Fluids and implementation of Hydraulic machinery & Pumps.
- To know the importance, application and inter relationship of various properties of fluid
- To study about various types of pumps and turbines

COURSE OUTCOMES (COs) : (3- 5)

CO1	knowledge on the basic Laws of Thermodynamics and the working principle of IC Engines
CO2	Capable of selecting the suitable turbines and boilers depending upon the applications
CO3	Incorporating the knowledge gained in operating the Hydraulic machinery & Pumps
CO4	knowledge on properties of different fluids and its applications
CO5	Develop knowledge on the working of different types of pumps and turbines

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**H**	**H**	**H**	**H**	**H**	**H**	**L**	**M**	**H**	**M**	**H**	**H**
CO2	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**H**	**M**
CO3	**H**	**H**	**H**	**H**	**H**	**H**	**L**	**H**	**H**	**M**	**H**	**L**
CO4	**H**	**H**	**H**	**H**	**H**	**H**	**L**	**L**	**H**	**M**	**H**	**L**
CO5	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**L**	**H**	**H**	**H**	**M**

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	**M**	**M**	**H**	**M**	**H**			
CO2	**M**	**H**	**H**	**H**	**H**			
CO3	**M**	**M**	**M**	**M**	**M**			
CO4	**M**	**M**	**M**	**M**	**M**			
CO5	**H**	**H**	**H**	**H**	**H**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
		✓										

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BME18I03 THERMODYNAMICS AND FLUID MECHANICS 3 0/0 0/0 3

UNIT I BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS 9

Thermodynamics systems, Concepts of continuum, Thermodynamics properties, Equilibrium, Process, Cycle, Work, Heat, Temperature, Zeroth law of thermodynamics. First law of thermodynamics – Applications to closed and open systems – Steady flow Energy Equations – Simple Problems

UNIT II SECOND LAW OF THERMODYNAMICS 9

Statements, Reversibility, Causes of irreversibility, Carnot Cycle, Reversed Carnot Cycle, Heat Engines, Refrigerators, Heat Pumps - Clausius Inequality – Entropy - Principles of increase of entropy - Carnot theorem

UNIT III POWER CYCLES 9

Air cycles – Assumptions - Otto, Diesel, Dual and Brayton cycle – Air standard efficiency – Mean effective pressure – Working of two stroke and Four Stroke Petrol and Diesel Engines

UNIT IV FLUID MECHANICS 9

Fluid properties; fluid statics, manometer, control-volume analysis of mass, momentum and energy; differential equations of continuity and momentum; Bernoulli's equation; viscous flow of incompressible fluids; boundary layer; elementary turbulent flow; flow through pipes, head losses in pipes, bends etc

UNIT V FLUID MACHINERY 9

Introduction, types of pumps – reciprocating pump – centrifugal pump - construction details – working principles, Pelton wheel, Francis and Kaplan turbines – construction and working principles

Total No of Periods: 45Hrs

TEXT BOOKS:

1. Nag, P.K. Engineering Thermodynamics,2nd Edn, Tata McGraw Hill Publishing Company Ltd.
2. Rajput R.K., Fluid Mechanics and Hydraulic Machines, S.Chand and Co., India

REFERENCES BOOKS:

1. Holman, J.P. (1995) Thermodynamics, McGraw Hill.
2. Yunus A. Cengel, Thermodynamics-An Engineering Approach. ,Tata McGraw Hill.
3. Bansal R.K., A Text Book of Fluid Mechanics and Hydraulic Machines , S.Chand and Co., India

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18L01	**Subject Name : ELECTRICAL TECHNOLOGY LAB**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: None	**L**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Providing fair knowledge on the working of various electrical machines
- Understanding the construction, working, characteristics and applications of DC generators & DC motors.
- The graduate will learn the construction, working, characteristics and testing of single phase transformers.
- Enabling the students to understand the principle of operation, construction and characteristics of 3 phase induction motor.
- To understand the construction and characteristics of single phase induction motor and some special motors

COURSE OUTCOMES (COs) : (3- 5)

CO1	Acquires fair knowledge on the working of various electrical machines
CO2	The graduate understands the construction, working, characteristics and applications of DC generators & DC motors.
CO3	The graduate will learn the construction, working, characteristics and testing of single phase transformers.
CO4	Understands the principle of operation, construction and characteristics of 3 phase induction motor.
CO5	Understands the construction and characteristics of single phase induction

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**M**	**H**	**M**	**L**	**H**	**H**	**H**	**M**	**M**	**L**	**H**	**H**
CO2	**M**	**H**	**M**	**H**	**H**	**L**	**H**	**M**	**H**	**M**	**L**	**H**
CO3	**H**	**H**	**M**	**L**	**H**	**H**	**L**	**M**	**H**	**M**	**L**	**H**
CO4	**H**	**M**	**L**	**H**	**H**	**M**	**L**	**H**	**M**	**H**	**L**	**H**
CO5	**H**	**M**	**M**	**L**	**H**	**H**	**L**	**M**	**H**	**L**	**M**	**M**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**H**	**M**	**H**	**L**	**L**			
CO2	**M**	**H**	**H**	**M**	**M**			
CO3	**L**	**H**	**M**	**H**	**H**			
CO4	**M**	**H**	**H**	**M**	**L**			
CO5	**M**	**H**	**H**	**H**	**L**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18L01	**ELECTRICAL TECHNOLOGY LAB**	**0**	**0/0**	**3/0**	**1**

LIST OF EXPERIMENTS:

1. Verification of network theorems.
2. Determination of coupling coefficient.
3. Series and parallel resonance.
4. Power measurement in single phase
5. Power measurement in three phase circuits.
6. Open circuit characteristics of DC generators.
7. Load characteristic of DC motors.
8. Speed control of DC motors
9. Brake test of DC motors.
10. Regulation of three-phase alternator.
11. Open circuit and short circuits of transformer.
12. Brake test of induction motors.
13. V-curve of synchronous motor.

Total No of Periods: 45

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18L02	Subject Name : ELECTRIC CIRCUITS LAB	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: None	**L**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Students will learn various network theorems
- Students will demonstrate the ability to Design and apply Hardware Implementation of what they have learnt theoretically in the field of Electronics, Electric circuits and network analysis using both analog techniques.
- Students will demonstrate the ability to Design and apply Hardware Implementation of what they have learnt theoretically in the field of Electronics, Electric circuits and network analysis using both digital techniques.
- To Design and implement the hardware of a voltage Regulator for AC inputs in hardware and Design a filter circuit for Active and passive components.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Students Understands various network theorems
CO2	The graduate gets the ability to Design and apply Hardware Implementation of what they have learnt theoretically in the field of Electronics, Electric circuits and network analysis using both analog techniques.
CO3	The graduate gets the ability to Design and apply Hardware Implementation of what they have learnt theoretically in the field of Electronics, Electric circuits and network analysis using both digital techniques.
CO4	Students will be able to Design and implement the hardware of a voltage Regulator for AC inputs in hardware
CO5	Students will be able to Design a filter circuit for Active and passive components.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	H	L	M	H	H	M	L	M	H	M
CO2	H	M	H	M	H	M	L	H	H	L	M	H
CO3	M	H	H	H	M	H	M	L	H	H	M	L
CO4	M	H	H	M	L	H	M	L	H	H	M	M
CO5	H	H	M	M	M	L	M	M	H	H	M	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	H	H	L			
CO2	H	H	M	H	H			
CO3	M	H	H	M	L			
CO4	L	H	M	H	M			
CO5	H	L	H	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18L02	**ELECTRIC CIRCUITS LAB**	**0**	**0/0**	**3/0**	**1**

LIST OF EXPERIMENTS

1. Experimental verification of Kirchhoff's voltage and current laws
2. Experimental verification of Current and Voltage Division and Source Transformation
3. Experimental verification of network theorems (Thevenin, Norton, Superposition and maximum power transfer Theorem).
4. Determination of average value, RMS value, form factor, peak factor of sinusoidal wave, square wave using hard ware and digital simulation.
5. Verification of Nodal and Mesh Analysis
6. Study of CRO and measurement of sinusoidal voltage, frequency and power factor
7. Experimental determination of time constant of series R-C electric circuits
8. Experimental determination of frequency response of RLC circuits.
9. Design and Simulation of series resonance circuit.
10. Design and Simulation of parallel resonant circuits
11. Simulation of three phase balanced and unbalanced star, delta networks circuits
12. Experimental determination of power in three phase circuits by two-watt meter method
13. Calibration of single phase energy meter.
14. Determination of self, mutual inductance and coefficient of coupling.
15. Simulation of transient response of RLC circuit

.

Total No of Periods: 45

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BME18IL2	**Subject Name:** FLUID MECHANICS AND IC ENGINE LAB	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	**L**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To analyze performance of flow using various measuring instruments.
- Providing fair knowledge on the working of various Pumps for testing their performance.
- The graduate will learn the valve timing and port timing diagrams for IC Engines.
- To analyze performance and Heat Balance Test of IC Engines.
- To analyze performance and Heat Balance Test of Refrigerator and boilers.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Analyze the performance of flow using various measuring instruments.
CO2	Gain knowledge on the performance and testing of various pumps
CO3	Gain knowledge on the concepts of timing diagrams for IC Engines
CO4	analyze the performance and testing of IC engines
CO5	Analyze the performance and testing of Refrigerator and boilers.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**H**	**M**	**H**	**L**
CO2	**H**	**H**	**H**	**M**	**H**	**H**	**L**	**L**	**H**	**M**	**H**	**H**
CO3	**H**	**H**	**H**	**M**	**M**	**H**	**M**	**L**	**H**	**M**	**H**	**L**
CO4	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**H**	**M**	**H**	**M**
CO5	**H**	**H**	**H**	**M**	**M**	**H**	**M**	**M**	**H**	**M**	**H**	**H**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**M**	**M**	**M**	**M**	**H**			
CO2	**H**	**M**	**M**	**M**	**H**			
CO3	**M**	**M**	**M**	**M**	**H**			
CO4	**H**	**M**	**M**	**M**	**M**			
CO5	**M**	**H**	**H**	**M**	**H**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							√					

BME18IL2	**FLUID MECHANICS AND IC ENGINE LABORATORY**	**0**	**0/0**	**3/0**	**1**

LIST OF EXPERIMENTS

FLUID MECHANICS

1. Measurement of flow using Orificemeter.
2. Measurement of flow using Venturimeter.
3. Measurement of flow using flow through pipes.
4. Measurement of flow using Flow meter.
5. Performance test on Reciprocating pump.
6. Performance test on Centrifugal pump.

IC ENGINES

7. Valve timing and port timing diagrams for IC Engines.
8. Performance test on a Petrol Engine.
9. Performance test on a Diesel Engine.
10. Heat Balance test on an IC Engine.
11. Boiler – performance and Heat Balance Test.
12. Performance test on a Refrigerator (Determination of COP)

Total No of Periods: 45

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BMA18011	Subject Name : NUMERICAL METHODS FOR ELECTRICAL ENGINEERS	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: None	T	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To develop the ability in Numerical Skills

COURSE OUTCOMES (COs) : (3- 5)

CO1	To understand the Basic concepts in Numerical Analysis
CO2	To understand the Basic concepts in System of Linear Equations
CO3	To understand the Basic concepts in Non Linear Equations
CO4	To understand the Basic concepts in Interpolation
CO5	To understand the Basic concepts in Numerical Differentiation and Integration

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	H	L	L	L	L	L	L	M	L	L	M
CO2	L	H	L	L	L	L	L	L	M	L	L	M
CO3	L	H	L	L	L	L	L	L	M	L	L	M
CO4	L	H	L	L	L	L	L	L	M	L	L	M
CO5	L	H	L	L	L	L	L	L	M	L	L	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	M	L	L	L			
CO2	M	M	L	L	L			
CO3	M	M	L	L	L			
CO4	M	M	L	L	L			
CO5	M	M	L	L	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
	✓											

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BMA18011	**NUMERICAL METHODS FOR ELECTRICAL ENGINEERS**	**3**	**1/0**	**0/0**	**4**

UNIT I BASICS OF NUMERICAL METHODS 12

Curve fitting-Method of group averages-Principle of least square-Method of moments-Finite differences-Operators (Forward, Backward & Shifting) -Relationship between the operators.

UNIT II SYSTEM OF LINEAR EQUATIONS 12

Gauss Elimination method – Gauss-Jordan method – Iterative methods – Gauss-Jacobi method – Gauss-Seidel method – Matrix Inversion by Gauss-Jordan method- Eigen value problem-Power method.

UNIT III NON LINEAR EQUATIONS 12

Solution of Algebraic and Transcendental equations – Method of false position -Fixed point iteration method (single and multi variables)- Newton-Raphson method (single and multi variables).

UNIT IV INTERPOLATION 12

Newton forward and backward differences – Central differences – Stirling's and Bessel's formulae – Interpolation with Newton's divided differences – Lagrange's method.

UNIT V NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Numerical differentiation with interpolation polynomials – Numerical integration by Trapezoidal and Simpson's (both 1/3 rd & 3/8 th) rules – Two and three point Gaussian Quadrature formulae – Double integrals using Trapezoidal and Simpson's rules.

Total No of Periods: 60

TEXT BOOKS:

1. Veerarajan T., Numerical Methods, Tata McGraw Hill Publishing Co., (2007)
2. Sastry S.S., Introductory Methods of Numerical Analysis, Prentice Hall of India, (2012)

REFERENCE BOOKS:

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, (2012)
2. Kandasamy P., Thilagavathy, Gunavathy K., Numerical Methods (Vol.IV), S.Chand & Co., (2008)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code:	Subject Name : TRANSDUCER ENGINEERING	TY / LB/ ETL	L	T / S.Lr	P/ R	C
BEI18005	Prerequisite: None	T	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Understanding how physical quantities are measured and converted to electrical or other forms.
- To have an adequate knowledge of different transducers, resistance.
- Developing the knowledge in inductance and capacitance transducers.
- Studying the operation, characteristics, applications of various types of transducers.
- Studying the advantages and disadvantages of various types of transducers.

COURSE OUTCOMES (COs) : (3- 5)

CO1	The student understands the dynamics of the transducer.
CO2	The student will be able to select a suitable transducer for a given application.
CO3	The student can design a transducer as per the requirement
CO4	Understands the operation, characteristics, applications of various types of transducers
CO5	Understands the advantages and disadvantages of various types of transducers

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	H	L	M	H	M	H	H	M	L	H
CO2	M	H	H	M	M	H	L	L	H	H	M	H
CO3	H	H	H	M	L	H	M	L	H	H	M	H
CO4	M	H	H	M	L	H	M	L	H	M	H	L
CO5	H	H	H	M	L	H	M	H	M	L	H	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	H	M	L			
CO2	H	M	H	M	L			
CO3	L	H	M	M	H			
CO4	M	H	H	L	M			
CO5	H	L	M	H	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18005 TRANSDUCER ENGINEERING 3 1/0 0/0 4

UNIT I SCIENCE OF MEASUREMENT 12

Units and standards – calibration methods – static calibration – classification of errors – error analysis – statistical methods – odds and uncertainty .

UNIT II CHARACTERISTICS OF TRANSDUCERS 12

Static characteristics – accuracy, precision, sensitivity, linearity etc. – mathematical model of transducers – zero, first-order and second-order transducers – response to Standard test signals

UNIT III VARIABLE RESISTANCE TRANSDUCERS 12

Resistance potentiometers, strain gauges, resistance thermometers, thermistors, hot-wire anemometer, piezoresistive sensors and humidity sensors.

UNIT IV VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE TRANSDUCERS 12

Induction potentiometer – variable reluctance transducers – EI pick up – LVDT – capacitive transducers – variable air gap type – variable area type – variable permittivity type – capacitor microphone.

UNIT V OTHER TRANSDUCERS 12

Piezoelectric transducer – magnetostrictive transducer – IC sensor – digital transducers – smart sensor – fiber optic transducers.

Total No of Periods: 60

TEXT BOOKS:

1. Neubert, H.K.P. Instrument Transducers, Clarenden Press, Oxford, 1988.
2. Patranabis, D, Sensors and Transducers, Wheeler Publishing Co., Ltd. New Delhi, 1997

REFERENCE BOOKS:

1. Doebelin, E.O., Measurement Systems, McGraw-Hill Book Co., 1998.
2. Neubert, H.K.P. Instrument Transducers, Clarenden Press, Oxford, 1988.
3. Patranabis, D, Sensors and Transducers, Wheeler Publishing Co., Ltd. New Delhi, 1997.
4. Murthy, D.V.s., Transducers and Instrumentation, Prentice Hall of India Pvt. Ltd., New Delhi, 1995.
5. Renganathan, S., Transducer Engineering, Allied Publishers, Chennai, 1999.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code:	**Subject Name : DIGITAL ELECTRONICS**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
BEI18006	**Prerequisite: Basics of Electrical and Electronics Engg.**	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Understanding logic and analyzing the logical processes
- Familiarity to common forms of number representation in digital electronic circuits and to be able to convert between different representations
- Understanding the logical operation of simple arithmetic and other MSI circuits (Medium Scale Integrated Circuits)
- To impart the concepts of sequential circuits enabling them to analyze sequential systems in terms of state machines

COURSE OUTCOMES (COs) : (3- 5)

CO1	The graduate can tell the history and development of digital electronics.
CO2	Students can describe and demonstrate the use digital test equipment and its operati characteristics.
CO3	Examine purpose of PAL, PLA and FPGA
CO4	Understand and recognize the various logic families like RTL, DTL, TTL, ECL.
CO5	Identify and describe flip-flop circuits.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**L**	**M**	**H**	**L**	**H**	**L**	**M**	**M**	**H**	**M**	**L**
CO2	**M**	**H**	**L**	**H**	**H**	**M**	**M**	**L**	**H**	**M**	**H**	**M**
CO3	**M**	**H**	**H**	**L**	**M**	**H**	**H**	**M**	**H**	**M**	**H**	**M**
CO4	**H**	**H**	**H**	**L**	**M**	**H**	**M**	**H**	**M**	**H**	**H**	**M**
CO5	**M**	**H**	**M**	**H**	**H**	**H**	**M**	**H**	**M**	**H**	**H**	**L**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**H**	**M**	**M**	**L**	**H**			
CO2	**H**	**M**	**M**	**M**	**H**			
CO3	**H**	**M**	**H**	**M**	**H**			
CO4	**H**	**H**	**M**	**M**	**L**			
CO5	**M**	**L**	**H**	**M**	**M**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEI18006	DIGITAL ELECTRONICS	3	0/0	0/0	3

UNIT I NUMBER SYSTEMS **9**

Review of binary, octal and hexadecimal number systems – Conversions; Binary Arithmetic– signed magnitude form – 1's, 2's Complement representation. Codes: - BCD, Excess-3, Grey codes, ASCII Codes, Error detecting codes (Hamming code)-Applications of Error Detecting Codes**.**

UNIT II BOOLEAN ALGEBRA **9**

Boolean algebra – De Morgan's law - Simplifications of Boolean expression – Sum of products and product of sums – KarnaughMap(upto 5 variables) – Quince McClusky method of simplification (Including Don't care conditions)

UNIT III COMBINATIONAL LOGIC **9**

Logic gates – AND, OR, NOT, NOR, NAND and EX-OR – combinational logic- Arithmetic circuits – Half adder – Full adder, Half Subtractor - Decimal Adder – Excess 3 adder – Code converters – Multiplexer – Demultiplexer- Encoder – decoder – Design of general combinational logic circuit. PAL, PLA and FPGA.

UNIT IV SEQUENTIAL LOGIC DESIGN **9**

Building blocks of sequential logic-RS, JK, Master-Slave, D and T flip-flop, Asynchronous and synchronous counters - Binary and BCD counters - Shift registers –Basic models of sequential machines – concept of state diagram - State table – State reduction - Design and implementation of synchronous sequential circuits

UNIT V LOGIC FAMILIES **9**

Characteristics of RTL, DTL, TTL, families – Schottky, clamped TTL, ECL, IIL – MOS Inverters – complementary MOS inverters .IC based Full adder ,IC based Magnitude Comparator.

Total No of Periods: 45

TEXT BOOKS:

1. Charles H. Roth, "Fundamentals of Logic Design", Thompson Learning ,5th Edition.
2. John. M. Yarbrough, "Digital Logic: Application and design", Thomson Learning

REFERENCE BOOKS:

1. FLOYD:" Digital Fundamentals",10th Edition Universal Book Stall, New Delhi.1993.
2. Morris Mano, "Digital Electronics and Design", Prentice Hall of India, 2000.
3. Albert Paul, Malvino and Donald P Leach: "Digital Principles and Applications" Tata McGraw Hill publications.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code:	**Subject Name : INTRODUCTION TO OOPS WITH C++ AND JAVA**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
BCS18I06	**Prerequisite: None**	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To be able to distinguish OOPS features with procedural Oriented and
- To Analyze OOPS features to a real world object,
- To analyze generic data type for the data type independent programming which relate it to reusability.
- To understand the concepts of Java programs
- To develop basic networking programs using Java.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Students will be able to distinguish OOPS features with procedural Oriented and analyze these features to a real world object,
CO2	Analyze OOPS features to a real world object,
CO3	Understands the analysis of generic data type for the data type independent programming which relate it to reusability.
CO4	Understands the concepts of Java programs
CO5	Develops basic networking programs using Java

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**H**	**L**	**M**	**H**	**H**	**L**	**H**	**H**	**M**	**H**
CO2	**L**	**M**	**H**	**M**	**H**	**M**	**H**	**L**	**L**	**M**	**H**	**H**
CO3	**M**	**H**	**H**	**M**	**L**	**H**	**M**	**H**	**L**	**H**	**L**	**H**
CO4	**H**	**H**	**M**	**H**	**L**	**H**	**M**	**H**	**H**	**L**	**M**	**M**
CO5	**L**	**H**	**H**	**M**	**H**	**M**	**H**	**L**	**H**	**M**	**H**	**M**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**H**	**M**	**H**	**M**	**L**			
CO2	**L**	**H**	**M**	**M**	**H**			
CO3	**M**	**L**	**H**	**M**	**H**			
CO4	**H**	**H**	**M**	**M**	**L**			
CO5	**H**	**M**	**L**	**H**	**M**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
		✓										

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BCS18I06	**INTRODUCTION TO OOPS WITH C++ AND JAVA**	**3**	**0/0**	**0/0**	**3**

UNIT I BASICS OF OOPS **9**

Programming methodologies -Object Oriented concepts-Definition-Data members-Function members-Access specifiers-Constructors-Default constructors-Copy constructors-Destructors-Static members-Control statements, Basics of C++environment. .

UNIT II INHERITANCE AND POLYMORPHISM **9**

Overloading operators-Functions-Friends-Class derivation-Virtual functions-Abstract base classes-Multiple inheritance.

UNIT III TEMPLATES **9**

Class templates-Function templates-Exception handling-Streams.

UNIT IV JAVA PROGRAMMING **9**

Java environment-Classes-Definition-Fields-Methods-Object creation-Constructors-Overloading methods-Static members-This keyword-Nested classes-Extending classes.

UNIT V INHERITANCE AND EXCEPTION **9**

Inheritance-member accessibility-Overriding methods-Abstract classes-Interfaces. Exceptions And Threads: Exception and errors -Exception classes - Runtime Exception - Uncompact Exception - Finally block – User defined Exceptions. Creating Threads -Controlling Threads

Total No of Periods: 45

TEXT BOOKS:

1. Stanley B.Lippman, "The C++ Primer" Addison Wesley, 5/e, 2012.
2. H.Schildt , Java 2 : The Complete Reference,6/e, Tata McGraw Hill-2008

REFERENCE BOOKS:

1. Deitel and Deitel, "C++ How to Program" Prentice Hall, 8/e, 2011
2. Programming in java –E.Balagurusamy-Tata McGraw Hill,4/e, 2009
3. Ken Arnold and James Gosling, "The Java Programming Language", Pearson Education, 3/e, Reprint 2009.
4. B.Stroustrup,"The C++ Programming Language", 3/e, Pearson Education, 2004.
5. E.Balagurusamy "Object Oriented Programming with C++"- 4/e. "Tata Mcgraw Hill", 2008.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: **BHS18NC1**	Subject Name **THE INDIAN CONSTITUTION**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: NIL	**Ty**	**2**	**0/0**	**0/0**	**NC**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To provide an overview of the history of the making of Indian Constitution
- To understand the preamble and the basic structures of the Constitution.
- To Know the fundamental rights, duties and the directive principles of state policy
- To understand the functionality of the legislature , the executive and the judiciary

COURSE OUTCOMES (COs) : After studying this course the student would be able to

CO1	To provide an overview of the history of the making of Indian Constitution
CO2	To understand the preamble and the basic structures of the Constitution.
CO3	To Know the fundamental rights, duties and the directive principles of state policy

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1						**H**	**L**	**L**	**L**	**L**		
CO2						**H**	**L**	**L**	**L**	**L**		
CO2						**H**	**L**	**L**	**M**	**L**		

COs / PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	**L**	**L**	**M**
CO2	**L**	**L**	**M**
CO3	**L**	**L**	**M**

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills			
			✓									

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BHS18NC1	**THE INDIAN CONSTITUTION**	**Ty**	**2**	**0/0**	**0/0**	**NC**

UNIT I **3Hrs**

The History of the Making of Indian Constitution, Preamble and the Basic Structures

UNIT II **3Hrs**

Fundamental Rights and Duties , Directive Principles of State Policy

UNIT III **3Hrs**

Legislature, Executive and Judiciary

UNIT IV **3Hrs**

Emergency Powers

UNIT V **3Hrs**

Special Provisions for Jammu and Kashmir, Nagaland and Other Regions, Amendments

Total Hours: 15

TEXT BOOKS:

1. D D Basu, Introduction to the Constitution of India, 20th Edn.,LexisnexisButterworths, 2012.

REFERENCE BOOKS:

1. *Rajeev Bhargava (ed), Ethics and Politics of the Indian Constitution, Oxford University Press, New Delhi, 2008.*
2. *Granville Austin, The Indian Constitution: Cornerstone of a Nation, Oxford University Press, Oxford, 1966.*
3. *Zoya Hassan, E. Sridharan and R. Sudarshan (eds), India's Living Constitution: Ideas, Practices, Controversies, Permanent Black, New Delhi, 2002.*
4. *Subhash C. Kashyap, Our Constitution, National Book Trust, New Delhi, 2011.*

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: **BHS18NC2**	Subject Name : **THE INDIAN TRADITIONAL KNOWLEDGE**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: NIL	**Ty**	**2**	**0/0**	**0/0**	**NC**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To understand the Pre- colonial and Colonial Period, Indian Traditional Knowledge System
- To understand the Traditional Medicine, Traditional Production and Construction Technology
- To Know the History of Physics and Chemistry, Traditional Art and Architecture and Vastu Shashtra, Astronomy and Astrology
- To understand the Origin of Mathematics, Aviation Technology in Ancient India, Crafts and Trade in Ancient India

COURSE OUTCOMES (COs) : After studying this course the student would be able to

CO1	To understand the Pre- colonial and Colonial Period, Indian Traditional Knowledge System
CO2	To understand the Traditional Medicine, Traditional Production and Construction Technology
CO3	To understand the Origin of Mathematics, Aviation Technology in Ancient India, Crafts and Trade in Ancient India

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		**H**	**H**	**L**		**M**				**M**		**L**
CO2		**H**	**H**	**L**		**M**				**M**		**L**
CO2		**H**	**H**	**L**		**M**				**M**		**L**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	**L**	**L**	**M**
CO2	**L**	**L**	**M**
CO3	**L**	**L**	**M**

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical	Soft Skills			
			✓									

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BHS18NC2	**THE INDIAN TRADITIONAL KNOWLEDGE**	**Ty**	**2**	**0/0**	**0/0**	**NC**

UNIT I **3Hrs**

Historical Background: TKS During the Pre- colonial and Colonial Period, Indian Traditional Knowledge System

UNIT II **3Hrs**

Traditional Medicine, Traditional Production and Construction Technology

UNIT III **3Hrs**

History of Physics and Chemistry, Traditional Art and Architecture and Vastu Shashtra, Astronomy and Astrology

UNIT IV **3Hrs**

Origin of Mathematics, Aviation Technology in Ancient India, Crafts and Trade in Ancient India

UNIT V **3Hrs**

TKS and the Contemporary World, TKS and the Indian Union, TKS and IT Revolution

Total Hours: 15

TEXT BOOKS:

1. Amit Jha (2009) , Traditional knowledge system in india, 1st Edition, Delhi University (North Campus)
2. Dr.A.K.Ghosh (2011), Traditional Knowledge of Household Products

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18ET1	**Subject Name : MEASUREMENTS AND INSTRUMENTATION**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: None	**ETL**	**1**	**0/1**	**3/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Developing adequate knowledge of the instruments, relevant circuits and their working
- Introduction to electrical instruments and
- Introduction to measurements techniques.
- To Emphasis Knowledge on analog techniques used to measure voltage, current, power etc
- To Emphasis Knowledge on digital techniques used to measure voltage, current, power etc

COURSE OUTCOMES (COs) : (3- 5)

CO1	The graduate will get adequate knowledge of the instruments, relevant circuits and their working
CO2	Capable of describing various electrical instruments
CO3	Capable of describing various measurements techniques.
CO4	Knowledge on analog techniques used to measure voltage, current, power etc. gets enhanced
CO5	Knowledge on digital techniques used to measure voltage, current, power etc. gets enhanced

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**M**	**H**	**H**	**L**	**H**	**M**	**M**	**H**	**M**	**H**	**L**	**H**
CO2	**H**	**H**	**M**	**H**	**M**	**H**	**H**	**L**	**H**	**M**	**H**	**L**
CO3	**M**	**H**	**L**	**M**	**H**	**M**	**L**	**M**	**H**	**M**	**H**	**L**
CO4	**H**	**M**	**L**	**M**	**H**	**M**	**L**	**H**	**H**	**H**	**M**	**M**
CO5	**L**	**H**	**M**	**H**	**H**	**M**	**L**	**H**	**H**	**H**	**L**	**M**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**M**	**H**	**H**	**M**	**L**			
CO2	**L**	**M**	**H**	**M**	**H**			
CO3	**H**	**H**	**M**	**L**	**L**			
CO4	**M**	**H**	**H**	**M**	**L**			
CO5	**H**	**M**	**M**	**L**	**H**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18ET1 MEASUREMENTS AND INSTRUMENTATION 1 0/1 3/0 3

UNIT I INTRODUCTION 9

Units, Dimensions and standards-measurement errors PMMC, moving iron instruments – Galvanometer – construction -Principle of operation- Types of Ammeter & voltmeter- Rectifier type voltmeter and ammeter .

UNIT II RESISTANCE, INDUCTANCE & CAPACITANCE MEASUREMENTS 9

Resistance measurement – wheat stone bridge & Kelvin double bridge measurement of inductance and capacitance– Maxwell bridge& Hay's bridge measurement of capacitance – Schering bridge, student type potentiometer- precision potentiometer – AC potentiometer, polar and co-ordinate type – application.

UNIT III WATT METER AND ENERGY METER CALIBRATION 9

Electro dynamic Instruments, wattmeter – theory and its error – methods of correction – LPF wattmeter – induction type wattmeter – theory and adjustment – calibration of wattmeter and energy meter, Instrument transformer – construction and theory of current Transformer & potential Transformer..

UNIT IV ANALOG & DIGITAL INSTRUMENTS 9

CRO – operation – measurement of voltage, frequency and phase-Analog storage oscilloscope, sampling oscilloscope -DSO – operation, signal & function generation – Digital voltmeter and multimeter Q-meter.

UNIT V DIGITAL DISPLAY AND RECORDING DEVICES 9

Bar graph display – seven segment and dot matrix display – signal recorders – XY recorders – magnetic tape recorders – digital recording and data loggers.

Total No of Periods: 45

TEXT BOOKS:

1. Rangan C.S. "Instrumentation Devices and Systems", Tata McGraw Hill, 1998.
2. Cooper, "Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 1988.
3. A. K. Shawney "Electronics and Electrical Instrumentation" Tata McGraw Hill, 1975.

REFERENCE BOOKS:

1. Bouwels A.J., "Digital Instrumentation", McGraw Hill, 1986.
2. Barney .C, "Intelligent Instrumentation ", Prentice Hall of India, 1985.
3. Oliver and Cage, "Electronic Measurements and Instruments and Instrumentation", McGraw Hill, 1975.
4. Deobelin, "Measurements Systems", McGraw Hill, 1990.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18L03	Subject Name : TRANSDUCER LAB	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Transducer Engineering	**L**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn practically about transducers and about the types of Transducers
- To study various transducers used for the measurement of various physical Quantities
- To identify suitable instruments to meet the requirements of industrial applications
- To measure Resistive, Capacitive and Inductive transducers
- To calibrate various transducers

COURSE OUTCOMES (COs) : (3- 5)

CO1	Enables the students to practically know about transducers and about the types of Transducers
CO2	various transducers used for the measurement of various physical Quantities
CO3	The student can identify suitable instruments to meet the requirements of industrial applications
CO4	The graduate can measure Resistive, Capacitive and Inductive transducers
CO5	Graduate can calibrate various transducers

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L	M	H	H	M	M	L	H	M	H	M
CO2	H	H	H	H	M	M	L	L	M	H	M	L
CO3	H	M	M	M	M	L	M	M	H	H	M	L
CO4	M	H	H	M	H	M	H	H	H	M	L	M
CO5	H	H	H	M	L	M	L	M	H	H	M	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	M	H	H	L			
CO2	H	H	H	M	M			
CO3	M	H	H	M	L			
CO4	H	H	M	H	L			
CO5	M	M	H	L	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18L03	**TRANSDUCER LAB**	**0**	**0/0**	**3/0**	**1**

LIST OF EXPERIMENTS

1. Displacement versus output voltage characteristics of a Potentiometric transducer.
2. Strain gauge characteristics.
3. Load cell characteristics.
4. Photoelectric tachometer.
5. Hall Effect transducer.
6. Characteristics of LVDT.
7. Characteristic of LDR, Thermistor and thermocouple.
8. Ramp response characteristic of filled in system thermometer.
9. Step response characteristic of RTD and thermocouple.
10. Flapper nozzle system.
11. P/I and I/P converters.
12. Study of smart transducers

Total No of Periods: 45

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18L04	Subject Name: DIGITAL DESIGN LAB	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Digital Electronics	**L**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To know the basic knowledge of logic gates
- Design knowledge on implementation of Boolean Function
- Students able to design Counters, Registers using flip-flops
- Students acquire knowledge in programming of verilog HDL
- To study about multiplexers and demultiplexers

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the basic concepts of logic gates
CO2	Familiarization to the Design and implementation of Boolean Function
CO3	Understand about Counters, Registers using flip-flops
CO4	Understand the concepts in programming of verilog HDL
CO5	Capable to understand about multiplexers and demultiplexers

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**L**	**M**	**M**	**M**	**L**
CO2	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**L**	**M**	**M**	**M**	**L**
CO3	**H**	**H**	**H**	**M**	**M**	**M**	**M**	**L**	**M**	**M**	**M**	**L**
CO4	**H**	**H**	**M**	**M**	**M**	**M**	**M**	**L**	**M**	**M**	**M**	**L**
CO5	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**L**	**M**	**M**	**M**	**L**

Cos / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	**H**	**L**	**L**	**L**	**H**			
CO2	**H**	**L**	**L**	**L**	**H**			
CO3	**H**	**L**	**L**	**L**	**H**			
CO4	**H**	**L**	**L**	**L**	**H**			
CO5	**H**	**L**	**L**	**L**	**H**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18L04	**DIGITAL DESIGN LAB**	**0**	**0/0**	**3/0**	**1**

LIST OF EXPERIMENTS

1. Study of Logic Gates & Digital Logic families
2. Implementation of Boolean functions
3. Adders & Subtractors
4. Multiplexers and De-multiplexers
5. Study of Flip-flops
6. Study of Registers
7. Study of Counters
8. Implementation of any general combinational / sequential logic circuits
9. Encoder and Decoder
10. 1’s Complement and 2’s Complement
11. Magnitude Comparator
12. Code Converter

Total No of Periods: 45

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BCS18IL6	**Subject Name : OOPS LAB USING C++**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: None	**L**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To be able to understand and apply various object oriented features like inheritance, data abstraction, encapsulation and polymorphism
- To solve various computing problems using C++ language.
- To be able to create a program that measures or simulates performance and use it
- To be analyze the behavior of the performance of the program
- The students will able to learn object-oriented program design into the class and template model of C++.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Able to understand and apply various object oriented features like inheritance, data abstraction, encapsulation and polymorphism to solve various computing problems using C++ language.
CO2	To solve various computing problems using C++ language
CO3	Students will be able to create a program that measures or simulates performance and use it
CO4	Analyze the behavior of the performance of the program
CO5	The graduates can map an object-oriented program design into the class and template model of C++.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**M**	**M**	**H**	**H**	**H**	**M**	**M**	**L**	**H**	**H**	**M**	**M**
CO2	**M**	**H**	**H**	**M**	**M**	**L**	**H**	**M**	**H**	**L**	**H**	**M**
CO3	**H**	**H**	**H**	**M**	**M**	**L**	**M**	**H**	**M**	**L**	**H**	**M**
CO4	**M**	**M**	**H**	**M**	**H**	**M**	**H**	**H**	**M**	**L**	**H**	**M**
CO5	**H**	**M**	**H**	**L**	**L**	**M**	**H**	**M**	**L**	**H**	**M**	**H**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**M**	**M**	**H**	**H**	**L**			
CO2	**H**	**H**	**M**	**M**	**L**			
CO3	**M**	**H**	**H**	**M**	**M**			
CO4	**H**	**H**	**M**	**M**	**M**			
CO5	**L**	**L**	**M**	**L**	**H**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BCS18IL6	**OOPS LAB USING C++**	**0**	**0/0**	**3/0**	**1**

LIST OF EXPERIMENTS

- To implement the following list of programs.

1. Write a C++ program for Simple Interest and adding two numbers
2. Write a C++ program for Control Structure.
3. Write a C++ program for Inline Function.
4. Write a C++ program for Function Overloading.
5. Using Class concept write a C++ program for Constructor and Destructor.
6. Using Class concept write a C++ program for Overloading Unary Operator, Binary operator.
7. Using Class concept write a C++ program for Single Inheritance.
8. Using Class concept write a C++ program for Multiple Inheritance.
9. Using Class concept write a C++ program for Multilevel Inheritance.

USING JAVA

1. Write a JAVA program Find the length of array.
2. Write a JAVA program to Prime number checking and sum of digit
3. Write a program for example of try and catch block. In this check whether the given array size is negative or not.
4. Write the programs using the concept of Generic class, Inheritance, Interface and Package
5. Write a program to create a file and write data into it using the methods Output Stream class.
6. Write a program that uses the concept of Applet and Exception Handling
7. Write a program to give example for multiple inheritance in Java
8. Write an application to simulate traffic lights and calculator using GridbagLayout
9. Write the program which creates the Frame and implements MouseListener

Total No of Periods: 45

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18TS1	Subject Name : TECHNICAL SKILL 1	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite:None	**L**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The objective is to develop the technical skill of the students.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Develop the technical skills required in the field of study
CO2	Bridge the gap between the skill requirements of the employer or industry and the competency of the students.
CO3	Enhance the employability of the students.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	H	H	M	M	H	M	H	M
CO2	H	H	M	H	H	H	M	M	H	H	H	H
CO3	H	H	H	H	H	H	M	M	H	H	H	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	H	H	H	H	H		
CO2	H	H	H	H	H		
CO3	H	H	H	H	H		

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
								✓				

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEN18SK1	**Subject Name :SOFT SKILLS – I (Career and Confidence Building)**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: None	**Ty**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To create awareness in students, various top companies helping them improve their skill set matrix, leading to develop a positive frame of mind.
- To help students be aware of various techniques of candidate recruitment and help them prepare CV's and resume.
- To help student how to face various types of interview, preparing for HR, technical interviews.
- To help students improve their verbal reading, narration and presentation skills by performs various mock sessions.

COURSE OUTCOMES (COs) : (3- 5)

Students will be able to

CO1	Be aware of various top companies leading to improvement in skills amongst them.
CO2	Be aware of various candidate recruitment techniques like group discussion, interviews and be able to prepare CV's and resumes.
CO3	Prepare for different types of interviews and be prepared for HR and technical interviews.
CO4	Improve their verbal, written and other skills by performing mock sessions.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**L**	**L**	**L**	**L**	**L**	**M**	**M**	**H**	**M**	**H**	**M**	**H**
CO2	**L**	**L**	**L**	**L**	**L**	**M**	**M**	**H**	**M**	**H**	**M**	**H**
CO3	**L**	**L**	**L**	**L**	**L**	**M**	**M**	**H**	**M**	**H**	**M**	**H**
CO4	**L**	**L**	**L**	**L**	**L**	**M**	**M**	**H**	**M**	**H**	**M**	**H**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**L**	**L**	**H**	**L**	**L**			
CO2	**L**	**L**	**H**	**L**	**L**			
CO3	**L**	**L**	**H**	**L**	**L**			
CO4	**L**	**L**	**H**	**L**	**L**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
									✓			

BEN18SK1	**SOFT SKILLS – I (Career and Confidence Building)**	**0**	**0/0**	**3/0**	**1**

UNIT I **6**

Creation of awareness of top companies / improving skill set matrix / Development of positive frame of mind / Creation of self-awareness.

UNIT II **6**

Group discussions / Do's and don'ts – handling group discussions / what evaluators look for interpersonal relationships / Preparation of Curriculum Vitae / Resume.

UNIT III **6**

Interview – awareness of facing questions – Do's and don'ts of personal interview / group interview, enabling students to prepare for different proce3dures such as HR interviews and Technical Interviews / self-introductions.

UNIT IV **6**

Verbal aptitude, Reading comprehension / narration / presentation / Mock Interviews.

UNIT V **6**

Practical session on Group Discussion and written tests on vocabulary and reading comprehension

Total No of Periods: 30

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18007	Subject Name : INDUSTRIAL INSTRUMENTATION-II	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Industrial Instrumentation-I	T	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Understanding variable head type flow meters, quantity meters.
- Understanding air flow meters and mass flow meters.
- Introduction to electrical type flow meters.
- Developing knowledge on the level measurement techniques.
- Capability to study the properties of Viscosity, Humidity and Moisture content.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Students can analyze about variable head type flow meters, quantity meters.
CO2	Students can analyze about air flow meters and mass flow meters
CO3	Students can analyze electrical type flow meters
CO4	Students acquire knowledge on various level measurement techniques
CO5	The graduate understands the properties of Viscosity, Humidity and Moisture content.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	M	H	L	L	H	H	M	L	H
CO2	M	H	M	H	M	H	H	M	L	H	M	L
CO3	H	M	M	M	H	H	M	L	H	M	H	H
CO4	M	H	M	H	H	M	H	M	H	H	L	H
CO5	M	H	L	H	H	M	H	M	H	L	H	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	L	H	M			
CO2	M	H	M	H	M			
CO3	H	H	M	H	L			
CO4	M	H	H	M	H			
CO5	M	H	M	H	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18007 INDUSTRIAL INSTRUMENTATION-II 3 1/0 0/0 4

UNIT I MEASUREMENT OF HUMIDITY & MOISTURE 12

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 FLOW METERS 12

Theory of fixed restriction valuable head type flow meters – Orifice plate – Venturi tube – Flow nozzle – Dall tube – installation of head flow meters – Piping arrangement for different fluids – Pivot tube.

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

Positive displacement flow meters – Constructional details and theory of operation of mutating disc, reciprocating piston, oval gear and helix type flow meters – Inferential meter – Turbine flow meter – Rotameter – Theory and installation – Angular momentum mass flow meter – Coriolis mass flow meters – Thermal mass flow meters – 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 – Vortex shedding flow meter – Target flow meter – Solid flow rate measurement – Guidelines for selection of flow meter.

UNIT V LEVEL MEASUREMENT 12

Gauge glass techniques coupled with photoelectric readout system – Float type level indication – Different schemes – Level switches, level measurement using displacer and torque tube – Bubble 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 No of Periods: 60

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, New Delhi 1999.

REFERENCE BOOKS:

1. Ernest O.Doebelin, Measurement systems application and design international student Edition, Tata McGraw Hill Publishing Co., New Delhi, 1999.
2. Patranabis, Principles of Industrial Instrumentation Tata McGraw-Hill Publishing Co., New Delhi, 1999
3. R.K.Jain, Mechanical and Industrial Measurements, Khanna Publishers, Delhi 1999.
4. A.K.Sawhney, A course in Electrical and Electronic Measurement and Instrumentation – Dhanpat Rai and Sons, New Delhi, 1999.
5. Eckman D.P.M Industrial Instrumentation – Wiley Eastern Limited, 1990.
6. Liptak B.G. Instrument Engineers Handbook (Measurement), Chilton Book Co., 1994.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18008	Subject Name : CONTROL ENGINEERING	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: None	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To provide strong foundation in basic science and mathematics necessary to formulate, solve and analyse control and instrumentation problems.
- To understand and apply differential equation, integrals, matrix theory, probability theory, etc..
- To provide good knowledge of instrumentation systems and their applications.
- To provide necessary foundation on computational platforms and software applications related to the respective field of engineering.
- To provide an opportunity to work in inter-disciplinary groups.

COURSE OUTCOMES (Cos) : (3- 5)

CO1	The graduate gets Strong foundation in basic science and mathematics necessary to formulate, solve and analyze control and instrumentation problems.
CO2	Understands and applies differential equation, integrals, matrix theory, probability theory, etc.
CO3	Gets good knowledge of instrumentation systems and their applications.
CO4	Gets necessary foundation on computational platforms and software applications related to the respective field of engineering
CO5	Gets an opportunity to work in inter-disciplinary groups.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	M	M	H	M	H	M	L	L	H	M
CO2	M	M	H	H	H	L	L	M	H	M	H	M
CO3	M	H	M	L	H	M	L	L	H	H	M	H
CO4	H	M	L	M	H	M	L	H	M	L	M	H
CO5	H	L	L	M	H	H	M	H	M	H	L	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	H	M	L			
CO2	H	M	M	H	L			
CO3	L	H	M	M	H			
CO4	H	L	L	H	M			
CO5	H	M	H	L	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18008	**CONTROL ENGINEERING**	**3**	**0/0**	**0/0**	**3**

UNIT I SYSTEMS AND THEIR REPRESENTATION 9

Basic elements in control systems-open and closed loop systems – Mathematical modeling of Mechanical Translational system and Rotational system - Electrical analogy of physical systems – transfer function – AC and DC servomotors – block diagram reduction techniques – signal flow graph. .

UNIT II TIME RESPONSE 9

Time response – time domain specifications – types of test inputs – I and II order system response – error coefficients – generalised error series – steady state error – PID controller response with and without I order system.

UNIT III FREQUENCY RESPONSE 9

Frequency response – definition – Bode plot – polar plot – constant M and N circles – Nichols chart – determinate of closed loop response from open loop response..

UNIT IV STABILITY OF CONTROL SYSTEM 9

Characteristic equation – location of roots in s-plane for stability – Routh Hurwitz criterion – root locus techniques – construction – gain margin and phase margin – Nyquist stability criterion.

UNIT V CONTROL SYSTEM DESIGN 9

Performance criteria – selection of controller modes – lag, lead, and lag-lead networks – compensator design for desired response. PI, PD and PID Controllers – Feedback compensation.

Total No of Periods: 45

TEXT BOOKS:

1. Ogata K., Modern Control Engineering, Prentice Hall of India Ltd., New Delhi, 1995.
2. I.Gopal, and M.Nagrath, Control Systems, Wiley Eastern, Ltd., New Delhi, 1985
3. A. NagoorKani, control systems, R.B.A publications, Chennai

REFERENCE BOOKS:

1. Kuo B.C., Automatic Control Systems, Prentice Hall of India Ltd., New Delhi, 1995.
2. M.Gopal, Control Systems, Principles and Design, Tata McGraw-Hill Publishing Co., New Delhi, 1997.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18ET2	**Subject Name: POWER ELECTRONICS**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: None	**ETL**	**1**	**0/1**	**3/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- The purpose of this course is to develop basic understanding of power semi conductor devices its construction, V-I and switching characteristic and implementation in various power converter applications.
- Detailed overview about operation of power semi conductor devices.
- The purpose to design protection circuits for power semiconductor devices used in power converters.
- Overview about the basics of industrial drives.
- Understand the implementation of power semi conductor devices in industrial drives applications.
  To know the design and selection of drives in industrial application

COURSE OUTCOMES (COs) : (3- 5)

CO1	Acquires knowledge about fundamental concepts and techniques used in power electronics.
CO2	Ability to analyze various single phase and three phase power converter circuits and understand their applications.
CO3	Ability to identify basic requirements for power electronics based design application.
CO4	Develops skills to build, and troubleshoot power electronics circuits.
CO5	Foster ability to understand the use of power converters in commercial and industrial applications.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**H**	**H**	**M**	**M**	**H**	**L**	**H**	**M**	**L**	**H**	**H**
CO2	**M**	**H**	**M**	**H**	**M**	**L**	**L**	**H**	**M**	**H**	**M**	**L**
CO3	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**L**	**L**	**H**	**M**	**H**
CO4	**M**	**H**	**L**	**H**	**M**	**H**	**M**	**L**	**H**	**M**	**H**	**M**
CO5	**H**	**M**	**M**	**H**	**M**	**L**	**H**	**M**	**H**	**M**	**H**	**M**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**H**	**M**	**H**	**M**	**L**			
CO2	**L**	**M**	**H**	**M**	**H**			
CO3	**H**	**M**	**L**	**H**	**M**			
CO4	**H**	**L**	**M**	**H**	**M**			
CO5	**H**	**M**	**L**	**H**	**H**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18ET2	**POWER ELECTRONICS**	**1**	**0/1**	**3/0**	**3**

UNIT I POWER SEMICONDUCTOR DEVICES **9**

Power diodes – power transistor – characteristics of SCR, Triac, power MOSFET – IGBT – MCT – LASCR – SCR turn on, turn off characteristics – thyristor specifications – thyristor protection circuits. .

UNIT II COMMUTATION CIRCUITS **9**

Thyristor trigger circuits – R, RL, RC triggering – Single pulse and train of pulses – triggering with microprocessor – forced commutation – different techniques – series and parallel operation of SCRs.

UNIT III CONVERTERS **9**

Natural commutation – single phase – three phase – half controlled and fully controlled rectifiers – effect of source and load inductance – dual converters – cyclo converter.

UNIT IV INVERTERS AND CHOPPERS **9**

Voltage source inverters – series, parallel and bridge inverters – current source inverters – PWM inverters – DC chopper – step up and step down chopper – AC chopper.

UNIT V TYPICAL APPLICATION **9**

Control of DC and AC drives – stepper and switched reluctance motor drive – AC voltage regulators – SMPS – uninterrupted power supply – induction heating.

Total No of Periods: 45

TEXT BOOKS:

1. P.S.Bimbhra, 'Power Electronics', Khanna Publishers, New Delhi, 2002
2. G.K.Dubey, Doradia, S.R. Joshi and R.M.Sinha, Thyristorised Power Controllers, New Age International Publishers, New Delhi, 1996.

REFERENCE BOOKS:

1. M.H.Rashid, Power Electronics circuits, devices and applications, PHI, New Delhi, 1995.
2. Joseph Vithyathi, Power Electronics, McGraw-Hill, USA, 1995.
3. Mohan, Undeland and Robbins, Power Electronics, John Wiley and Sons, New York, 1995.
4. P.C.Sen, Modern Power Electronics, Wheeler Publishers, New Delhi, 1998.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18L05	**Subject Name: MICROPROCESSOR, MICROCONTROLLER AND ITS APPLICATIONS LAB**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: None	**L**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- The students understand to do basic programming in microprocessors and Interfacing.
- Basic concept to understand code conversion.
- Logical calculations to carry out basic arithmetic.
- Graduates to understand the programming concepts of microprocessor.
- To understand the programming concepts of microcontroller.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Capable of programming in microprocessors and Interfacing.
CO2	Familiar with code conversion.
CO3	Capable of performing Logical calculations to carry out basic arithmetic
CO4	Capable of understand the programming concepts of microprocessor.
CO5	Understand the programming concepts of microcontroller.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**L**	**H**	**M**	**H**	**M**
CO2	**H**	**H**	**H**	**M**	**M**	**L**	**L**	**L**	**M**	**L**	**M**	**L**
CO3	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**H**	**M**	**H**	**M**
CO4	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**H**	**M**	**H**	**M**
CO5	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**H**	**M**	**H**	**M**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**L**	**M**	**M**	**L**	**M**			
CO2	**M**	**M**	**M**	**M**	**H**			
CO3	**M**	**M**	**M**	**M**	**H**			
CO4	**M**	**M**	**M**	**L**	**H**			
CO5	**L**	**M**	**M**	**M**	**M**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEI18L05	**MICROPROCESSOR, MICROCONTROLLER AND ITS APPLICATIONS LAB**	**0**	**0/0**	**3/0**	**1**

LIST OF EXPERIMENTS:

1. Familiarisation of 8085 Microprocessor kit
2. Familiarisation of 8051 Microcontroller kit
3. 8085 and 8051 assembly language programming exercises
4. Interfacing of switches and display devices
5. Interfacing of D/A and A/D Converters
6. Interface of key board and display using programmable controllers
7. Interface of programmable Timer
8. Stepper motor control using microprocessor
9. Simple 8086 assembly language programming exercises
10. Study of MASM and DEBUG utilities

Total No of Periods: 45

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18L06	Subject Name : INDUSTRIAL INSTRUMENTATION LAB	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Industrial Instrumentation	**L**	**0**	**0 /0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To enable the students to understand the fundamentals of orifice plate.
- The graduate can understand calibration and measurement.
- Overview about the practical knowledge about the spectrophotometer

COURSE OUTCOMES (COs) : (3- 5)

CO1	Enable the students to understand the fundamentals of orifice plate.
CO2	The graduate can understand calibration and measurement.
CO3	Understands the Overview about the practical knowledge about the spectrophotometer

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	H	M	L	H	M	M	H	L	H	L
CO2	L	H	M	M	L	H	L	M	H	L	M	H
CO3	H	H	H	M	M	M	L	L	L	H	M	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	L	H	M			
CO2	M	H	M	H	M			
CO3	H	M	M	M	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18L06	**INDUSTRIAL INSTRUMENTATION LABORATORY**	**0**	**0 /0**	**3/0**	**1**

LIST OF EXPERIMENTS:

1. Discharge coefficient of orifice plate
2. Measurement of Force using Proving Ring Calibration of pressure gauge
3. Calibration of Thermocouple
4. Measurement of Flow using Wheel Flow Meter
5. Measurement of Viscosity
6. Vacuum Pressure Measurement
7. Level measurement using d/p transmitter
8. UV – Visible spectrophotometer
9. Calibration of Pressure Gauge using Dead Weight Tester
10. pH Meter standardization and Measurement of pH values of solutions
11. Conductivity meter calibration and measurements of conductivity of test solutions.
12. Measurement of Temperature using Radiation Pyrometer.
13. Capacitance measurement using Capacitive Pickup.

Total No of Periods: 45 Hrs

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEE18L10	Subject Name: MICROGRID LAB	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: None	Ty	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Students can obtain knowledge about specific wind power, calculate the wind frequency, turbines characteristics, time period and frequency of the rotating turbine at different speeds.
- To understand the concept of semiconductors and p-n junction energy band, Illumination effect on PV Modules, effect of Temperature, Effect of Shading on PV Modules and Effect of Angle of Inclination of Solar Modules.
- To understand the Characteristics of Solar Modules when connected in series and parallel
- To help the students to understand the modelling, simulation, implementation and performance characteristics of solar photovoltaic and wind turbine.
- To help the students to design and simulate the performance characteristics of a Micro-grid

COURSE OUTCOMES (COs) : (3- 5)

CO1	Students can obtain knowledge about generated wind power, turbines characteristics, performance of turbine at different speeds.
CO2	Students can understand the concept of semiconductors and p-n junction energy band, Illumination effect on PV Modules, effect of Temperature, Effect of Shading on PV Modules, Effect of Angle of Inclination of Solar Modules.
CO3	Capable of understanding the concept of the Characteristics of Solar Modules when connected in series and parallel
CO4	Students will be able to model, simulate, implement and perform the characteristics of solar photovoltaic and wind turbine.
CO5	Students will be able to design and simulate the performance characteristics of a Micro-grid

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	H	H	H	M	H	M	H	L
CO2	H	H	H	H	H	H	H	M	H	M	H	L
CO3	M	M	H	H	H	H	H	M	H	M	H	L
CO4	H	H	H	H	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	L	H	H	H	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	H	H	H	H			
CO2	M	H	H	H	H			
CO3	H	H	H	H	H			
CO4	H	H	H	H	H			
CO5	M	H	H	H	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEE18L10	**MICROGRID LAB**	**0**	**0/0**	**3/0**	**1**

LIST OF EXPERIMENTS

1. Characteristics of PV Modules
2. Characteristics of Series connection PV Modules
3. Characteristics of Parallel Connection PV Modules
4. Effect of Shading in the PV Characteristics
5. Effect of Tilting in PV Characteristics
6. Evaluation of cut-in and start up speed of Wind Turbine
7. Evaluation of efficiency of charge controller
8. Evaluation of Tip Speed Ratio (TSR) of Wind Turbine
9. Evaluation of co-efficient of performance of Wind Turbine
10. Evaluation of Turbine Power and Wind Speed
11. Evaluation of TSR and Co-efficient of Power
12. Simulation of Characteristics of PV Module.
13. Simulation of Characteristics of Wind Turbine
14. Simulation of Characteristics of PV Modules Connected in Parallel
15. Simulation of Characteristics of PV Modules Connected in Series
16. Design of a Micro-grid using Matlab/PSCAD/ETAP

Total No of Periods: 45

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18TS2	**Subject Name : TECHNICAL SKILL 2**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	**L**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The objective is to develop the technical skill of the students.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Develop the technical skills required in the field of study
CO2	Bridge the gap between the skill requirements of the employer or industry and the competency of the students.
CO3	Enhance the employability of the students.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**H**	**M**	**H**	**M**
CO2	**H**	**H**	**M**	**H**	**H**	**H**	**M**	**M**	**H**	**H**	**H**	**H**
CO3	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**H**	**H**	**H**	**H**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**H**	**H**	**H**	**H**	**H**			
CO2	**H**	**H**	**H**	**H**	**H**			
CO3	**H**	**H**	**H**	**H**	**H**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill Soft Skills			
								✓			

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18009	Subject Name : COMPUTER NETWORK AND DISTRIBUTED CONTROL SYSTEM	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: None	**T**	**3**	**1/0**	**0/0**	**4**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Introduction about the concept, terminologies and technologies associated with instrumentation buses and data network.
- Focus on the basic concept of communication buses.
- Providing an idea about various data networks.
- Enabling the student to get familiarized with different protocols and network components.
- The graduate can understand the application of DCS in industries

COURSE OUTCOMES (COs) : (3- 5)

CO1	The graduate understands terminologies and technologies associated with instrumentation buses and data network.
CO2	The student knows the basic concept of communication buses.
CO3	The student will be able to know about various data networks.
CO4	Enable the student to get familiarized with different protocols and network components.
CO5	The graduate understands the application of DCS in industrial

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	H	M	H	H	L	H	M	H	M	L
CO2	M	H	H	M	L	H	M	L	M	H	L	M
CO3	L	M	H	H	L	M	H	L	M	H	H	M
CO4	M	H	H	M	H	M	H	L	L	H	M	H
CO5	H	M	H	M	H	H	L	M	M	H	L	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	H	M	M	L			
CO2	M	H	L	M	H			
CO3	H	M	M	H	H			
CO4	M	H	H	M	L			
CO5	M	L	H	M	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18009	**COMPUTER NETWORK AND CONTROL SYSTEM**	**DISTRIBUTED**	**3**	**1/0**	**0/0**	**4**

UNIT I DATA NETWORK FUNDAMENTALS 12

Network hierarchy and switching – open system interconnection model of ISO – Data link control protocol – BISYNC – SLDC – HLDC – media access protocol – Command – response – Token passing – CSMA/CD, TCIP/IP. .

UNIT II INTER NETWORKING 12

Bridges – Routers – Gateways – open system with bridge configuration – open system with gateway configuration – Standard ETHERNET and ARCNET configuration – Special requirement for networks used for control.

UNIT III DISTRIBUTED CONTROL SYSTEMS 12

Evolution – Different architecture – local control unit – Operator interface – Displays – Engineering interface.

UNIT IV APPLICATIONS OF DCS 12

DCS applications in Power plants, Iron and Steel plants, Chemical plants, Cement plants and Pulp and Paper plants.

UNIT V HART AND FIELD BUS 12

Introduction – Evolution of signal standards – HART communication protocol – communication modes – HART networks – Control system interface – HART commands – HART field controller implementation – HART and OSI model – Field bus – Introduction – General field bus architecture – basic requirements of field bus standard – field bus topology – interoperability – interchangeability

Total No of Periods: 60

TEXT BOOKS:

1. A.S.Tanenbaum, Computer Networks, Third Edition, Prentice Hall of India, 1996
2. Michal P.Lucas, Distributed control systems, Van nostrand Reinhold Co., 1986

REFERENCE BOOKS:

1. Romily Bowden, HART application guide and the OSI communication foundation., 1999
2. G.K.McMillan, Process/ Industrial instrument and handnook, McGraw-Hill, New york, 1999.
3. Popovic D. and Bhatkar V.P., Distributed Computer Control for industrial automation, Marcel Dekkar Inc., 1990 (for Unit 4)
4. Buchanan W., Computer Busses, Arnold Publishers, London, 2000.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18010	**Subject Name: PROCESS CONTROL**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Control Engineering	**T**	**3**	**1/0**	**0/0**	**4**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- The introduction of need for process control and over all view of self- regulation.
- The overview of control action and pneumatic and electronic controllers with practical form of PID.
- The analysis of various process reaction curve method.
- The graduate will learn the design of multi loop control and examples of distillation column and boiler system.
- The brief view of various controller actions, control valve sizing and control valve positioning.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Students learn the necessity of process control, the mathematical modeling of different processes and characteristics of different controllers.
CO2	Understands the need for process control and over all view of self- regulation
CO3	Capable to design of multi loop control and examples of distillation column and boiler system
CO4	Students learn different control actions and controllers like ON-OFF, P,P+I+D and also about tuning methods for setting optimum value and various multi-loop controlling methods.
CO5	Students acquire the knowledge of final control elements

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**H**	**M**	**H**	**H**	**L**	**H**	**M**	**H**	**M**	**L**
CO2	**M**	**H**	**H**	**M**	**L**	**H**	**M**	**L**	**M**	**H**	**L**	**M**
CO3	**L**	**M**	**H**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**H**	**M**
CO4	**M**	**H**	**H**	**M**	**H**	**M**	**H**	**L**	**L**	**H**	**M**	**H**
CO5	**H**	**M**	**H**	**M**	**H**	**H**	**L**	**M**	**M**	**H**	**L**	**M**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**H**	**H**	**H**	**H**	**H**			
CO2	**M**	**H**	**H**	**H**	**H**			
CO3	**H**	**H**	**H**	**H**	**H**			
CO4	**H**	**H**	**H**	**H**	**H**			
CO5	**M**	**H**	**H**	**H**	**H**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18010	**PROCESS CONTROL**	**3**	**1/0**	**0/0**	**4**

UNIT I INTRODUCTION **12**

Need for process control – mathematical model of first – order level, pressure and thermal processes – higher order process – interacting and non-interacting systems – continuous and batch process – self-regulation – servo and regulator operation-Heat Exchanger-CSTR. .

UNIT II CONTROL ACTIONS AND CONTROLLERS **12**

Basic control actions – characteristics of on-off, proportional, single-speed floating, integral and derivative control modes – P+I, P+D and P+I+D control modes – pneumatic and electronic controllers –Practical form of PID Controller.

UNIT III OPTIMUM CONTROLLER SETTINGS **12**

Evaluation criteria – IAE, ISE, ITAE and ¼ decay ratio – determination of optimum settings for mathematically described processes using time response and frequency response – tuning – process reaction curve method – Ziegler Nichols method – damped oscillation method..

UNIT IV MULTILOOP CONTROL **12**

Feed forward control – ratio control- cascade control – inferential control – split range control – introduction to multivariable control – Model Predictive control-Plant wide control-Adaptive control-examples from distillation column and boiler systems.

UNIT V FINAL CONTROL ELEMENT **12**

I/P converter – pneumatic and electric actuators – valve positioner – control values – characteristics of control valves – inherent and installed characteristics – valve body – commercial valve bodies – control valve sizing – cavitation and flashing – selection criteria.

Total No of Periods: 60

TEXT BOOKS:

1. Stephanopoulis, G, Chemical Process Control, Prentice Hall of India, New Delhi, 1990.
2. Eckman. D.P., Automatic Process Control, Wiley Eastern Ltd., New Delhi, 1993.

REFERENCE BOOKS:

1. Pollard A.Process Control, Heinemann educational books, London, 1971.
2. Harriott. P., Process Control, Tata McGraw-Hill Publishing Co., New Delhi, 1991.
3. Curtis.D.Johnson, Process control Instrumentation Technology, PHI Learning ,2009

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18ET3	Subject Name: VIRTUAL INSTRUMENTATION	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: None	ETL	1	0/1	3/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- The graduate can understand the fundamental of virtual instrumentation.
- To understand programming and data flow in virtual instrumentation.
- Overview about the interfacing of external instruments to pc and detailed information about the different protocols.
- To study about the graphical programming environment in virtual instrumentation.
- Analysis tools and simple application used in virtual instrumentation.

COURSE OUTCOMES (COs) : (3- 5)

CO1	The graduate can understand the fundamental of virtual instrumentation.
CO2	Understands programming and data flow in virtual instrumentation.
CO3	Understands the Overview about the interfacing of external instruments to PC and detailed information about the different protocols
CO4	The graduate can provide graphical programming environment in virtual instrumentation.
CO5	The student will get capability to analyse tools and simple applications used in virtual instrumentation.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	H	M	H	H	M	H	M	H	L
CO2	M	H	M	H	H	H	M	H	M	H	M	H
CO3	M	H	M	H	M	M	H	L	M	H	H	M
CO4	H	H	M	H	M	H	L	H	M	H	M	L
CO5	H	M	H	M	H	M	H	L	H	M	H	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	H	M	H			
CO2	M	H	M	H	L			
CO3	L	H	M	M	H			
CO4	M	M	H	M	H			
CO5	L	H	H	M	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18ET3	**VIRTUAL INSTRUMENTATION**	**1**	**0/1**	**3/0**	**3**

UNIT I REVIEW OF DIGITAL INSTRUMENTATION 9

Representation of analog signals in the digital domain – Review of quantization in amplitude and time axes, sample and hold, sampling theorem, ADC and DAC.

UNIT II FUNDAMENTALS OF VIRTUAL INSTRUMENTATION 9

Concept of virtual instrumentation – PC based data acquisition – Typical on board DAQ card – Resolution and sampling frequency - Multiplexing of analog inputs – Single-ended and differential inputs – Different strategies for sampling of multi-channel analog inputs. Concept of universal DAQ card - Use of timer-counter and analog outputs on the universal DAQ card.

UNIT III CLUSTER OF INSTRUMENTS IN VI SYSTEM 9

Interfacing of external instruments to a PC – RS232, RS 422, RS 485 and USB standards - IEEE 488 standard – ISO-OSI model for serial bus – Introduction to bus protocols of MOD bus and CAN bus..

UNIT IV GRAPHICAL PROGRAMMING ENVIRONMENT IN VI 9

Concepts of graphical programming – Lab-view software – Concept of VIs and sub VI - Display types – Digital – Analog – Chart – Oscilloscopic types – Loops – Case and sequence structures - Types of data – Arrays – Formulae nodes –Local and global variables – String and file I/O.

UNIT V ANALYSIS TOOLS AND SIMPLE APPLICATIONS IN VI 9

Fourier transform - Power spectrum - Correlation – Windowing and filtering tools – Simple temperature indicator – ON/OFF controller – P-I-D controller - CRO emulation - Simulation of a simple second order system – Generation of HTML page.

Total No of Periods: 45

TEXTBOOKS:

1. S. Gupta and J.P Gupta, 'PC Interfacing for Data Acquisition and Process Control', Instrument society of America, 1994.
2. Peter W. Gofton, 'Understanding Serial Communications', Sybex International.
3. Robert H. Bishop, 'Learning with Lab-view', Prentice Hall, 2003.

REFERENCE BOOKS:

1. Kevin James, 'PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control', Newness, 2000.
2. Gary W. Johnson, Richard Jennings, 'Lab-view Graphical Programming', McGraw Hill Professional Publishing, 2001.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18L07	Subject Name: PROCESS CONTROL LAB	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Process Control	**L**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To enable the students to understand the fundamentals of process control, types of processes, characteristics of different types of controllers for controlling a process and process automation.
- Control of processes using PID and ON-OFF controllers
- Automation of process
- Design and Tuning of controllers
- Control of a process using personal computer.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Enable the students to understand the fundamentals of process control, types of processes, characteristics of different types of controllers for controlling a process and process automation.
CO2	Control of processes using PID and ON-OFF controllers can be performed
CO3	Understands Automation of process
CO4	The graduate will be able to Design and Tune controllers
CO5	Understands the Control of a process using personal computer.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	H	H	L	M	H	M	H	M	H	M
CO2	M	H	M	H	L	H	M	L	M	H	H	M
CO3	H	L	H	M	H	H	L	H	H	L	M	M
CO4	H	M	H	M	L	H	M	H	L	M	H	H
CO5	M	H	L	M	H	H	L	H	M	H	L	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	H	H	M			
CO2	M	H	M	H	L			
CO3	M	H	M	L	M			
CO4	H	H	M	L	H			
CO5	L	H	M	M	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18L07	**PROCESS CONTROL LABORATORY**	**0**	**0/0**	**3/0**	**1**

LIST OF EXPERIMENTS:

1. Operation of Interacting and Non-Interacting systems
2. Responses of different order processes with and without transportation lag
3. Response of ON-OFF controller
4. Response of PID controller
5. Characteristics of Equal Percentage Control Viscosity Valve
6. Characteristics of Control Valve with Positioner.
7. Operation of ON-OFF controller Using Simple Thermal System.
8. Closed loop response of Flow Control Loop
9. Closed loop response of Level Control Loop
10. Closed loop response of Temperature Control Loop
11. Closed loop response of pressure control loop
12. Tuning of Controllers
13. Study of complex control system (ratio / cascade / feed forward)
14. Analysis of Non-Linear Systems(Conical Tanks)

Total No of Periods: 45

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18L08	**Subject Name :DIGITAL CONTROL LAB**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Control Engineering	**L**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To study various signals.
- To enable the students to understand the various response of the system .
- To Study about the various types of sequential circuits
- To study the PLC & application of PLC.
- To Design and verify compensator using bode plot.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Graduates should study various signals.
CO2	Students can understand the various responses of the system
CO3	The various types of sequential circuits can be analyzed
CO4	The graduate becomes familiar with the PLC & application of PLC.
CO5	The students will be able to Design and verify compensator using bode plot

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**H**	**M**	**L**	**L**	**H**	**H**	**M**	**H**	**M**	**H**
CO2	**M**	**H**	**H**	**M**	**L**	**H**	**M**	**H**	**M**	**H**	**L**	**L**
CO3	**L**	**M**	**M**	**L**	**H**	**M**	**H**	**L**	**H**	**M**	**L**	**H**
CO4	**H**	**H**	**M**	**L**	**H**	**H**	**M**	**L**	**H**	**M**	**H**	**L**
CO5	**H**	**M**	**H**	**M**	**L**	**H**	**M**	**L**	**L**	**H**	**M**	**L**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**M**	**H**	**M**	**L**	**H**			
CO2	**H**	**H**	**M**	**L**	**H**			
CO3	**M**	**L**	**H**	**M**	**H**			
CO4	**L**	**L**	**H**	**L**	**M**			
CO5	**M**	**H**	**L**	**H**	**M**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18L08	**DIGITAL CONTROL LABORATORY**	**0**	**0/0**	**3/0**	**1**

LIST OF EXPERIMENTS:

1. Standard test signal
2. Response for the first order system
3. Response for the second order system
4. Bode plot for a given system
5. Root locus for the given system
6. Polar plot for the given system
7. Design of lead compensator using bode plot
8. Design of lag compensator using bode plot
9. Study of programmable logic controller (PLC)
10. Verification of logic gates using PLC
11. Application of PLC

Total No of Periods: 45

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: **BEN18SK2**	**Subject Name: SOFT SKILL –II (Qualitative and Quantitative Skills)**	**T /L/ ETL**	**L**	**T / S.Lr**	**P / R**	**C**
	Prerequisite: BSK18ET1	**ETL**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE:

- To help students to improve their Logical reasoning.
- To help students to improve their arithmetic reasoning.
- To help students improve their data interpretation skills

COURSE OUTCOMES (COs) : (3- 5)

CO1	Prepare students for Logical reasoning
CO2	Prepare students for arithmetic reasoning
CO3	Prepare students for data interpretation skills

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**L**	**L**	**L**	**L**	**L**	**M**	**M**	**H**	**M**	**H**	**M**	**H**
CO2	**L**	**L**	**L**	**L**	**L**	**M**	**M**	**H**	**M**	**H**	**M**	**H**
CO3	**L**	**L**	**L**	**L**	**L**	**M**	**M**	**H**	**M**	**H**	**M**	**H**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**L**	**L**	**H**	**L**	**L**			
CO2	**L**	**L**	**H**	**L**	**L**			
CO3	**L**	**L**	**H**	**L**	**L**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
			✓									

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEN18SK2	**SOFT SKILLS – II**	**0**	**0/0**	**3/0**	**1**

UNIT I LOGICAL REASONING I **6**

Logical Statements – Arguments – Assumptions – Courses of Action.

UNIT II LOGICAL REASONING II **6**

Logical conclusions – Deriving conclusions from passages – Theme detection.

UNIT III ARITHMETICAL REASONING I **6**

Number system – H.C.F & L.C.M – Problem on ages – Percentage – Profit & Loss – Ratio & Proportion – Partnership.

UNIT IV ARITHMETICAL REASONING II **6**

Time & Work – Time & Distance – Clocks – Permutations & Combinations – Heights & Distances – Odd man out and Series.

UNIT V DATA INTERPRETATION **6**

Tabulation – Bar graphs – Pie graphs – Line graphs.

Total No. of Periods : 30

REFERENCE BOOK:

1. R.S.Agarwal, A modern approach to Logical Reasoning, S.Chand & Co., (2017).
2. R.S.Agarwal, A modern approach to Verbal and Non verbal Reasoning, S.Chand & Co., (2017).
3. R.S.Agarwal, Quantitative Aptitude for Competitive Examinations, S.Chand & Co., (2017).
4. A.K.Gupta, Logical and Analytical Reasoning, Ramesh Publishing House, (2014).
5. B.S.Sijwali, Indu sijwali, A new approach to Reasoning (Verbal and Non verbal), Arihant Publishers, (2014).

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18L09	**Subject Name : MINI PROJECT / INPLANT TRAINING/INDUSTRIAL TRAINING**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: --	**L**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : The main objective of the Inplant training is to provide a short-term work experience in an Industry/ Company/ Organization

COURSE OUTCOMES (COs) : (3- 5)

CO1	To get an insight of an industry / organization/company pertaining to the domain of study.
CO2	To acquire skills and knowledge for a smooth transition into the career.
CO3	To gain field experience and get linked with the professional network.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**M**	**L**	**L**	**L**	**L**	**H**	**H**	**H**	**H**	**H**	**H**	**H**
CO2	**H**	**M**	**H**	**H**	**M**	**H**	**H**	**H**	**H**	**H**	**H**	**M**
CO3	**H**	**H**	**H**	**H**	**M**	**H**	**H**	**H**	**H**	**H**	**H**	**M**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**H**	**H**	**H**	**H**	**H**			
CO2	**H**	**H**	**H**	**H**	**H**			
CO3	**H**	**H**	**H**	**H**	**H**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
								✓				

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18TS3	Subject Name : TECHNICAL SKILL - 3	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite:	**L**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : The objective is to develop the technical skill of the students.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Develop the technical skills required in the field of study
CO2	Bridge the gap between the skill requirements of the employer or industry and the competency of the students.
CO3	Enhance the employability of the students.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	H	H	M	M	H	M	H	M
CO2	H	H	M	H	H	H	M	M	H	H	H	H
CO3	H	H	H	H	H	H	M	M	H	H	H	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	H	H	H	H			
CO2	H	H	H	H	H			
CO3	H	H	H	H	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
								✓				

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18011	Subject Name : INTRODUCTION TO BIOMEDICAL INSTRUMENTATION	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: None	**T**	**3**	**1/0**	**0/0**	**4**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Introduction to the Fundamentals of Biomedical Engineering
- The study of communication mechanics in a biomedical system with few examples
- Understanding the basic principles in imaging techniques
- Acquiring basic knowledge in life assisting devices
- Acquiring basic knowledge in life therapeutic devices

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the Fundamentals of Biomedical Engineering
CO2	The graduate will be able to study about communication mechanics in a biomedical system with few examples
CO3	Ability to understand the basic principles in imaging techniques
CO4	Acquires basic knowledge in life assisting devices
CO5	Gains basic knowledge in life therapeutic devices

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	M	L	H	M	L	H	M	L	H	L
CO2	M	M	L	H	M	H	M	L	H	M	L	H
CO3	H	M	L	H	M	L	H	M	L	H	M	L
CO4	H	M	L	M	L	H	M	M	L	M	H	M
CO5	H	M	L	H	M	L	M	H	M	L	M	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	L	H	M			
CO2	M	H	L	M	H			
CO3	H	M	H	M	H			
CO4	L	M	H	M	L			
CO5	H	H	M	L	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18011	**INTRODUCTION TO BIOMEDICAL INSTRUMENTATION**	**3**	**1/0**	**0/0**	**4**

UNIT I ANATOMY, PHYSIOLOGY AND TRANSDUCERS 12

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 – difference amplifiers – chopper amplifiers – electrical safety – grounding and isolation.

UNIT II ELECTRO – PHYSIOLOGICAL MEASUREMENT 12

ECG – EEG – EMG – ERG – lead system and recording methods – typical waveforms. Instruments for checking safety parameters of biomedical equipments.

UNIT III NON – ELECTRICAL PARAMETER MEASUREMENTS 12

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 PARAMETER MEASUREMENTS 12

X- RAY machine – computer tomography – magnetic resonance imaging system – ultra sonography – endoscopy – different types of telemetry system – laser in biomedicine.

UNIT V ASSISTING AND THERAPETIC DEVICES 12

Cardiac pacemakers – defibrillators ventilators –Nerve and muscle stimulators – diathermy – introduction to artificial kidney artificial heart – heart lung machine – Dialysers-limb prosthetics – orthotics – elements of audio and visual aids

Total No of Periods: 60

TEXT BOOKS:

1. Webster J.G., Medical Instrumentation: Application and Design, 3rd Edition, John Wiley and Son, 1999.
2. Khandpur R.S. Hand book of Biomedical Instrumentation and Measurements, Tata McGraw-Hill New Delhi 1987.

REFERENCE BOOKS:

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, Chichester, 1980.
4. Wise D. L., Applied Bio- sensors, Butterworth USA, 1989.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code:	**Subject Name : MANAGEMENT CONCEPTS AND ORGANIZATION BEHAVIOR**	**TY / LB/ ETL**	**L**	**T**	**P**	**C**
BMG18002	**Prerequisite: Basic Knowledge as Statistical Techniques and Probability Theory**	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial P : Project C: Credits

OBJECTIVE:

- This course is aimed at addressing the contemporary issues, which fall under the broad title of management, and its functions.
- There will also be an attempt to analyze the behavior of individuals within an organization and the issues of working with other group or teams.

COURSE OUTCOMES (COs) :

CO1	Effective leadership skills
CO2	Accommodating with co workers and at Work environment
CO3	Enhanced leadership skills
CO4	Understanding and implementing good policies for the welfare of management and workers

Mapping of Course Outcomes (COs) with Program Outcomes (POs) & Program Specific Outcomes (PSOs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**		**M**		**M**		**L**		**M**		**L**	
CO2	**M**	**M**				**M**		**H**	**M**	**M**	**L**	**H**
CO3	**L**		**H**	**H**	**M**		**M**	**H**	**M**	**L**	**M**	
CO4	**M**	**L**				**M**			**M**			**M**

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Management Science		
										✓		

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BMG18002	**MANAGEMENT CONCEPTS AND ORGANIZATION BEHAVIOR**	**3**	**0/0**	**0/0**	**3**

UNIT I INTRODUCTION TO MANAGEMENT 9

Definition of Management – Science or Art or Profession – Manager vs Entrepreneur vs Leader – Types of Managers – Managerial roles and skills – Evolution of Management – Scientific, Human relations and system approaches

UNIT II PLANNING AND ORGANIZING 9

Nature and purpose of planning – planning process – types of planning – planning premises – Nature and purpose of organizing – Formal and Informal organization – organization chart – organization structure – types - Line and staff authority

UNIT III DIRECTING AND CONTROLLING 9

Leadership – Types and theories of leadership – communication – process of communication – barriers in communication – System and process of controlling – Budgetary and non budgetary control techniques – Direct and preventive control – reporting

UNIT IV INDIVIDUAL BEHAVIOR 9

Diversity - Attitudes and Job satisfaction – Emotions and Moods – personality and values – perception – Decision making – Motivation concepts – Motivation Applications

UNIT V GROUP BEHAVIOR 9

Foundations of Group Behavior – Understanding Teams – power and politics – Conflict and Negotiation – Stress Management

Total No of Periods: 45

TEXT BOOKS:

1. Harold Koontz and Heinz Weihrich “Essentials of Management” Tata McGraw Hill Education 2015
2. Stephen. P. Robbins, Timothy A. Judge and Seema Sanghi “Essentials of Organizational Behavior” Pearson 10th Edition 2010

REFERENCE BOOKS:

1. Tripathi PC & Reddy PN “Priciples of Management” Tata McGraw Hill 2012
2. Stephen P. Robbins, David A.De.Cenzo, Mary Coulter “Fundamentals of Management” Pearson Education 2016

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18ET4	**Subject Name: INDUSTRIAL AUTOMATION**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Industrial Instrumentation I,II.	**L**	**1**	**0/1**	**3/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To study Introduction to Industrial Automation, Plant Wide Control Systems And Automation Strategy.
- To Study the Instrumentation Standard Protocols
- To Study the Application using PLC and Machine Automation.
- To Analyze the Distributed Control System Basics
- To study and analyze Distributed Control Systems Engineering and Design.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Introduction to Industrial Automation, Plant Wide Control Systems and Automation Strategy
CO2	Instrumentation Standard Protocols
CO3	PLC Configuration, Applications and Machine Automation
CO4	Distributed Control System Basics
CO5	Distributed Control Systems Engineering and Design

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**H**	**M**	**H**	**M**	**L**	**L**	**H**	**M**	**M**	**H**
CO2	**M**	**M**	**M**	**H**	**M**	**H**	**L**	**H**	**M**	**H**	**M**	**L**
CO3	**M**	**H**	**M**	**L**	**H**	**M**	**H**	**M**	**H**	**L**	**H**	**M**
CO4	**H**	**L**	**H**	**M**	**L**	**H**	**M**	**L**	**H**	**M**	**L**	**H**
CO5	**H**	**H**	**M**	**M**	**H**	**M**	**H**	**L**	**M**	**H**	**M**	**L**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**M**	**H**	**M**	**H**	**M**			
CO2	**H**	**H**	**H**	**M**	**M**			
CO3	**H**	**M**	**H**	**H**	**L**			
CO4	**L**	**M**	**H**	**M**	**L**			
CO5	**M**	**H**	**H**	**M**	**H**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18ET4	**INDUSTRIAL AUTOMATION**	**1**	**0/1**	**3/0**	**3**

UNIT I INTRODUCTION TO INDUSTRIAL AUTOMATION, PLANT WIDE CONTROL SYSTEMS AND AUTOMATION STRATEGY 9

Introduction to Industrial Automation- Role of automation in industries- Introduction to the types of manufacturing industries- Introduction to type of automation system- Benefits of automation - Introduction to Automation pyramid - Introduction to automation tools like PAC, PLC, SCADA, DCS, Hybrid DCS with reference to automation pyramid.

UNIT II INSTRUMENTATION STANDARD PROTOCOLS 9

Definition of protocol - Introduction to Open System Interconnection (OSI) model - Communication standard (RS232, RS485) - Modbus (ASCII/RTU)- Introduction to third party interface - concept of OPC (Object linking and embedding for Process Control) - HART Protocol: Introduction - frame structure, programming - implementation examples - benefits, advantages and limitation.

UNIT III PLC CONFIGURATION, APPLICATIONS AND MACHINE AUTOMATION 9

PLC programming methods as per IEC 61131 - Developing programs using Sequential Function Chart - Functional Block Diagram - Analog control using PLC (PID controller configuration) - Interfacing PLC to SCADA/DCS using communication link (RS232, RS485) - Protocols (Modbus ASCII/RTU) and OPC- Development stages involved for PLC based automation systems

UNIT IV DISTRIBUTED CONTROL SYSTEM BASICS 9

DCS introduction - Various function Blocks - DCS components/block diagram - DCS Architecture of different makes- comparison of these architectures with automation pyramid - DCS specification - latest trend and developments - DCS support to Enterprise Resources Planning (ERP) - performance criteria for DCS and other automation tool

UNIT V DISTRIBUTED CONTROL SYSTEM S ENGINEERING AND DESIGN 9

DCS detail Engineering - configuration and programming - functions including database management – reporting - alarm management – diagnosis -Historical database management - security and user access management –communication - third party interfaces – control - display etc - Enhanced functions like Advance process control - fuzzy logic - ANN.

Total No of Periods: 45

REFERENCE BOOKS:

1. The management of control system: Justification and Technical Auditing, N.E. Bhattiha, ISA
2. Computer aided process control, S.K.Singh, PHI.
3. Understanding Distributed Process Systems for Control, Samuel Herb, ISA.
4. Programmable Logic Controllers: Principles and Applications, Webb &Reis, PHI.
5. Introduction to Programmable Logic Controllers, Garry Dunning, Thomson Learning.
6. Distributed computer control for industrial automation, Ppovik Bhatkar, Dekkar Pub.
7. Computer Based Process control, Krishna Kant, PHI 8. Mechatronics ,HMT, TMH publication

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BBI18L03	**Subject Name : BIOMEDICAL INSTRUMENTATION LAB**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite:	**L**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Study of Biological Preamplifiers.
- To learn Recording of ECG signal and Analysis.
- To learn Recording of Audiogram.
- To study Recording of EMG

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands Biological Preamplifiers.
CO2	Capable of Recording of ECG signal and Analysis.
CO3	Capable of Recording of Audiogram.
CO4	Capable of Recording of EMG

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**M**	**H**	**M**	**L**	**M**	**M**	**L**	**H**	**M**	**L**
CO2	**H**	**M**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**
CO3	**M**	**M**	**M**	**L**	**H**	**M**	**L**	**H**	**M**	**L**	**M**	**H**
CO4	**L**	**M**	**H**	**M**	**L**	**M**	**H**	**L**	**M**	**H**	**H**	**M**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**M**	**H**	**L**	**M**	**H**			
CO2	**M**	**H**	**L**	**M**	**H**			
CO3	**M**	**H**	**L**	**M**	**H**			
CO4	**M**	**L**	**M**	**H**	**L**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BBI18L03	**BIO-MEDICAL INSTRUMENTATION LABORATORY**	**0**	**0/0**	**3/0**	**1**

LIST OF EXPERIMENTS

1. Study of Biological Preamplifiers.
2. Recording of ECG signal and Analysis.
3. Recording of Audiogram.
4. Recording of EMG.
5. Recording of EEG.
6. Recording of various physiological parameters using patient monitoring system and telemetry units.
7. Measurement of pH, pO_2 and conductivity.
8. Study and analysis of functioning and safety aspects of surgical diathermy.

Total No of Periods:45

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18L10	**Subject Name: EMBEDDED SYSTEM LAB**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: None	**L**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To design and simulate combinational circuits and sequential circuits
- To design toggle, Bitwise, Arithmetic, Delay

COURSE OUTCOMES (COs) : (3- 5)

CO1	Students will be able to design and simulate combinational circuits and sequential circuits
CO2	Graduate capable to design toggle, Bitwise, Arithmetic, Delay

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**M**	**L**	**L**	**H**	**M**	**M**	**H**	**M**	**L**	**H**
CO2	**M**	**H**	**M**	**H**	**L**	**H**	**M**	**H**	**M**	**H**	**L**	**M**

Cos / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**H**	**M**	**L**	**H**	**M**			
CO2	**M**	**H**	**M**	**H**	**M**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18L10	**EMBEDDED SYSTEM LAB**	**0**	**0/0**	**3/0**	**1**

LIST OF EXPERIMENTS

Design and Simulate Using Keil Version

1. Design of Logic Gates
2. Design of Multiplexer and De-multiplexer
3. Design of Encoder and Decoders
4. Flip Flops
5. Counters
6. Toggle a port bit in Keil
7. Bitwise operators
8. Arithmetic Operators
9. Delay Operations
10. ADC Interfacing with ARM Processor

Total No of Periods: 45

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18L11	Subject Name : PROJECT PHASE - 1	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	**L**	**0**	**0/0**	**3/3**	**2**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue, address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Apply the knowledge and skills acquired in the course of study addressing a specific problem or issue.
CO2	To encourage students to think critically and creatively about societal issues and develop user friendly and reachable solutions
CO3	To refine research skills and demonstrate their proficiency in communication skills.
CO4	To take on the challenges of teamwork, prepare a presentation and demonstrate the innate talents.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	M	H	H	L	M	M	H	H
CO2	H	H	H	H	H	H	H	M	M	M	H	H
CO3	H	H	H	H	H	H	H	M	M	H	H	M
CO4	H	M	H	H	H	H	M	H	H	H	H	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	H	H	H	H			
CO2	H	H	H	H	H			
CO3	H	H	H	H	H			
CO4	H	H	H	H	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BHS18FLX	Subject Name : FOREIGN LANGUAGE	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	**L**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: To recognize the cultural values, practices, and heritage of the foreign country, communicate effectively in a foreign language and interact in a culturally appropriate manner with native speakers of that language.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Achieve functional proficiency in listening, speaking, reading, and writing.
CO2	Develop an insight into the nature of language itself, the process of language and culture acquisition.
CO3	Decode, analyze, and interpret authentic texts of different genres.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	L	L	L	L	H	L	H	M	H	H	L
CO2	M	L	L	L	L	H	L	H	H	H	H	L
CO3	L	L	M	M	L	H	M	H	M	H	H	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	L	L	L	L	L			
CO2	L	L	L	L	L			
CO3	L	L	L	L	L			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
			✓									

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18012	**Subject Name: COMPUTER CONTROL PROCESS**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Process Control	**T**	**3**	**1/0**	**0/0**	**4**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Capability to analyze discrete data systems, sampling process and z-transform.
- Ability to design of dead beat, dahlin, pole placement and predictive controllers
- To understand the basic systems to make computer as a controller.
- Overview of PLC's architectures, programs, logic & their functional blocks.
- Communications in PLC's and case study of bottle filling plant.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Capability to analyze discrete data systems, sampling process and z-transform.
CO2	Ability to design dead beat, dahlin, pole placement and predictive controllers
CO3	Understands the basic systems to make computer as a controller.
CO4	Understands the Overview of PLC's architectures, programs, logic & their functional blocks.
CO5	Understands Communications in PLC's and case study of bottle filling plant.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**M**	**H**	**M**	**H**	**L**	**M**	**H**	**M**	**H**	**L**
CO2	**M**	**H**	**H**	**M**	**H**	**M**	**H**	**M**	**L**	**L**	**H**	**M**
CO3	**M**	**H**	**M**	**H**	**L**	**M**	**H**	**M**	**H**	**M**	**L**	**H**
CO4	**M**	**H**	**M**	**L**	**H**	**M**	**H**	**L**	**H**	**M**	**H**	**L**
CO5	**M**	**H**	**L**	**H**	**M**	**H**	**M**	**H**	**L**	**H**	**M**	**H**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**M**	**M**	**H**	**L**	**H**			
CO2	**M**	**H**	**L**	**M**	**H**			
CO3	**H**	**M**	**H**	**M**	**H**			
CO4	**H**	**M**	**H**	**M**	**M**			
CO5	**L**	**H**	**M**	**H**	**M**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18012	**COMPUTER CONTROL PROCESS**	**3**	**1/0**	**0/0**	**4**

UNIT I ANALYSIS OF DISCRETE DATA SYSTEM **12**

Z-Transform- Selection of sampling process – Selection of Sampling period – pulse transfer function – modified Z-transform – Stability of Discrete Data System. .

UNIT II DESIGN OF DIGITAL CONTROLLER **12**

Digital PID – Dead beat – Dahlin algorithms – pole placement controller Design of feed forward controller – predictive controller.

UNIT III COMPUTER AS A CONTROLLER **12**

Basic building blocks of computer control system – SCADA – Direct Digital Control – AI and expert control systems – Case studies on computer control for Industrial process..

UNIT IV PLC **12**

Evolution of PLC's – Sequential and programmable controllers – Architecture- Relay logic – Ladder logic – Programming Timers & Counters

UNIT V PROGRAMMING & APPLICATIONS OF PLC'S **12**

Instructions in PLC-Program control instructions, math instructions, and sequencer instructions-use of PC as PLC-Application of PLC-Bottle filling system application.

Total No of Periods: 60

TEXT BOOKS:

1. Despande and R.H.Ash, Computer process control, ISA Publication, USA 1995.
2. Shanthisasidharan, Computer control of Process

REFERENCE BOOKS:

1. Stephan opoulous, Chemical Process control, Prentice Hall of India, New Delhi.
2. Chidambaram, Computer control of Process

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18013	**Subject Name: POWER PLANT INSTRUMENTATION**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Nil	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To provide an overview on power generation through various methods.
- Acquiring knowledge on the various types of power plants and the measurement devices.
- Educating on the basic and advanced boiler control techniques.
- Gaining knowledge about different analysers in power plant.
- Studying about different control loops used in boilers.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the power generation through various methods.
CO2	Acquires knowledge on the various types of power plants and the measurement devices
CO3	Understands the basic and advanced boiler control techniques.
CO4	Capable to get knowledge about different analyzers in power plant
CO5	Understands different control loops used in boilers.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**H**	**M**	**H**	**M**	**H**	**L**	**L**	**M**	**H**	**H**
CO2	**L**	**M**	**L**	**H**	**M**	**L**	**H**	**M**	**M**	**H**	**M**	**H**
CO3	**M**	**L**	**H**	**L**	**H**	**M**	**L**	**H**	**M**	**L**	**M**	**H**
CO4	**H**	**H**	**H**	**H**	**L**	**M**	**M**	**L**	**M**	**H**	**H**	**M**
CO5	**M**	**H**	**L**	**M**	**H**	**L**	**H**	**M**	**L**	**H**	**M**	**L**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**M**	**M**	**H**	**H**	**L**			
CO2	**L**	**M**	**H**	**M**	**L**			
CO3	**H**	**H**	**M**	**L**	**H**			
CO4	**M**	**M**	**H**	**L**	**H**			
CO5	**H**	**M**	**M**	**L**	**H**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18013 POWER PLANT INSTRUMENTATION 3 0/0 0/0 3

UNIT I OVERVIEW OF POWER GENERATION 9

Brief survey of methods of power generation – hydro, thermal, nuclear, solar and wind power – importance of instrumentation in power generation – thermal power plants – building blocks – details of boiler processes UP&I diagram of boiler – cogeneration. .

UNIT II MEASUREMENTS IN POWER PLANTS 9

Electrical measurements – current, voltage, power, frequency, power – factor etc. – non electrical parameters – flow of feed water, fuel, air and steam with correction factor for temperature – steam pressure and steam temperature – drum level measurement – radiation detector – smoke density measurement – dust monitor

UNIT III ANALYZERS IN POWER PLANTS 9

Flue gas oxygen analyser – analysis of impurities in feed water and steam – dissolved oxygen analyser – chromatography – PH meter – fuel analyser – pollution monitoring instruments..

UNIT IV CONTROL LOOPS IN BOILER 9

Combustion control – air/fuel ratio control – furnace draft control – drum level control – main stem and reheat steam temperature control – superheater control – attemperator – deaerator control – distributed control system in power plants – interlocks in boiler operation.

UNIT V TURBINE – MONITORING AND CONTROL 9

Speed, vibration, shell temperature monitoring and control – steam pressure control – lubricant oil temperature control – cooling system

Total No of Periods: 45

TEXT BOOKS:

1. Sam G. Dukelow, The control of Boilers, instrument Society of America, 1991.
2. Modern Power Station Practice, Vol.6, Instrumentation, Controls and Testing, Pergamon Press, Oxford, 1971.

REFERENCE BOOKS:

1. Elonka,S.M. and Kohal, A.L., Standard Boiler Operations, McGraw-Hill, New Delhi, 1994.
2. R.K.Jain, Mechanical and industrial Measurements, Khanna Publishers, Delhi ,1995.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18L12	Subject Name : PROJECT PHASE - II	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	L	**0**	**0/0**	**12/12**	**8**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue, address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Apply the knowledge and skills acquired in the course of study addressing a specific problem or issue.
CO2	To encourage students to think critically and creatively about societal issues and develop user friendly and reachable solutions
CO3	To refine research skills and demonstrate their proficiency in communication skills.
CO4	To take on the challenges of teamwork, prepare a presentation and demonstrate the innate talents.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	`PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H	H	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H	H	H	H	H	H
CO3	H	H	H	H	H	H	H	H	H	H	H	H
CO4	H	H	H	H	H	H	H	H	H	H	H	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	H	H	H	H			
CO2	H	H	H	H	H			
CO3	H	H	H	H	H			
CO4	H	H	H	H	H			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E01	**Subject Name : FIBER OPTICS AND LASER INSTRUMENTS**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Nil	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Introduction to basic concepts of optical fibers and their industrial applications.
- Providing adequate knowledge about Industrial application of optical fibers.
- Understanding basic concepts of lasers.
- Exposure to the basic knowledge about Industrial application of lasers
- Exposure to the Industrial application of Holography and Medical applications of lasers

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the basic concepts of optical fibers and their industrial applications.
CO2	Providing adequate knowledge about Industrial application of optical fibers.
CO3	Understands basic concepts of lasers.
CO4	Understands the basic knowledge about Industrial application of lasers
CO5	Understands the Industrial application of Holography and Medical applications of lasers

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**L**	**H**	**M**	**L**	**H**	**M**	**H**	**M**	**H**	**L**
CO2	**M**	**H**	**M**	**H**	**M**	**L**	**H**	**M**	**M**	**H**	**M**	**H**
CO3	**H**	**M**	**H**	**H**	**H**	**M**	**L**	**M**	**L**	**M**	**L**	**H**
CO4	**H**	**M**	**H**	**M**	**H**	**M**	**L**	**H**	**M**	**H**	**M**	**L**
CO5	**M**	**L**	**M**	**L**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**H**	**M**	**L**	**H**	**M**			
CO2	**H**	**M**	**L**	**H**	**M**			
CO3	**M**	**L**	**L**	**H**	**M**			
CO4	**H**	**M**	**H**	**M**	**H**			
CO5	**M**	**H**	**M**	**H**	**L**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18E01 FIBER OPTICS AND LASER INSTRUMENTS 3 0/0 0/0 3

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 interferometry 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 No of Periods: 45

TEXT BOOKS:

1. John and Harry, Industrial lasers and their applications, McGraw-ill, 1974
2. Senior J.M., Optical Fiber Communication Principles and Practice, Prentice Hall, 1985

REFERENCE BOOKS:

1. John F Read, Industrial applications of lasers, Academic Press, 1978
2. MonteRoss, Laser applications, McGraw-Hill, 1968
3. Keiser G., Optical Fiber Communication, McGraw-Hill, 1991
4. Jasprit Singh, Semi conductor optoelectronics, McGraw-Hill, 1995

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E02	**Subject Name :PC BASED INSTRUMENTATION**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Nil	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Introduction to the measurement and analyzing techniques of digital computer power and performance
- Exposure to the various types of interfacing systems and components
- Developing the knowledge of real-time systems and case studies in instrumentation
- To have the Capability to analyze PC based data
- To develop instrumentation systems on various processes of industrial measurements.

COURSE OUTCOMES (Cos) : (3- 5)

CO1	Understands measurement and analyzing techniques of digital computer power and performance
CO2	Understands the various types of interfacing systems and components
CO3	Develops the knowledge of real-time systems and case studies in instrumentation
CO4	Capability to analyze PC based data
CO5	Capable to develop instrumentation systems on various processes of industrial measurements

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**H**	**M**	**H**	**M**	**H**	**H**	**M**	**L**	**M**	**H**
CO2	**H**	**H**	**L**	**H**	**M**	**H**	**H**	**L**	**H**	**H**	**H**	**L**
CO3	**M**	**M**	**H**	**M**	**H**	**M**	**M**	**M**	**M**	**M**	**M**	**M**
CO4	**H**	**H**	**M**	**L**	**M**	**L**	**L**	**H**	**H**	**L**	**H**	**H**
CO5	**M**	**M**	**M**	**H**	**L**	**H**	**M**	**M**	**M**	**H**	**M**	**M**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**M**	**M**	**H**	**L**	**H**			
CO2	**M**	**H**	**M**	**L**	**H**			
CO3	**M**	**H**	**M**	**L**	**H**			
CO4	**M**	**H**	**L**	**M**	**H**			
CO5	**H**	**L**	**M**	**H**	**M**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18E02	**PC BASED INSTRUMENTATION**	**3**	**0/0**	**0/0**	**3**

UNIT I INTRODUCTION **9**

Review of microprocessors, microcomputers, micro processing systems - Input-output structures - Measurement of digital computer power and performance. .

UNIT II INTERFACING **9**

Analogue signal conversion – Interface components and techniques - Signal processing - Interface systems and standards – Communications.

UNIT III SOFTWARE **9**

Real time languages – Programming real time systems - Discrete PID algorithms -Real time operating systems - Case studies in instrumentation..

UNIT IV MEASUREMENT AND CONTROL **9**

PC based data - Acquisition systems – Data Acquisition- Data Gathering

UNIT V APPLICATION EXAMPLES **9**

Industrial process measurements, like flow temperature, pressure, and level PC based instruments development system.

Total No of Periods: 45

TEXT BOOKS:

1. Krishna Khan, “Computer based industrial control”, Prentice Hall, 1997.

REFERENCE BOOKS:

1. Ahson, S.I., “Microprocessors with applications in process control”, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1984.
2. George Barney C., “Intelligent Instrumentation”, Prentice Hall of India Pvt. Ltd., New Delhi, 1998.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E03	Subject Name : CONTROL SYSTEM DESIGN	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Control Engineering	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Imparting knowledge on performance specifications, limitation and structure of controllers.
- Acquiring knowledge on design of controllers and to study the characteristics of different controllers.
- Designing different controllers using root locus and frequency domain techniques.
- To introduce design in discrete state space systems.
- Studying about radar tracking, temperature control and satellite altitude control.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the performance specifications, limitation and structure of controllers
CO2	Acquires knowledge on design of controllers and to study the characteristics of different controllers.
CO3	Designs the different controllers using root locus and frequency domain techniques.
CO4	Capable to design discrete state space systems
CO5	Understands the radar tracking, temperature control and satellite altitude control

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	H	M	H	M	H	M	H	L	H
CO2	M	H	L	H	M	L	H	L	M	H	L	H
CO3	H	M	H	M	H	L	H	M	L	H	M	L
CO4	M	H	L	M	H	L	M	L	H	H	H	L
CO5	L	M	H	L	M	H	L	M	H	H	M	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	L	M	H	L			
CO2	M	M	L	H	M			
CO3	M	H	L	M	H			
CO4	M	H	L	M	H			
CO5	M	L	H	L	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18E03	**CONTROL SYSTEM DESIGN**	**3**	**0/0**	**0/0**	**3**

UNIT I INTRODUCTION TO DESIGN **9**

Systems performance and specifications – Compensators – Methodologies and assessment .

UNIT II CLASSICAL CONTROLLERS DESIGN **9**

Proportional (P) – Integral (I) – derivatives (D) – PI – PD – PID controllers – Characteristics – Design – Tuning - Manual and automatic.

UNIT III FREQUENCY DOMAIN DESIGN **9**

Design of lag, lead, lead-lag compensators – Design using bode plots – Polar plots – Nichols charts – MIMO design.

UNIT IV STATE VARIABLE DESIGN **9**

Design by state feedback – Output feedback – Pole assignment technique – Design of state and output regulators – Design of reduced and full order observers – Introduction to robust control - H∞ control – Parameter optimisation.

UNIT V CASE STUDIES **9**

Radar tracking – Control of robot arm – Satellite altitude control – Temperature control

Total No of Periods: 45

TEXT BOOKS:

1. S.Thompson, ‘Control Systems Engineering and Design’, Longman group, U.K.Ltd., 1989.
2. E.O.Doebelin, ‘Control Systems Principles and Design’, John Wiley 1990.

REFERENCE BOOKS:

1. I.J.Nagrath and M.Gopal, ‘Control Systems Engineering’, Wiley eastern Ltd., 1982.
2. M.Gopal, ‘Modern Control Systems Theory’, Wiley Eastern Ltd, 1993.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E04	**Subject Name : NANO TECHNOLOGY**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Nil	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Brief view about what is nanotechnology and how to use it in the field of electronics.
- Basic concepts and definition of nano structure and material.
- The graduate can get the knowledge about the tools used for measuring nano materials.
- Ability to recognize sensors and self-healing structure.
- The graduate will have the complete impact of nanotechnology in medical industries.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Brief view about nanotechnology and how to use it in the field of electronics.
CO2	The graduate gets basic concepts and definition of nano structure and material.
CO3	The graduate can get the knowledge about the tools used for measuring nano materials.
CO4	Ability to recognize sensors and self-healing structure.
CO5	The graduate will have the complete impact of nanotechnology in medical industries.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**L**	**H**	**M**	**L**	**M**	**H**	**M**	**H**	**M**	**L**
CO2	**M**	**H**	**M**	**L**	**H**	**M**	**L**	**H**	**M**	**L**	**H**	**H**
CO3	**H**	**M**	**L**	**M**	**L**	**L**	**H**	**M**	**L**	**M**	**M**	**H**
CO4	**L**	**M**	**H**	**L**	**M**	**L**	**H**	**M**	**L**	**H**	**H**	**L**
CO5	**H**	**L**	**M**	**L**	**H**	**L**	**M**	**H**	**M**	**L**	**H**	**M**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**M**	**H**	**L**	**M**	**H**			
CO2	**H**	**M**	**L**	**H**	**L**			
CO3	**M**	**H**	**L**	**M**	**M**			
CO4	**H**	**M**	**H**	**L**	**M**			
CO5	**H**	**M**	**L**	**H**	**M**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18E04	**NANO TECHNOLOGY**	**3**	**0/0**	**0/0**	**3**

UNIT I INTRODUCTION **9**

Preliminary definitions, need for Nanotechnology, benefits of Nanotechnology a note on measures, elements of electricity, optics and electronics. .

UNIT II FUNDAMENTALS **9**

Electrons, atoms, ions, molecules, various metals, biosystems, molecular recognition, ohm's law, elements of quantum mechanics and magnetism.

UNIT III TOOLS **9**

Tools for measuring nanostructures, scanning probe instruments, spectroscopy, electrochemistry and electron microscopy, tools for making nano structures, smart materials, nano scale biostructures , Energy capture, transformation and storage.

UNIT IV SENSORS &SELF HEALING STRUCTURES **9**

Self healing structures, recognition, separation, catalysis, heterogeneous nano structures and composites encapsulation, consumer goods, natural sensors, electromagnetic sensors, biosensors.

UNIT V BIO MEDICAL APPLICATIONS **9**

Drugs, drug delivery, photodynamic therapy, molecular motors, neuro- electronics interfaces, protein engineering, nanobusiness, nanoethics.

Total No of Periods: 45

TEXT BOOKS:

1. Mark Ratner and Daniel Ratner, Nanotechnology Pearson Educational.
2. M.H. Fulekar, Nanotechnology: Importance and Applications, I. K. International Pvt Ltd 2010.

REFERENCE BOOKS:

1. Marc J. Madou, Fundamentals of Microfabrication and Nanotechnology, Third Edition, Three-Volume Set: Manufacturing Techniques for Microfabrication and Nanotechnology of Microfabrication and Nanotechnolgy) Hardcover –15 Jul 2011

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E05	Subject Name : EMBEDDED SYSTEM	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- The brief view of real time and embedded system.
- The graduates can understand the embedded system components and interface.
- Detailed overview about embedded system design and development.
- Analysis of real time system performance, language and their features.
- The case studies of safety, aerospace ,automobile, medical and industrial application.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Capable to get brief view of real time and embedded system.
CO2	Understands embedded system components and interface.
CO3	The graduates understands embedded system design and development .
CO4	The graduates Analysis of real time system performance, language and their features
CO5	The graduate will be capable to perform case study on safety, aerospace ,automobile, medical and industrial application.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	H	M	L	H	M	H	L	L	M
CO2	M	M	H	M	L	H	M	L	H	M	L	H
CO3	H	H	H	M	H	M	H	L	H	M	H	M
CO4	H	H	M	L	H	M	L	H	M	L	H	M
CO5	M	H	M	L	H	M	L	H	M	L	H	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	M	L	H			
CO2	H	M	H	M	L			
CO3	M	M	L	H	M			
CO4	H	L	M	H	L			
CO5	L	M	M	H	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEI18E05	**EMBEDDED SYSTEM**	**3**	**0/0**	**0/0**	**3**

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS **9**

Brief overview of real time systems and embedded systems - Classification of embedded systems - Embedded system definitions - Functional and non-functional requirements - Architectures and standards - Typical applications.

UNIT II EMBEDDED SYSTEM COMPONENTS AND INTERFACE **9**

Device choices - Selection criteria and characteristics of Processors and memory systems for embedded applications - Interface and Peripherals - Power sources and management.

UNIT III EMBEDDED SYSTEM DESIGN AND DEVELOPMENT **9**

Design methods and techniques - Classification of need - Need analysis -Requirement and specification - Conceptual design - Models and languages – State machine model - State machine tables - Verification – Validation - Simulation and emulation.

UNIT IV REAL TIME SYSTEMS AND MODELS **9**

Characteristics and classification of real time systems - Real time specifications and Design techniques - Event based - Process based and graph based models – Real time kernel - Hierarchy services and design strategy - Real time system performance and analysis - Typical real time systems - Their languages and features.

UNIT V CASE STUDIES **9**

Case studies of safety-critical and time-critical embedded systems with reference to Aerospace, automobile, Medical and Industrial applications.

Total No of Periods: 45

TEXT BOOKS:

1. Noergaard, T., “Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers”, Elsevier Publications, 2005.
2. Berger, A.S., “Embedded System Design: An Introduction to Process, Tools and Techniques”, CMP Books, 2002.

REFERENCE BOOKS:

1. David, S., “An Embedded Software Primer”, Addison-Wesley, 1999.
2. Liv, J.W.S., “Real-Time Systems”, Pearson Education, 2001.
3. Vahid and Givargis, T., “Embedded System Design: A Unified Hardware/ Software Introduction”, John Wiley and Sons, 2002.
4. Peatman, J.B., “Design with Microcontrollers”, McGraw-Hill International Ltd.,Singapore, 1989.
5. Kang, C.M.K., and Shin, G., “Real Time Systems”, McGraw Hill, 1997.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E06	Subject Name : SYSTEMS THEORY	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Control Engineering	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Analysis of various frequency domain descriptions.
- The review of state model of a system and its properties.
- To design in state space systems and control.
- The brief view of various types of non -linear systems and their phase plane analysis with examples.
- The graduate will have the complete impact of stability and applications related to non linear problems.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Capable to analyse of various frequency domain descriptions.
CO2	Understands review of state model of a system and its properties
CO3	The graduates design state space systems and control.
CO4	The student understands brief view of various types of non -linear systems and their phase plane analysis with examples.
CO5	The graduate will have the complete impact of stability and applications related to non linear problems.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	H	M	L	H	M	H	L	L	M
CO2	M	M	H	M	L	H	M	L	H	M	L	H
CO3	H	H	H	M	H	M	H	L	H	M	H	M
CO4	H	H	M	L	H	M	L	H	M	L	H	M
CO5	M	H	M	L	H	M	L	H	M	L	H	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	M	L	H			
CO2	H	M	H	M	L			
CO3	M	M	L	H	M			
CO4	H	L	M	H	L			
CO5	L	M	M	H	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18E06	**SYSTEMS THEORY**	**3**	**0/0**	**0/0**	**3**

UNIT I FREQUENCY DOMAIN DESCRIPTIONS 9

Properties of transfer functions – Impulse response matrices – Poles and zeros of transfer function matrices – Critical frequencies – Resonance – Steady state and dynamic response – Bandwidth. .

UNIT II STATE SPACE DESCRIPTION 9

Review of state model for systems – State transition matrix and its properties - Free and forced responses – Controllability and observability – Kalman decomposition – Minimal realisation – Balanced realisation

UNIT III DESIGN IN STATE SPACE SYSTEMS 9

State feedback – Output feedback – Design methods – Pole assignment – Full order and reduced order observers – Deadbeat control – Deadbeat observers – Introduction to optimal control..

UNIT IV NON-LINEAR SYSTEMS 9

Types of non-linearity – Typical examples – Phase plane analysis – Limit cycles -Equivalent linearization – Describing functions – Chaotic behaviour. Need for model reduction – Aggregation techniques – Dominant pole concept – Model reduction via partial realisation – Time moment matching and pade approximation – Hankel norm model reduction – Comparative merits of various methods.

UNIT V STABILITY 9

Stability concepts – Equilibrium points – BIBO and asymptotic stability – Direct method of Lyapunov – Application to non-linear problems – Frequency domain stability criteria – Popov's method and its extensions.

Total No of Periods: 45

TEXT BOOKS:

1. M.Gopal, "Modern Control Engineering", Wiley, 1996.
2. Theodore E. Djaferis , Irvin c.schick, System Theory: Modeling, Analysis and Control, springer science, 2000.

REFERENCE BOOKS:

1. Ogatta, "Modern Control Engineering", PHI, 3rd Edition, 1997.
2. G.J.Thaler, "Automatic control systems", Jaico publishers, Chennai, 1993.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E07	**Subject Name : SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Control Engineering	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Providing theoretical and practical knowledge on methods to develop mathematical models from experimental data, adaptive control system.
- Designing and implement system identification experiments.
- To use input/output experimental data for identification of mathematical dynamical models.
- Equipping the students with designing methods of adaptive control.

COURSE OUTCOMES (COs) : (3- 5)

CO1	The graduate understands theoretical and practical knowledge on methods to develop mathematical models from experimental data, adaptive control system.
CO2	Capable of Designing and implement system identification experiments.
CO3	The students are capable of designing methods of adaptive control.
CO4	Capable to use input/output experimental data for identification of mathematical dynamical models
CO5	Capable to design various methods of adaptive control.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**M**	**H**	**M**	**L**	**H**	**M**	**L**	**H**	**M**	**M**	**H**	**L**
CO2	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**M**	**L**	**M**	**M**	**H**
CO3	**L**	**M**	**H**	**L**	**M**	**H**	**M**	**L**	**H**	**M**	**L**	**H**
CO4	**H**	**H**	**M**	**L**	**H**	**M**	**L**	**H**	**M**	**L**	**H**	**M**
CO5	**M**	**H**	**M**	**L**	**H**	**M**	**H**	**L**	**M**	**L**	**H**	**M**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**M**	**H**	**L**	**M**	**M**			
CO2	**H**	**H**	**M**	**L**	**M**			
CO3	**H**	**H**	**M**	**L**	**H**			
CO4	**M**	**M**	**H**	**M**	**L**			
CO5	**M**	**H**	**H**	**L**	**M**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18E07	**SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL**	**3**	**0/0**	**0/0**	**3**

UNIT I NON PARAMETRIC METHODS 9

Non parametric methods: Transient analysis – frequency analysis – correlation analysis spectral analysis .

UNIT II PARAMETRIC METHODS 9

Linear Regression: The least square estimate – best linear unbiased estimation under linear constraints – updating the parameter estimates for linear regression models – prediction error methods: description of prediction error methods – optimal prediction – relationships between prediction error methods and other identification methods – theoretical analysis.

Instrumental variable methods: Description of instrumental variable methods – theortical analysis – covariance matrix of IV estimates – comparison of optimal IV and prediction error estimates.

UNIT III RECURSIVE IDENTIFICATION METHODS 9

The recursive least squares method – the recursive instrumental variable method – the recursive prediction error method – model validation and model structure determination. Identification of systems operating in closed loop: identifiability considerations – direct identification – indirect identification – joint input – output identification.

UNIT IV ADAPTIVE CONTROL SCHEMES 9

Introduction – uses – definitions – auto tuning – types of adaptive control – gain scheduling controller – model reference adaptive control schemes –self-tuning controller.

UNIT V MRAC AND STC 9

Approaches – the gradient approach –liapunov functions – passivity theory – pole placement method – minimum variance control – predictive control-Stability – convergence – robustness – application of adaptive control.

Total No of Periods: 45

TEXT BOOKS:

1. Soderstorm, T. and PetreStoica, System Identification, Prentice Hall International (UK)Ltd., 1989.
2. Sastry S. and Bodson M., Adaptive control – stability, convergence and Robustness, Prentice Hall inc., New Jersey, 1989.

REFERENCE BOOKS:

1. Ljung L, system identification: Theory for the user, Prentice Hall, Englewood Cliffs, 1987

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E08	Subject Name : NEURAL AND FUZZY LOGIC CONTROL	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- The graduates can understand what is neural network ,maps and theories.
- To overview of control case study for neural network.
- Detailed overview about fuzzy sets,fuzzyrules, fuzzy relation and fuzzy algorithm.
- To understand about the design of fuzzy logic controller.
- Analysis of fuzzy algorithm and case study.

COURSE OUTCOMES (COs) : (3- 5)

CO1	The graduates understand neural network, maps and theories
CO2	Understands overview of control case study for neural network.
CO3	The student will be able to give Detailed overview about fuzzy sets, fuzzyrules, fuzzy relation and fuzzy algorithm.
CO4	The student understands about the design of fuzzy logic controller.
CO5	Capable to Analyse of fuzzy algorithm and case study.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	M	H	L	H	M	L	H	M	H
CO2	M	H	L	H	M	L	H	M	M	H	L	M
CO3	H	H	H	M	L	H	M	L	M	L	H	M
CO4	L	L	M	H	L	H	M	L	M	H	M	H
CO5	M	H	M	L	H	M	L	H	M	H	H	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	L	H	M			
CO2	H	L	M	H	M			
CO3	M	L	H	M	L			
CO4	H	M	L	H	H			
CO5	M	M	H	M	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18E08	**NEURAL AND FUZZY LOGIC CONTROL**	**3**	**0/0**	**0/0**	**3**

UNIT I INTRODUCTION AND DIFFERENT ARCHITECTURES OF NEURAL NETWORKS 9

Artificial neuron – MLP – Back propagation – Hope field networks – Kohonenself- organising maps – adaptive resonance theory. .

UNIT II NEURAL NETWORKS FOR CONTROL 9

Schemes of neuro-control – identification and control of dynamical systems – adaptive neuro controller – case study.

UNIT III INTRODUCTION TO FUZZY LOGIC 9

Fuzzy sets – fuzzy relations – fuzzy conditional statements – fuzzy rules – fuzzy algorithm. Fuzzy logic controller – fuzzification interface – knowledge base –

UNIT IV FUZZY LOGIC 9

decision making logic – defuzzification interface – design of fuzzy logic controller – case study.

UNIT V NEURO-FUZZY LOGIC CONTROL 9

Optimisation of membership function and rules base of fuzzy logic controller using neural networks – genetic algorithm – fuzzy neuron – adaptive fuzzy systems – case study.

Total No of Periods: 45

TEXT BOOKS:

1. LauranceFausett, Fundamentals of Neural Networks, Prentice Hall, Englewood cliffs, N.J, 1992.
2. Zimmermann H.J., Fuzzy set theory and its applications, Allied Publication Ltd., 1996.

REFERENCE BOOKS:

1. Tsoukalas L.H, and Robert E.Uhrig, Fuzzy and Neural approach in Engineerin,John Wiley and Sons, 1997.
2. JacekM.Zurada, Introduction to artificial Neural Systems, Jaico Publishing House Mumbai, 1997.
3. KlirG.J.and Yuan B.B, Fuzzy sets and fuzzy logic, Prentice Hall of India, New Delhi, 1997.
4. Driankov D., Hellendron. H. Reinfrank M., An Introduction to Fuzzy control, Narosa publishing House, New Delhi, 1996.
5. Millon W.T., Sutton R.S.andWebrose P.J., Neural Networks for control, MIT Press, 1992.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E09	**Subject Name : INSTRUMENTATION IN PETRO CHEMICAL INDUSTRY**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Industrial Instrumentation-I,II	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Introduction to the methods of crude oil extraction, processing and refining
- The study of Unit operations in petroleum refinery and petrochemical industry
- Understanding the production routes of important petrochemicals.
- Gaining familiarity in Control of selected petrochemicals production processes
- Gaining familiarity safety in instrumentation systems

COURSE OUTCOMES (COs) : (3- 5)

CO1	The graduate will be able to know the methods of crude oil extraction, processing and refining
CO2	Understands the operations in petroleum refinery and petrochemical industry
CO3	Understands the production routes of important petrochemicals
CO4	Capable to Control selected petrochemicals production processes
CO5	Familiarized with safety in instrumentation systems

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**M**	**H**	**L**	**M**	**H**	**M**	**L**	**H**	**M**	**L**
CO2	**M**	**H**	**L**	**M**	**H**	**L**	**H**	**M**	**L**	**H**	**M**	**L**
CO3	**H**	**H**	**H**	**M**	**L**	**M**	**L**	**H**	**M**	**H**	**L**	**M**
CO4	**M**	**M**	**L**	**H**	**M**	**L**	**M**	**H**	**L**	**M**	**H**	**L**
CO5	**H**	**M**	**L**	**H**	**L**	**M**	**H**	**M**	**L**	**M**	**H**	**M**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**H**	**M**	**H**	**M**	**H**			
CO2	**M**	**H**	**M**	**H**	**L**			
CO3	**H**	**M**	**H**	**M**	**M**			
CO4	**L**	**H**	**M**	**H**	**H**			
CO5	**M**	**M**	**H**	**M**	**M**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18E09	**INSTRUMENTATION IN PETRO CHEMICAL INDUSTRY**	**3**	**0/0**	**0/0**	**3**

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

Chemical 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 in 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

Total No of Periods: 45

TEXT BOOKS:

1. Waddams A.L, Chemical from petroleum, Butter and Janner Ltd., 1968
2. Balchan.J.G. and Mumme K.I., Process Control Structures and Applications, Van Nostrand Reinhold Company, New York, 1988.

REFERENCE BOOKS:

1. Austin G.T.Shreeves, Chemical Process Industries, McGraw-Hill International student edition, Singapore, 1985
2. Liptak B.G. Instrumentation in Process Industries, Chilton Book Company, 1994.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E10	**Subject Name : INTELLIGENT CONTROLLERS**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Nil	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Graduates to understand difference between conventional and expert system.
- Providing the ideas of knowledge Acquisition.
- Learning about expert system tool.
- Enabling the students to understand about Fuzzy modeling.
- Enabling the students to understand control with Neural Controllers.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Graduates can understand difference between conventional and expert system
CO2	Understands the ideas of knowledge Acquisition.
CO3	Understands expert system tool
CO4	Understand about Fuzzy modeling
CO5	Understands about control with Neural Controllers.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**H**	**M**	**H**	**M**	**L**	**M**	**H**	**H**	**M**	**H**
CO2	**M**	**H**	**M**	**L**	**M**	**H**	**L**	**M**	**H**	**M**	**L**	**M**
CO3	**M**	**H**	**M**	**H**	**M**	**L**	**H**	**M**	**L**	**H**	**M**	**H**
CO4	**L**	**M**	**H**	**M**	**L**	**H**	**M**	**H**	**L**	**M**	**H**	**L**
CO5	**H**	**L**	**H**	**L**	**H**	**L**	**M**	**H**	**L**	**M**	**M**	**L**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**M**	**H**	**L**	**M**	**H**			
CO2	**H**	**M**	**L**	**M**	**H**			
CO3	**H**	**M**	**L**	**H**	**M**			
CO4	**M**	**L**	**H**	**M**	**H**			
CO5	**M**	**L**	**H**	**M**	**H**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18E10	**INTELLIGENT CONTROLLERS**	**3**	**0/0**	**0/0**	**3**

UNIT I INTRODUCTION **9**

Definition – architecture – difference between conventional and expert system.

UNIT II KNOWLEDGE ACQUISITION **9**

Knowledge representation and formal logic-knowledge engineer – knowledge acquisition techniques – concept formalisation – knowledge representation development – knowledge acquisition for core problem knowledge acquisition without knowledge engineers.

UNIT III EXPERT SYSTEM TOOLS **9**

Problem solving start engines – languages for expert system development – expert system shells – LISP machines – PC-based expert system tools.

UNIT IV FUZZY MODELLING AND CONTROL **9**

Fuzzy sets – Fuzzy set operators – Fuzzy Reasoning – Fuzzy propositions – Linguistic variable – Decomposition and Defuzzification – Fuzzy systems- Case studies

UNIT V NEURAL CONTROLLERS **9**

Introduction: Neural networks – supervised and unsupervised learning – neural network models – single and multilayers – back propagation – learning and training. Neural controllers case studies

Total No of Periods: 45

TEXT BOOKS

1. Rolston, D.W., 'Principles of Artificial and Expert Systems Development', McGrawHill Book Company, International Edition, 1998.
2. Kosko, B, 'Neural Networks and Fuzzy Systems', Prentice Hall of India Pvt. Ltd., 1994.

REFERENCE BOOKS:

1. Klir, G.J. and Folger, T.A., 'Fuzzy Sets, and Information', Prentice Hall, 1994.
2. James A. Freeman, David M. Skapura, 'Neural Networks Algorithms', Applications and programming Techniques', Addison Wesley Publishing company 1992.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E11	**Subject Name : ADVANCED PROCESS CONTROL**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Process Control	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Introducing some of the techniques of nonlinear control.
- Developing an in-depth understanding of generalized predictive control [GPC] as a vehicle for explaining the principles of modern predictive control [MPC].
- To become familiar with the minimum variance methods as a basis for studying the techniques of self-tuning and adaptive control.
- Providing a basis for applying these techniques in an industrial context.
- To appreciate the functionality of commercially available packages for realizing model predictive control.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands some of the techniques of nonlinear control
CO2	Develops an in-depth understanding of generalized predictive control [GPC] for explaining the principles of modern predictive control[MPC].
CO3	Gets familiarized with the minimum variance methods as a basis for studying the techniques of self-tuning and adaptive control.
CO4	Understands the basis for applying these techniques in an industrial context
CO5	Develops the functionality of commercially available packages for realizing model predictive control.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**M**	**H**	**H**	**M**	**H**	**M**	**L**	**M**	**H**	**M**
CO2	**M**	**H**	**M**	**H**	**M**	**H**	**L**	**M**	**H**	**L**	**H**	**M**
CO3	**M**	**H**	**M**	**L**	**M**	**H**	**M**	**L**	**H**	**M**	**H**	**M**
CO4	**M**	**H**	**L**	**H**	**H**	**M**	**L**	**H**	**M**	**L**	**H**	**H**
CO5	**M**	**L**	**H**	**M**	**L**	**H**	**M**	**L**	**M**	**H**	**H**	**L**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**M**	**H**	**M**	**L**	**H**			
CO2	**H**	**M**	**L**	**H**	**M**			
CO3	**H**	**L**	**M**	**L**	**H**			
CO4	**H**	**M**	**L**	**L**	**H**			
CO5	**M**	**L**	**H**	**L**	**M**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEI18E11	**ADVANCED PROCESS CONTROL**	**3**	**0/0**	**0/0**	**3**

UNIT I MULTIVARIABLE SYSTEMS 9

Multivariable Systems – Transfer Matrix Representation – State Space Representation – Poles and Zeros of MIMO System - Multivariable frequency response analysis - Directions in multivariable systems - Singular value decomposition.

UNIT II 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 - Decoupling Control – LQG Control – RGA for Non-square Plant

UNIT III MULTIVARIABLE REGULATORY CONTROL 9

Introduction to Multivariable control –Multivariable PID Controller -Multivariable IMC– Multivariable Dynamic Matrix Controller -Multivariable Model Predictive Control –Generalized Predictive Controller – Multiple Model based Predictive Controller – Constrained Model Predictive Controller - Implementation Issues.

UNIT IV CONTROL OF TIME-VARYING AND NONLINEAR SYSTEMS 9

Models for Time-varying and Nonlinear systems – Input signal design for Identification –Real-time parameter estimation - Types of Adaptive Control - Gain scheduling - Adaptive Control - Deterministic Self-tuning Controller and Model Reference Adaptive Controller – Nonlinear PID Controller - Control of Hammerstein and Wiener Systems

UNIT V CASE STUDIES 9

Control Schemes for Distillation Column, CSTR, Bioreactor, Three-tank hybrid system, Four-tank system, pH, and polymerization reactor

Total No of Periods: 45

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.
4. Coughanowr, D.R., “Process Systems Analysis and Control”, McGraw -Hill International Edition, 2004.

REFERENCE BOOKS:

1. E. Ikonen and K. Najim, “Advanced Process Identification and Control”, Marcel Dekker, Inc. Newyork, 2002
2. P. Albertos and S. Antonio, “Multivariable Control Systems An Engineering Approach”, Springer Verlag, 2004
3. Sigurd Skogestad, Ian Postlethwaite, “Multivariable Feedback Control: Aalysis and Design”, John Wiley and Sons, 2004

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E12	Subject Name : ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Representing the concept of intelligent agents, search technique, knowledge, reasoning and planning.
- Providing the ideas of intelligent agents and search method.
- Learning about knowledge representation.
- Graduates to understand about planning and learning methodologies.
- Implementation of plans and method for designing controllers

COURSE OUTCOMES (COs) : (3- 5)

CO1	The graduate can represent the concept of intelligent agents, search technique, knowledge, reasoning and planning.
CO2	Capable of giving ideas of intelligent agents and search method.
CO3	Understands knowledge representation
CO4	Graduates can understand about planning and learning methodologies.
CO5	Understands Implementation of plans and method for designing controllers

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	H	H	H	M	L	H	M	H	L
CO2	M	H	M	L	H	M	L	H	M	L	H	M
CO3	H	H	M	L	H	L	M	H	L	M	H	L
CO4	L	M	H	L	H	M	L	M	H	L	M	H
CO5	H	M	L	H	L	M	H	L	M	H	L	H

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	L	H	H			
CO2	M	H	L	H	M			
CO3	H	H	H	M	L			
CO4	M	M	H	L	M			
CO5	H	H	M	L	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18E12	**ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS**	**3**	**0/0**	**0/0**	**3**

UNIT I INTRODUCTION TO ARTIFICIAL INTELLIGENCE 9

Overview of Al-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 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 ERCEPTION – 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 by induction – explanation based learning

Total No of Periods: 45

TEXT BOOKS:

1. Elaine Rich and Kelvin Knight, Artificial Intelligence, Tata McGraw-Hill, New Delhi, 1991.
2. Stuart Russell and Peter Norvig, Artificial Intelligence: A modern approach Prentice Hal, 1995

REFERENCE BOOKS:

1. Nelson N.J. Principles of Artificial Intelligence, Springer Verlag, Berlin, 1980.
2. Patterson, Introduction to Artificial Intelligence and Expert systems, Prentice Hall of India, New delhi, 1990.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E13	Subject Name : DIGITAL IMAGE PROCESSING	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Introduction to the basic theory and algorithms that are widely used in digital image processing
- Exposure to current technologies and issues that are specific to image processing systems
- To develop an hands-on experience in using computers to process image
- To familiarize with MATLAB Image Processing Toolbox
- Developing critical thinking about shortcomings of the state of the art in image processing

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the basic theory and algorithms that are widely used in digital image processing
CO2	Gets Exposure to current technologies and issues that are specific to image processing systems
CO3	Develops hands-on experience in using computers to process image
CO4	Familiarized with MATLAB Image Processing Toolbox
CO5	Develops critical thinking about shortcomings of the state of the art in image processing

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	H	M	H	M	H	L	L	M	H	M
CO2	H	H	M	H	M	M	H	H	M	H	H	H
CO3	M	M	H	H	L	M	M	H	H	L	M	M
CO4	L	L	L	M	M	M	L	M	H	M	L	L
CO5	M	M	M	L	H	L	M	L	H	H	M	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	L	M	L			
CO2	H	H	H	H	H			
CO3	H	M	M	M	M			
CO4	M	H	L	L	H			
CO5	L	L	M	M	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18E13	**DIGITAL IMAGE PROCESSING**	**3**	**0/0**	**0/0**	**3**

UNIT I FUNDAMENTALS OF IMAGE PROCESSING **9**

Introduction – Steps in image processing systems – Image acquisition – Sampling and Quantization – Pixel relationships – Color fundamentals and models, File formats, Image operations – Arithmetic, Geometric and Morphological. .

UNIT II IMAGE ENHANCEMENT **9**

Spatial Domain: Gray level Transformations – Histogram processing – Spatial filtering smoothing and sharpening. Frequency Domain: Filtering in frequency domain – DFT, FFT, DCT – Smoothing and sharpening filters – Homomorphic Filtering.

UNIT III IMAGE SEGMENTATION AND FEATURE ANALYSIS **9**

Detection of Discontinuities – Edge operators – Edge linking and Boundary Detection – Thresholding – Region based segmentation – Morphological Watersheds – Motion Segmentation, Feature Analysis and Extraction.

UNIT IV MULTI RESOLUTION ANALYSIS AND COMPRESSIONS **9**

Multi Resolution Analysis: Image Pyramids – Multi resolution expansion – Wavelet Transforms, Image compression: Fundamentals – Models – Elements of Information Theory – Error free compression – Lossy Compression – Compression Standards.

UNIT V APPLICATION OF IMAGE PROCESSING **9**

Image classification – Image recognition – Image understanding – Video motion analysis – Image fusion – Steganography – Digital compositing Mosaics – Colour Image Processing.

Total No of Periods: 45

TEXT BOOKS:

1. Anil K.Jain, “Fundamentals of Digital Image Processing”. Pearson Education, 2003

REFERENCE BOOKS:

1. Rafael C.Gonzalez and Richard E.Woods, “Digital Image Processing”, 2ndEdition, Pearson Education, 2003.
2. Milan Sonka, ValclavHalavac and Roger Boyle, “Image Processing, Analysis and Machine Vision”, 2nd Edition, Thomson Learning, 2001.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E14	Subject Name :DIGITAL INSTRUMENTATION	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Introduction to the various types of digital instruments
- Providing insight into the various digital measurement techniques used in the industrial processes
- Understanding the use of various electrical/electronic instruments, their construction, applications, principles of operation
- Provides insight into the standards and units of measurements
- Provision of opportunities to develop basic skills in the design of electronic Equipment

COURSE OUTCOMES(COs) : (3- 5)

CO1	Understands various types of digital instruments
CO2	Capable of understanding various digital measurement techniques used in the industrial processes
CO3	Understands the use of various electrical/electronic instruments, their construction, applications, principles of operation
CO4	Understands the concepts of the standards and units of measurements
CO5	Develops basic skills in the design of electronic Equipment

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	H	M	H	M	L	H	M	L	H
CO2	M	L	H	M	L	H	L	M	H	L	H	M
CO3	H	M	H	L	H	M	H	L	H	M	L	H
CO4	M	H	M	L	H	M	L	L	H	M	L	H
CO5	L	H	M	L	H	L	M	H	M	L	H	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	L	M	L	M			
CO2	H	M	H	M	L			
CO3	M	M	L	H	M			
CO4	H	M	L	H	M			
CO5	H	M	L	H	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18E14	**DIGITAL INSTRUMENTATION**	**3**	**0/0**	**0/0**	**3**

UNIT I INTRODUCTION 9

Digital codes – Memory devices – Basic building blocks – Gates, FF and counters – Discrete data handling – Sampling – Sampling theorem – Aliasing errors – Reconstruction – Extrapolation – Synchronous and asynchronous sampling.

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UNIT II DIGITAL METHODS OF MEASUREMENTS 9

Review of A/D, D/A techniques – F/V and V/F conversion techniques – Digital voltmeters and multimeters – Automation and accuracy of digital voltmeters and multimeters – Digital phase meters – Digital tachometers – Digital frequency, period and time measurements – Low frequency measurements – Automatic time and frequency scaling – Sources of error – Noise – Inherent error in digital meters, hidden errors in conventional ac measurements – RMS detector in digital multimeters – Mathematical aspects of RMS.

UNIT III DIGITAL DISPLAY & RECORDING DEVICES 9

Digital storage oscilloscopes – Digital printers and plotters – CDROMS – Digital magnetic tapes, dot matrix and LCD display CROs, colour monitor, digital signal analyser and digital data acquisition..

UNIT IV SIGNAL ANALYSIS 9

Amplifiers, filters, transmitter, receiver, wireless base and mobile station test sets, noise figures meters, RF network analyser and high frequency signal sources

UNIT V CURRENT TRENDS IN DIGITAL INSTRUMENTATION 9

Introduction to special function add on cards – Resistance card – Input and output cards – Counter, test and time of card and digital equipment construction with modular designing; interfacing to microprocessor, micro controllers and computers - Computer aided software engineering tools (CASE) – Use of CASE tools in design and development of automated measuring systems – Interfacing IEEE cards – Intelligent and programmable instruments using computers.

Total No of Periods: 45

TEXT BOOKS:

1. Doebelin, ‘Measurement System, Application & Design’, IV Ed, McGraw-Hill, 1990

REFERENCE BOOKS:

1. Bouwens, A.J., “Digital Instrumentation”, McGraw Hill, 1984.
2. John Lenk, D., “Handbook of Micro computer based Instrumentation and Control”, PHI, 1984.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E15	Subject Name : DIGITAL CONTROL SYSTEMS	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Control Engineering	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Understanding the basics of z-transform.
- To study the stability analysis of digital control system.
- Equipping the students with the basic knowledge of A/D conversion.
- Equipping the students with the basic knowledge of D/A conversion.
- Acquiring the basic knowledge of digital process control design.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the basics of z-transform.
CO2	Able to know the stability analysis of digital control system.
CO3	The graduate is Equipped with the basic knowledge of A/D conversion.
CO4	The graduate is Equipped with the basic knowledge of D/A conversion.
CO5	Acquires the basic knowledge of digital process control design

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L	M	H	H	H	M	L	M	H	M	L
CO2	H	H	M	L	H	L	M	H	M	L	H	M
CO3	H	M	M	L	H	M	L	L	M	H	M	L
CO4	M	H	L	M	H	L	H	M	L	H	H	H
CO5	L	H	M	L	H	M	H	L	H	L	H	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	L	M	H	L			
CO2	M	H	L	M	H			
CO3	H	H	M	L	H			
CO4	H	M	L	H	H			
CO5	L	M	H	L	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18E15	**DIGITAL CONTROL SYSTEMS**	**3**	**0/0**	**0/0**	**3**

UNIT I INTRODUCTION **9**

Digitisation – Effect of sampling – Linear difference equation - Review of - Z transforms – solution of difference equation – convergence. .

UNIT II DISCRETE SYSTEM ANALYSIS **9**

The transfer function – State Variable description – Relation of transfer function to pulse response – external stability state space form – solution of state equation – Numerical consideration – dynamic response – controllability and observability effect of sampling.

UNIT III SAMPLED DATA SYSTEMS **9**

Sample and hold – spectrum of a sampled signal – extrapolation – response between samples – Hold equivalents.

UNIT IV DESIGN OF DIGITAL CONTROLLER **9**

Pole placement – estimation design – regulation design – Integral control and disturbance estimation – design by emulation – root locus design – direct design method – frequency response methods.

UNIT V PLC **9**

Evolution of PLC's – Sequential and programmable controllers – Architecture- Programming of PLC – Relay logic – Ladder logic – Functional blocks.

Total No of Periods: 45

TEXT BOOKS:

1. Franklin G.F, J.David Powell, Michael Worleman, " Digital Control of dynamic Systems"3rd Edition, Addison Wesley, 2000
2. Petrezeulla, Programmable Controllers, McGraw-Hill, 1989

REFERENCE BOOKS:

1. M.Gopal, 'State variables and Digital control methods', Tata McGraw-Hill, 1997.
2. Ogatta.K. 'Modern Control Engineering', Prentice hall of India, II edition, 1997.
3. Kuo, "Digital control systems", Second Edition, Oxford University press, 1992.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E16	Subject Name : PRINCIPLES OF ROBOTICS	TY / LB/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Artificial Intelligence , Embedded System	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To introduce the basic concepts and parts of robots.
- Understanding the working of robots and various types of robots.
- Familiarising with the various drive systems of robots, sensors and their applications in robots and programming of robots.
- The various application of robots, justification and implementation of robots.
- Studying about the manipulators, activators and grippers and their design considerations

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the basic concepts and parts of robots.
CO2	Understanding the working of robots and various types of robots.
CO3	Familiarized with the various drive systems of robots, sensors and their applications in robots and programming of robots.
CO4	Capable of knowing the various applications of robots, justification and implementation of robots.
CO5	Understands the concept of the manipulators, activators and grippers and their design considerations

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H	M	L	H	M	H	M	L	H	M	L
CO2	H	M	L	H	L	M	H	L	M	H	L	M
CO3	H	H	M	L	H	M	L	M	L	H	M	L
CO4	M	H	M	M	H	M	L	L	H	M	L	M
CO5	M	H	M	L	M	H	L	M	H	L	H	M

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H	M	L	H	M			
CO2	M	L	H	M	H			
CO3	L	H	M	H	M			
CO4	M	H	L	M	H			
CO5	M	H	L	M	M			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18E16	**PRINCIPLES OF ROBOTICS**	**3**	**0/0**	**0/0**	**3**

UNIT I BASIC CONCEPTS 9

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 POWER SOURCES AND SENSORS 9

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 MANIPULATORS, ACTUATORS AND GRIPPERS 9

Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations..

UNIT IV KINEMATICS AND PATH PLANNING 9

Solution of inverse kinematics problem – multiple solution Jacobian work envelop – hill climbing techniques – robot programming languages.

UNIT V CASE STUDIES 9

Mutiple robots – machine interface – robots in manufacturing and non- manufacturing applications – robot cell design – selection of robot.

Total No of Periods: 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.

REFERENCE BOOKS:

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

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E17	**Subject Name : MODERN CONTROL SYSTEMS**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Control Engineering	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Learning the fundamental concepts of control system and
- To learn the mathematical modelling of the system.
- Identifying stability of the system.
- To study the concept of time response and frequency response of the system.
- Basics of stability and analysis of the system. is discussed.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands the fundamental concepts of control system
CO2	Mathematical modeling of the system can be analyzed.
CO3	Understands the concepts of stability of the system
CO4	The graduate understands the concept of time response and frequency response of the system.
CO5	Capable of analyzing stability of the system.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**L**	**M**	**H**	**M**	**H**	**M**	**L**	**M**	**H**	**M**
CO2	**M**	**L**	**H**	**M**	**L**	**M**	**H**	**M**	**L**	**L**	**M**	**H**
CO3	**H**	**H**	**H**	**M**	**L**	**M**	**H**	**L**	**H**	**M**	**L**	**M**
CO4	**H**	**M**	**L**	**M**	**H**	**M**	**L**	**H**	**L**	**M**	**H**	**H**
CO5	**M**	**H**	**L**	**M**	**H**	**L**	**H**	**M**	**L**	**H**	**L**	**H**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**M**	**M**	**L**	**H**	**M**			
CO2	**H**	**H**	**L**	**M**	**H**			
CO3	**L**	**M**	**H**	**M**	**L**			
CO4	**M**	**H**	**L**	**M**	**H**			
CO5	**M**	**H**	**M**	**L**	**H**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18E17	**MODERN CONTROL SYSTEMS**	**3**	**0/0**	**0/0**	**3**

UNIT I STATE VARIABLE ANALYSIS AND DESIGN 9

State models – solution of state equations – controllability and observability- pole assignment by state feedback – full and reduced order observers. .

UNIT II NONLINEAR SYSTEMS 9

Common types of non-linear phenomena – Linearisation – singular points – phase plane method – construction of phase trajectories – system analysis by phase plane method – describing function method – describing function of non-linear elements

UNIT III STABILITY ANALYSIS OF NON LINEAR SYSTEM 9

Stability analysis by describing function method – jump resonance – Liapunov's and Popv's stability criteria.

UNIT IV OPTIMAL CONTROL 9

Problem formulation – necessary conditions of optimality – state regulator problem – Matrix Riccati equation – infinite time regulator problem – output regulator and tracking problems – Pontryagin's minimum principles – time - optimal control problem.

UNIT V ADAPTIVE CONTROL 9

Classification – MRAC systems – Different configuration, classification, mathematical description – direct and indirect MRAC – self tuning regulator – different approach to self tuning, recursive parameter estimation, implicit and explicit STR.

Total No of Periods: 45

TEXT BOOKS:

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. 1970.

REFERENCE BOOKS:

1. Chalam V.V., Adaptive control systems Marcel Dekker, INC New York and Bassel, 1987
2. Stanley M.Shinners, Modern Control System Theory and Design, John Wiley and Sons, 1998.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEE18E03	**Subject Name : MECHATRONICS**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Nil	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Introduction to mechatronics and mechatronics approaches to modem engineering design.
- Ability to understand various sensors and transducers for signal processing and data display.
- To study of applications of mechanical and electrical type actuators.
- Graduates to observe control systems and applications.
- Objectives of recent advances of mechatronics in automobile, medical and other fields.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understands mechatronics and mechatronics approaches to modem engineering design
CO2	Ability to understand various sensors and transducers for signal processing and data display.
CO3	Acquires knowledge on applications of mechanical and electrical type actuators
CO4	Graduates to observe control systems and applications.
CO5	Understands the Objectives of recent advances of mechatronics in automobile, medical and other fields.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**M**	**H**	**M**	**H**	**M**	**L**	**H**	**M**	**M**	**M**
CO2	**H**	**M**	**M**	**M**	**H**	**L**	**H**	**L**	**M**	**L**	**M**	**H**
CO3	**H**	**M**	**H**	**M**	**L**	**H**	**M**	**L**	**H**	**M**	**H**	**L**
CO4	**H**	**M**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**M**
CO5	**M**	**M**	**H**	**M**	**L**	**M**	**H**	**L**	**H**	**M**	**L**	**H**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**M**	**H**	**M**	**H**	**M**			
CO2	**H**	**L**	**M**	**H**	**L**			
CO3	**H**	**M**	**L**	**H**	**M**			
CO4	**M**	**L**	**H**	**M**	**L**			
CO5	**H**	**M**	**L**	**M**	**H**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEE18E03	**MECHATRONICS**	**3**	**0/0**	**0/0**	**3**

UNIT I INTRODUCTION **9**

Mechatronics – definition and key issues – evolution – elements – mechatronics approach to modern engineering design. .

UNIT II SENSORS AND TRANSDUCERS **9**

Types – displacement, position, proximity and velocity sensors – signal processing – data display.

UNIT III ACTUATION SYSTEMS **9**

Mechanical types – applications – electrical types – applications – pneumatic and hydraulic systems – applications – selection of actuators.

UNIT IV CONTROL SYSTEMS **9**

Types of controllers – programmable logic controllers – applications – ladder diagrams – microprocessor applications in mechatronics – programming interfacing – computer applications

UNIT V RECENT ADVANCES **9**

Manufacturing mechatronics – automobile mechatronics – medical mechatronics – office automation – case studies.

Total No of Periods: 45

TEXT BOOKS:

1. Bulton, N., Mechatronics : Electronic Control system for Mechanical and Electrical Engineering, Longman, 1995.
2. Dradly, D.A. Dawson., D, Burd, N.C., and Loader, A.J., Mechatronics: Electronics in products and processes, Chapman & Hall, 1993.

REFERENCE BOOKS:

1. HMT Mechatronics, Tata McGraw-Hill, New Delhi, 1968
2. GalipUlsoy, A., and Devires, W.R. microcomputer Applications in manufacturing John wiley, USA 1989.
3. James Harter, Electromechanics : Principles, concepts and devices – Prentice Hall – New Jersey 1995

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E19	**Subject Name : INSTRUMENTATION IN PAPER AND PULP INDUSTRY**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Industrial Instrumentation I,II	T	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Introduction to the raw materials, bleaching, screening.
- The study of Units gave knowledge about the properties
- Understanding the measurement consistency.
- Gaining familiarity in paper making machines.
- Gaining familiarity safety in instrumentation systems

COURSE OUTCOMES (COs) : (3- 5)

CO1	The graduate will be able to know the raw materials , screening , bleaching,
CO2	Understands the electrical, physical, optical properties
CO3	Understanding the measurement consistency.
CO4	Gaining familiarity in paper making machines
CO5	Familiarized with safety in instrumentation systems

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**M**	**H**	**L**	**M**	**H**	**M**	**L**	**H**	**M**	**L**
CO2	**M**	**H**	**L**	**M**	**H**	**L**	**H**	**M**	**L**	**H**	**M**	**L**
CO3	**H**	**H**	**H**	**M**	**L**	**M**	**L**	**H**	**M**	**H**	**L**	**M**
CO4	**M**	**M**	**L**	**H**	**M**	**L**	**M**	**H**	**L**	**M**	**H**	**L**
CO5	**H**	**M**	**L**	**H**	**L**	**M**	**H**	**M**	**L**	**M**	**H**	**M**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**H**	**M**	**H**	**M**	**H**			
CO2	**M**	**H**	**M**	**H**	**L**			
CO3	**H**	**M**	**H**	**M**	**M**			
CO4	**L**	**H**	**M**	**H**	**H**			
CO5	**M**	**M**	**H**	**M**	**M**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18E19 INSTRUMENTATION IN PAPER AND PULP INDUSTRY 3 0/0 0/0 3

UNIT 1 AN OVERVIEW OF PAPER MAKING PROCESS 9

Paper making process — Raw materials — Pulp separation — screening — Bleaching — Cooking — Chemical reaction — chippers — types of digesters — H factor and Kappa factors- Stock preparation — Instrumentation needs — Energy conservation and paper quality control.

UNIT II PAPER PROPERTIES AND ITS MEASUREMENT 9

Physical, electrical, optical and chemical properties of paper — Basic weight, thickness, density, porosity, smoothness, softness, hardness and compressibility — stress-strain relationship — Tensile strength, bursting strength, tearing resistance, folding endurance, stuffiness and impact strength — Dielectric constant, dielectric strength, dielectric loss and Properties of electrical insulating paper — Brightness, colour, gloss and capacity — Starch constant acidity and pH - Measurement techniques.

UNIT III CONSISTENCY MEASUREMENT 9

Definition of consistency — Techniques for head box consistency measurement — Stock consistency measurement and control.

UNIT IV PAPER MAKING MACHINE 9

Functioning of Paper making machine — Quality parameters — moisture, basic weight, caliper, brightness, colour, ash content, strength, gloss and tensile strength - parameters monitoring Instrumentation.

UNIT V CONTROL ASPECTS 9

Machine and cross direction control technique — consistency, moisture and basic weight control — dryer control — computer based control systems - mill wide control.

Total No of Periods: 45

REFERENCES:

1. Sankaranarayanan, P.E., Pulp and Paper Industries — Technology and Instrumentation Kotharis Desk book series, 1995.
2. Handbook of Pulp and Paper technology, Britt K.W.Van Nostrand Reinbold Company, 1970.
3. James P.Casey, Pulp and Paper chemistry and chemical Technology, John Wiley and sons, 1981.
4. Austin G.T., Shrencs Chemical Process Industries, McGraw Hill International Student Edition, Singapore, 1985.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEI18E20	**Subject Name : INSTRUMENTATION IN IRON AND STEEL INDUSTRY**	**TY / LB/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Industrial Instrumentation I,II	**T**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Introduction to furnaces.
- The study of Casting and Rolling
- Understanding the measurement in Iron and Steel industries
- Gaining familiarity in control Application
- Gaining familiarity in Evolution in computer Application

COURSE OUTCOMES (COs) : (3- 5)

CO1	Introduction to furnaces
CO2	The study of Casting and Rolling
CO3	Understanding the measurement in Iron and Steel industries
CO4	Gaining familiarity in control Application
CO5	Gaining familiarity in Evolution in computer Application

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**M**	**M**	**H**	**L**	**M**	**H**	**M**	**L**	**H**	**M**	**L**
CO2	**M**	**H**	**L**	**M**	**H**	**L**	**H**	**M**	**L**	**H**	**M**	**L**
CO3	**H**	**H**	**H**	**M**	**L**	**M**	**L**	**H**	**M**	**H**	**L**	**M**
CO4	**M**	**M**	**L**	**H**	**M**	**L**	**M**	**H**	**L**	**M**	**H**	**L**
CO5	**H**	**M**	**L**	**H**	**L**	**M**	**H**	**M**	**L**	**M**	**H**	**M**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	**H**	**M**	**H**	**M**	**H**			
CO2	**M**	**H**	**M**	**H**	**L**			
CO3	**H**	**M**	**H**	**M**	**M**			
CO4	**L**	**H**	**M**	**H**	**H**			
CO5	**M**	**M**	**H**	**M**	**M**			

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BEI18E20	**INSTRUMENTATION IN IRON AND STEEL INDUSTRY**	**3**	**0/0**	**0/0**	**3**

UNIT-I INTRODUCTION TO FURNACES 9

Process description in diagrammatic and functional block details – raw materials preparation – operation of blast furnace (BF) and auxiliary units including stoves – basic oxygen furnace (BoF) – electric furnace (EF) – open hearth furnace (OHF) – relative merits of various steel making furnaces.

UNIT II CASTING AND ROLLING 9

Quality of steel – impurities present and allowed limits for usable steel – waste recycling. Continuous casting and batch casting of steel – primary and secondary rolling – features of cold rolling – steel finishing operations.

UNIT III MEASUREMENTS IN IRON AND STEEL INDUSTRIES 9

Identification of various process parameters in the industry – selection of suitable measurement hardware for temperature, pressure, level, flow, weighing and proportioning – special gauges for measurement of thickness and shape – Control room layout for mill operations – graphic displays – alarm management.

UNIT IV CONTROL APPLICATION 9

Special applications for controls – Blast Furnace (BF) Stove combustion control system – gas and water control system in Basic Oxygen Furnace (BoF) – Mould Level control system in Strand Casting operations.

UNIT V EVOLUTION OF COMPUTER APPLICATIONS 9

Evolution of computer applications in the industry – Review of data logging, SCADA, DDC and DCS. Practices for model calculating and data logging – steel rolling mill control – annealing process control – utilities management with computer system.

Total No of Periods: 45

TEXT BOOKS:

1. Liptak, Bela G, Instrumentation in the Processing Industries, Chilton Publishers, 1973.

REFERENCE BOOKS:

1. Considine D. M., Process/Industrial Instruments and control Handbook, McGraw Hill, 4th edition 1993. 2. Serope Kalpakjian, Manufacturing Engineering and Technology, Addison Wesley Publishing Company, Massachusetts,3rd edition, 1995.
2. Robert H. Perry, D.W. Green and J.O. Maloney, Perry's Chemical Engineers, Handbook, McGraw Hill Inc, New York, 7th ed, 1998.