

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

**(An Autonomous Institution Affiliated to Anna University, Chennai,
Approved by AICTE, New Delhi & Accredited by NAAC with 'A'Grade)
Coimbatore – 641032.**

B. E. ELECTRONICS AND INSTRUMENTATION ENGINEERING



Curriculum & Syllabus

2022-2023

CHOICE BASED CREDIT SYSTEM

VISION AND MISSION OF THE INSTITUTION

VISION

To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values.

MISSION

IM1: To provide academic excellence in technical education through novel teaching methods.

IM2: To empower students with creative skills and leadership qualities.

IM3: To produce dedicated professionals with social responsibility.


Chairman - BoS
EIE - HICET




Dean (Academics)
HICET

VISION AND MISSION OF THE DEPARTMENT

VISION

To impart quality technical education in the field of Electronics and Instrumentation Engineering and strive to serve the society.

MISSION

- M1. To enrich technical knowledge through effective teaching-learning process.
- M2. To inculcate leadership and managerial skills.
- M3. To create passion for serving the society with innovation and ethical responsible.


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PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

- PO 1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO 2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- PO 3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO 4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.


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- PO 5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- PO 6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO 7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO 8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- PO 9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.


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PO10.Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11.Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12.Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1. Ability to apply concepts of measurement and sensor to design, calibrate and control various process instruments using industrial automation.

PSO 2. Ability to analyze advanced electronics and instrumentation concepts required for industrial and research pursuits.


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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- PEO 1. Graduates would have strong foundation in basic science and mathematics to formulate, analyze and solve electronics and instrumentation problems.
- PEO 2. Graduates shall have good knowledge of instrumentation systems and their applications to design control and safety systems for industrial process.
- PEO 3. Graduates exhibit professionalism with ethics, communication and team work to satisfy the needs of the society.


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CURRICULUM

**DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS
CBCS PATTERN
UNDERGRADUATE PROGRAMMES
B.E. ELECTRONICS AND INSTRUMENTATION ENGINEERING (UG)
REGULATION-2022 & 2019**

For the students admitted during the academic year 2022-2023 and onwards

**REGULATION-2022
SEMESTER - I**

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22MA1101	Matrices and Calculus (common to all branches)	BSC	3	1	0	4	4	40	60	100
2.	22EI1201	Fundamentals of Electrical, Electronics and Instrumentation Engineering	PCC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
3.	22HE1151	English for Engineers (Common to all branches)	HSC	2	0	2	3	4	50	50	100
4.	22CY1151	Chemistry for Circuit Engineering	BSC	2	0	2	3	4	50	50	100
5.	22CS1151	Problem Solving using C Programming	ESC	2	0	2	3	4	50	50	100
EEC COURSES (SE/AE)											
6.	22HE1071	Universal Human Values (Common to all branches)	AEC	2	0	0	2	3	40	60	100
7.	22HE1072	Entrepreneurship & Innovation (Common to all)	AEC	1	0	0	1	1	100	0	100
NON CREDIT - MANDATORY COURSE											
8.	22MC1091/ 22MC1092	தமிழரும் தொழில்நுட்பமும்// Indian Constitution	MC	2	0	0	0	2	100	0	100
TOTAL				15	5	6	19	27	370	330	700

SEMESTER -II

S. No	Course Code	Course Title	Category	L	T	P	C	TC P	CIA	ESE	Total
THEORY											
1.	22MA2102	Differential Equations and Laplace Transform	BSC	3	1	0	4	4	40	60	100
2.	22CY2101	Environmental Studies	ESC	2	0	0	2	3	40	60	100
3.	22PH2101	Basics of Material Science	BSC	2	0	0	2	3	40	60	100
THEORY WITH LAB COMPONENT											
4.	22HE2151	Effective Technical Communication (Common to all)	HSC	2	0	2	3	4	50	50	100
5.	22PH2151	Physics For Circuit Engineering	BSC	2	0	2	3	4	50	50	100
6.	22EI2251	Electronic Devices and Circuits	PCC	2	0	2	3	4	50	50	100
PRACTICAL											
7.	22ME2001	Engineering Practices (Common to all)	ESC	0	0	4	2	2	60	40	100
EEC COURSES (SE/AE)											
8.	22HE2071	Design Thinking(Common to all)	AEC	2	0	0	2	2	100	0	100
9.	22HE2072	Soft Skills and Aptitude-I (Common to all)	SEC	1	0	0	1	1	100	0	100
NON CREDIT - MANDATORY COURSE											
10.	22MC2091/ 22MC2092	தமிழர் மரபு / Heritage of Tamil	MC	2	0	0	0	2	100	0	100
11.	22MC2093	NCC */NSS / YRC / Sports / Clubs / Society Service - Enrollment (Common)	MC	All students shall enroll, on admission, in anyone of the personality and character development programmes and undergo training for about 80 hours							
TOTAL				19	1	8	22	27	520	380	900

REGULATION-2019**For the students admitted during the academic year 2021-2022 and onwards****SEMESTER- III**

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21MA3102	Fourier Analysis and Transforms	BS	3	1	0	4	40	60	100
2	21EI3201	Electronic Devices and Circuits	PC	3	1	0	4	40	60	100
3	21EI3202	Sensors and Transducers	PC	3	0	0	3	40	60	100
4	21ME3231	Fluid Mechanics and Thermal Engineering	PC	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
5	21EI3251	Electrical and Electronic Measurements	PC	2	0	2	3	50	50	100
PRACTICAL										
6	21EI3001	Electronic Devices and Circuits Laboratory	PC	0	0	3	1.5	60	40	100
7	21EI3002	Sensors and Transducers Laboratory	PC	0	0	3	1.5	60	40	100
MANDATORY COURSES										
8	21MC3191	Indian Constitution	MC	2	0	0	0	100	0	100
9	21HE3072	Career Guidance Level – III Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10	21HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
Total				19	2	8	20	630	370	1000

SEMESTER- IV

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21MA4101	Numerical Methods	BS	3	1	0	4	40	60	100
2	21EI4201	Electrical Machines	PC	3	1	0	4	40	60	100
3	21EI4202	Integrated Circuits and Its Applications	PC	3	0	0	3	40	60	100
4	21EI4203	Industrial Instrumentation – I	PC	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
5	21EI4251	Digital Logic Circuits	PC	2	1	2	4	50	50	100
PRACTICAL										
6	21EI4001	Electrical Machines Laboratory	PC	0	0	3	1.5	60	40	100
7	21EI4002	Integrated Circuits Laboratory	PC	0	0	3	1.5	60	40	100
MANDATORY COURSES										
8	21MC4191	Essence of Indian tradition knowledge/Value Education	MC	2	0	0	0	100	0	100
9	21HE4072	Career Guidance Level – IV Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10	21HE4073	Ideation Skills	EEC	2	0	0	0	100	0	100
Total				20	3	8	21	630	370	1000

For the students admitted during the academic year 2020-2021 and onwards

SEMESTER – V

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19EI5201	Industrial Instrumentation – II	PC	3	0	0	3	25	75	100
2	19EI5202	Control Systems	PC	3	1	0	4	25	75	100
3	19EI5203	Microprocessors and Microcontrollers	PC	3	0	0	3	25	75	100
4	19EI5204	Analytical Instrumentation	PC	3	0	0	3	25	75	100
5	19EI53XX	Professional Elective -I	PE	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
6	19EI5251	Programmable Logic Controllers and SCADA	PC	2	0	2	3	50	50	100
PRACTICALS										
7	19EI5001	Industrial Instrumentation Laboratory	PC	0	0	3	1.5	50	50	100
8	19EI5002	Microprocessors and Microcontrollers Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
9	19HE5071	Soft Skills - I	EEC	1	0	0	1	100	0	100
10	19HE5072	Design Thinking	EEC	1	0	0	1	100	0	100
Total				19	1	8	24	475	525	1000

SEMESTER – VI

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19EI6181	Industrial Safety Management	HS	3	0	0	3	25	75	100
2	19EI6201	Process Control	PC	3	0	0	3	25	75	100
3	19EI6202	Discrete Time and Signal Processing	PC	3	0	0	3	25	75	100
4	19EI63XX	Professional Elective - II	PE	3	0	0	3	25	75	100
5	19XX64XX	Open Elective– I	OE	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
6	19EI6251	Embedded Systems	PC	2	0	2	3	50	50	100
PRACTICALS										
7	19EI6001	Process Control Laboratory	PC	0	0	3	1.5	50	50	100
8	19EI6002	Virtual Instrumentation Laboratory	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
9	19EI6701	Internship Training	EEC	0	0	0	1	0	100	100
10	19HE6071	Soft Skills - II	EEC	1	0	0	1	100	0	100
11	19HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	100	0	100
Total				19	0	8	24	475	625	1100

LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1	19EI5301	Power Plant Instrumentation	PE	3	0	0	3	25	75	100
2	19EI5302	Communication Theory	PE	3	0	0	3	25	75	100
3	19IT5331	Fundamentals of Java Programming	PE	3	0	0	3	25	75	100
4	19EI5303	Industrial Chemical Process	PE	3	0	0	3	25	75	100
5	19EI5304	Operating Systems	PE	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE II										
1	19EI6301	VLSI Design	PE	3	0	0	3	25	75	100
2	19EI6302	Micro Electro Mechanical Systems	PE	3	0	0	3	25	75	100
3	19EI6303	Industrial Data Communication	PE	3	0	0	3	25	75	100
4	19EI6304	Digital Image Processing	PE	3	0	0	3	25	75	100
5	19EI6305	Introduction to Soft Computing	PE	3	0	0	3	25	75	100

OPEN ELECTIVE

ELECTRONICS AND INSTRUMENTATION ENGINEERING										
S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
1	19EI6401	Smart Sensors for Engineering Applications	OE	3	0	0	3	25	75	100

For the students admitted during the academic year 2019-2020 and onwards

SEMESTER – VII

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19EI7201	Computer Control of Process	PC	3	0	0	3	25	75	100
2	19EI7202	Industrial Electronics	PC	3	0	0	3	25	75	100
3	19EI73XX	Professional Elective-III	PE	3	0	0	3	25	75	100
4	19XX74XX	Open Elective – II	OE	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
5	19EI7251	Bio-Medical Instrumentation	PC	2	0	2	3	50	50	100
PRACTICALS										
6	19EI7001	Computer Control of Process Laboratory	PC	0	0	3	1.5	50	50	100
7	19EI7002	Instrumentation System Design Laboratory	PC	0	0	3	1.5	50	50	100
PROJECT WORK										
8	19EI7901	Project Work – Phase I	EEC	0	0	4	2	50	50	100
Total				14	0	12	20	300	500	800

SEMESTER – VIII

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19EI83XX	Professional Elective –IV	PE	3	0	0	3	25	75	100
2	19EI81XX	Professional Elective- V	PE	3	0	0	3	25	75	100
PROJECT WORK										
3	19EI8901	Project Work – Phase II	EEC	0	0	16	8	100	100	200
Total				6	0	16	14	150	250	400

LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE III										
1	19EI7301	Non-Linear Control System	PE	3	0	0	3	25	75	100
2	19EI7302	Industrial IoT	PE	3	0	0	3	25	75	100
3	19EI7303	Robotics and Automation	PE	3	0	0	3	25	75	100
4	19EI7304	Microcontroller Based System Design	PE	3	0	0	3	25	75	100
5	19EI7305	Neural Networks and Fuzzy Systems	PE	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE IV										
1	19EI8301	Fiber Optics and Laser Instruments	PE	3	0	0	3	25	75	100
2	19EI8302	Instrumentation in Petrochemical Industries	PE	3	0	0	3	25	75	100
3	19EI8303	Instrumentation System Design	PE	3	0	0	3	25	75	100
4	19EI8304	Artificial Intelligence and Machine Learning	PE	3	0	0	3	25	75	100
5	19EI8305	Instrumentation and Control in Paper Industry	PE	3	0	0	3	25	75	100
6	19EI8306	Chemical Process Instrumentation	PE	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE V										
1	19EI8181	Disaster Management	PE	3	0	0	3	25	75	100
2	19EI8182	Total Quality Management	PE	3	0	0	3	25	75	100
3	19EI8183	Professional Ethics for Engineers	PE	3	0	0	3	25	75	100
4	19EI8184	Principles of Management	PE	3	0	0	3	25	75	100
5	19EI8185	Patent, Copyright and Competition Law	PE	3	0	0	3	25	75	100

OPEN ELECTIVES

ELECTRONICS AND INSTRUMENTATION ENGINEERING										
S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
1.	19EI7401	Introduction to Programmable Logic Controllers	OE	3	0	0	3	25	75	100
LIFE SKILL COURSES										
1.	19LSZ401	General Studies for Competitive Examinations	OE	3	0	0	3	25	75	100
2.	19LSZ402	Human Rights, Women's Rights and Gender Equality	OE	3	0	0	3	25	75	100
3.	19LSZ403	Indian Ethos and Human Values	OE	3	0	0	3	25	75	100
4.	19LSZ404	Indian Constitution and Political System	OE	3	0	0	3	25	75	100
5.	19LSZ405	Yoga for Human Excellence	OE	3	0	0	3	25	75	100

CREDIT DISTRIBUTION – R2019

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	24	24	20	14	165

CREDIT DISTRIBUTION- R2022

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	19	22	25	23	22	24	20	10	165



Chairman BoS

**Chairman - BoS
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Dean Academics

**Dean (Academics)
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Principal

PRINCIPAL
Hindusthan College Of Engineering & Technology
COIMBATORE - 641 032.

SYLLABUS

SEMESTER I

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22MA1101	MATRICES AND CALCULUS (Common to all Branches)	3	1	0	4

The learner should be able to

- | | |
|---------------------|--|
| Course
Objective | <ol style="list-style-type: none"> 1. Construct the characteristic polynomial of a matrix and use it to identify eigen values and Eigenvectors 2. Impart the knowledge of sequences and series. 3. Analyse and discuss the maxima and minima of the functions of several variables. 4. Evaluate the multiple integrals and apply in solving problems. 5. Apply vector differential operator for vector function and theorems to solve engineering problems. |
|---------------------|--|

Unit	Description	Instructional Hours
I	Matrices Eigen values and Eigen vectors –Properties of Eigen values and Eigen vectors(without proof) - Cayley - Hamilton Theorem (excluding proof) - Reduction of a quadratic form to canonical form by orthogonal transformation.	12
II	Single Variate Calculus Rolle’s Theorem–Lagrange’s Mean Value Theorem–Maxima and Minima–Taylor’s and Maclaurin’s Series.	12
III	Functions of Several Variables Partial derivatives–Total derivative, Jacobian, Maxima, minima and saddle points; Method of Lagrange multipliers.	12
IV	Integral Calculus Double integrals in Cartesian coordinates–Area enclosed by plane curves (excluding surface area)–Triple integrals in Cartesian co-ordinates–Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates.	12
V	Vector Calculus Gradient, divergence and curl; Green’s theorem, Stoke’s and Gauss divergence theorem (statement only) for cubes only.	12
Total Instructional Hours		60

At the end of the course, the learner will be able to

- | | |
|-------------------|--|
| Course
Outcome | <p>CO1: Compute Eigen values and Eigen vectors of the given matrix and transform given quadratic form into canonical form.</p> <p>CO2: Apply the concept of differentiation to identify the maximum and minimum values of curve.</p> <p>CO3: Compute partial derivatives of function of several variables and write Taylor’s series for functions with two variables.</p> <p>CO4: Evaluate multiple integral and its applications in finding area, volume.</p> <p>CO5: Apply the concept of vector calculus in two and three dimensional spaces.</p> |
|-------------------|--|

TEXTBOOKS:

T1: G.B. Thomas and R.L. Finney, “Calculus and Analytical Geometry”, 9th Edition Addison Wesley Publishing Company, 2016.

T2: Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, 2019.

T3: K.P. Uma and S. Padma, “Engineering Mathematics I (Matrices and Calculus)”, Pearson Ltd, 2022.

REFERENCE BOOKS:

R1- Jerrold E. Marsden, Anthony Tromba, “Vector Calculus”, W.H. Freeman, 2003

R2- Strauss M.J, G.L. Bradley and K.J. Smith, “Multivariable Calculus”, Prentice Hall, 2002.

R3- Veerarajan T, “Engineering Mathematics”, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2016.


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Programme /Sem	Course Code	Name of the Course	L	T	P	C
B.E/B.Tech/ I	22CY1151	Chemistry for Circuit Engineering (ECE,EEE,EIE,BME,CSE,IT,AI ML)	2	0	2	3

The learner should be able to

Course Objective

1. Acquire knowledge on the concepts of chemistry involved in day to day life.
2. Identify the water related problems and water treatment techniques.
3. Enhance the fundamental knowledge on electrochemistry and the mechanism of corrosion and its control.
4. Gain knowledge on the nuclear energy source and batteries.
5. Extend the knowledge on the concepts of spectroscopy and its applications.

Unit	Description	Instructional Hours
I	CHEMISTRY IN EVERYDAY LIFE Chemicals in food – Food colors – Artificial sweeteners – Food preservatives. Soaps and Detergents – Soaps – Types of Soap – Detergents – Types of detergents. Drugs – Classification of drugs - Therapeutic Action of Different Classes of Drugs. Chemicals in Cosmetics– Creams– Talcum powders–Deodorants– Perfumes. Plastics – Thermoplastics- Preparation, properties and uses of PVC, Teflon and Thermosetting plastics-Preparation,propertiesandusesofPolyesterandPolyurethane.	6
II	WATER TECHNOLOGY Impurities in Water, Hardness of Water, Boiler feed Water – Boiler troubles -Sludge and scale formation, Caustic embrittlement, priming and foaming, boiler corrosion- -Softening Methods (Zeolite & Ion- Exchange Methods)- Desalination of Brackish Water - Reverse Osmosis, Potable water and treatment. Estimation of total, permanent and temporary hardness of water by EDTA. Determination of Dissolved Oxygen in sewage water by Winkler's method. Estimation of alkalinity of water sample by Indicator method.	6+9
III	ELECTRO CHEMISTRY AND CORROSION Electrochemical cells – reversible and irreversible cells - EMF- Single electrode potential – Nernst equation (derivation only) – Conductometric titrations. Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types –galvanic corrosion – differential aeration corrosion –corrosion control – sacrificial anode and impressed cathodic current methods. Conductometric titration of strong acid vs strong base(HCl vs NaOH).Estimation of Ferrous iron by Potentiometry.	6+6
IV	ENERGY SOURCES AND STORAGE DEVICES Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion differences between nuclear fission and fusion-nuclear chain reactions-nuclear reactor power generator-classification of nuclear reactor- light water reactor- breeder reactor. Batteries and fuel cells: Types of batteries- alkaline battery-lead storage battery-lithium ion battery-fuel cell H ₂ -O ₂ fuelcell applications.	6
V	SPECTROSCOPY Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (block diagram only) - applications – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry–atomic absorption spectroscopy–principles–instrumentation (block diagram only) – Estimation of nickel by atomic absorption spectroscopy.	6
Total Instructional Hours		45


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Course
Outcome

At the end of the course, the learner will be able to

CO1: List out the chemicals used in food, soaps and detergents, drugs, cosmetics and plastics

CO2: Differentiate hard and soft water and solve the related problems on water purification in domestic

CO3: Develop knowledge on the basic principles of electro chemistry and understand the causes of corrosion, its consequences to minimize corrosion to improve industrial design

CO4: Develop knowledge about the renewable energy resources and batteries along with the need of new materials to improve energy storage capabilities

CO5: List out the applications of spectroscopic techniques in various engineering fields.

TEXTBOOKS

T1 -P.C.Jain & Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., 2018.

T2-O.G.Palanna, "Engineering chemistry" McGraw Hill Education India (2017).

REFERENCES

R1-Shikha Agarwal "Engineering Chemistry-Fundamentals and Applications, Cambridge University Press, Delhi, 2019

R2-S.S.Dara "A Text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi(2018).


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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22HE1151	ENGLISH FOR ENGINEERS (Common to all Branches)	2	0	2	3

The student should be able

- | | |
|---------------------|--|
| Course
Objective | 1. To improve the communicative proficiency of learners. |
| | 2. To help learners use language effectively in professional writing. |
| | 3. To advance the skills of maintaining the suitable one of communication. |
| | 4. To introduce the professional life skills. |
| | 5. To impart official communication etiquette. |

Unit	Description	Instructional Hours
I	Language Proficiency: Types of Sentences, Functional Units, Framing question. Writing: process description, Writing Checklist. Vocabulary —words on environment. Practical Component: Listening- Watching short videos and answer the questions, Speaking- Self introduction, formal& semi-formal	7+2
II	Language Proficiency: Tenses, Adjectives and adverbs. Writing: Formal letters (letters conveying positive and negative news), Formal and informal email writing (using emoticons, abbreviations& acronyms), reading comprehension. Vocabulary — words on entertainment. Practical Component: Listening- Comprehensions based on TED talks Speaking- Narrating a Short story or an event happened in their life	7+2
III	Language Proficiency: Prepositions, phrasal verbs. Writing: Formal thanks giving, Congratulating, warning and apologizing letters, cloze test. Vocabulary – words on tools. PracticalComponent:Listening- Listentosongsandanswerthequestions Speaking- Just a minute	5+4
IV	Language Proficiency: Subject verb concord, Prefixes& suffixes. Writing: Preparing agenda &minutes, writing an event report. Vocabulary — words on engineering process. Practical Component: Listening- Comprehensions based on Talk of orators or interview shows Speaking- Presentation on a general topic with ppt.	5+4
V	Language Proficiency: Modal Auxiliaries, Active& passive voice, Writing: Project report (proposal & progress) ,sequencing of sentences Vocabulary – words on engineering material Practical Component: Listening- Listening- Comprehensions based on Nat Geo/Discovery channel videos Speaking- Preparing posters and presenting as a team.	6+3
Total Instructional Hours		45

After completion of the course the learner will be able

- | | |
|-------------------|---|
| Course
Outcome | CO1:To communicate in a professional forum |
| | CO2:To speak or write a content in the proficient language |
| | CO3:To maintain and use appropriate one of the communication. |
| | CO4:To read ,write and present in a professional way. |
| | CO5:To follow the etiquettes in formal communication. |

TEXTBOOKS:

T1-Norman Whitby, “Business Benchmark-Pre-intermediate to Intermediate”, Cambridge University Press, 2016. T2- Raymond Murphy, “Essential English Grammar”, Cambridge University Press, 2019.

REFERENCE BOOKS:

R1-Meenakshi Raman and Sangeetha Sharma. “Technical Communication-Principles and Practice”, Oxford University Press, 2009.
R2-Raymond Murphy, “English Grammar in Use” -4th edition Cambridge University Press, 2004.
R3-Kamalesh Sadanan “A Foundation Course for the Speakers of Tamil-Part-I&II”, Orient Blackswan, 2010.


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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22EI1201	Fundamentals of Electrical, Electronics and Instrumentation Engineering	3	0	0	3

The learner should be able to

- Course Objective
1. Explain the basics of electrical quantities.
 2. Educate on AC Fundamentals.
 3. Explain the basics of semi conductor devices and applications
 4. Elucidate the concepts of electrical wiring and safety
 5. Introduce the fundamentals of measurements and instrumentation.

Unit	Description	Instructional Hours
I	BASICS OF ELECTRICAL ENGINEERING Conductors, Insulators and Semiconductors- Energy Sources - Electric Quantities: Power, Energy – Law of Electromagnetic Induction - Ohm’s Law - Kirchoff’s Laws - Resistors in Series Parallel Circuit Current and Voltage revision rule– Star – Delta Transformation – Source Transformation – Active and Passive Elements.	9
II	AC CIRCUITS AC Fundamentals, Introduction to AC Circuits- Phasor Representation – Relationship Between Voltage And Current in R,L,C – Single phase AC circuits– Power – Power factor- R, RL,RLC Circuits(Quantitative approach only) – Resonance in RLC series Circuits- Bandwidth – Q-Factor.	9
III	SEMICONDUCTOR DEVICES AND APPLICATIONS Semiconductor Materials - PN Junction Diode and its Characteristics – Zener Diode and its Characteristics – Zener Effect – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor (BJT) – CB, CE, CC Configurations and Characteristics – SMPS, UPS.	9
IV	ELECTRICAL WIRING AND SAFETY Wiring types - Concealed wiring- One way and two way control-Need for Electrical safety- Electric shock -Precautions against shock - Elementary discussion on Circuit protective devices - Fuse and Miniature Circuit Breaker (MCB’s) –Earthing – Types –Neutral Earthing - Pipe and plate Earthing - Residual current circuit Breaker.	9
V	BASICS OF MEASUREMENTS AND INSTRUMENTATION S.I. Units and Standards – Elements of generalized measurement system - Instrument signal levels- Methods of measurements, Classification - Static and dynamic characteristics - Operating Principles of Permanent Magnet Moving coil (PMMC) Instruments - Voltmeter and Ammeter- Moving Iron (MI) Ammeters and Voltmeters - Energy meter – Wattmeter.	9
Total Instructional Hours		45

- Course Outcome
- At the end of the course, the learner will be able to
- CO1: Analyze the DC electric circuits.
 - CO2: Understand the concepts of AC circuits.
 - CO3: Analyze basics of semi conductor devices and applications
 - CO4: Familiarize on electrical wiring and safety
 - CO5: Understand the basics of measurements and measuring instruments.

TEXTBOOKS:

- T1-S.K.Bhattacharya,S.Annadurai, N.PAnanthamoorthy,“Basic Electrical and Electronics Engineering”, Pearson India Education Services Pvt.Ltd. 2020
T2-DPKothariandIJNagrath,“BasicElectricalEngineering”,TataMcGrawHill,2010.
T3-SawhneyA.K,“A Course in Electrical and Electronics measurements and instrumentation”,19th edition,DhanpatRai,2011.

REFERENCEBOOKS:

- R1-Salivahanan,“ElectronicdevicesandCircuits”,5thedition PHI,2008. R2 - Jegatheesan, R., “ Analysis of Electric Circuits”,McGraw Hill, 2015.
R3-CharlesK.Alxander,MathewN.OSadiku,“FundamentalsofElectriccircuits”,2ndeditionMcGrawHill,2013.


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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22CS1151	PROBLEM SOLVING USING C PROGRAMMING (EEE, EIE, CSE, IT)	2	0	2	3

The learner should be able

Course
Objective

1. To develop simple algorithms for arithmetic and logical problems.
2. To understand and implement the fundamental concepts in a program.
3. To enable how to implement conditional branching, iteration and recursion.
4. To understand how to decompose a problem into functions and synthesize a complete program and to enable them to use arrays, pointers, strings and structures in solving problems.
5. To understand the use files to performer ad and write operations

Unit	Description	Instructional Hours
	INTRODUCTION TO COMPUTERS	
I	Computer Systems – Computing Environments – Computer Language – Creating and Running programs – Computer Numbering System – Storing Integers and Real Numbers – Algorithms - Flowchart. INTRODUCTION TO C LANGUAGE Character set - C Tokens, Identifiers and Keywords - Constants, Variables - Data types – Text Input / Output – Operators - Expressions – Precedence and Associativity – Evaluating Expressions – Type Conversions. Illustrative program: 1) Josh went to the market to buy N apples. He found two shops, shop A and B, where apples were being sold in lots. He can buy any number of the complete lot(s) but not loose apples. He is confused with the price and wants you to figure out the minimum cost to buy exactly N apples. Write an algorithm for Josh to calculate the minimum cost to buy exactly N apples. (Wipro 2022) Input Format: <ul style="list-style-type: none"> • The first line of the input consists of an integer – N, representing the total number of apples that Josh wants to buy. 	7
II	<ul style="list-style-type: none"> • The second line consists of two space-separated positive integers – M1 and P1, representing the number of apples in a lot and the lot’s price at shop A, respectively. • The third line consists of two space-separated positive integers – M2 and P2, representing the number of apples in a lot and lot’s price at shop B, respectively. Output Format: Print a positive integer representing the minimum price at which Josh can buy the apples. 2) Chaman planned to choose a four digit lucky number for his car. His lucky numbers are 3, 5 and 7. Help him find the number, whose sum is divisible by 3 or 5 or 7. Provide a valid car number, fails to provide a valid input then display that number is not a valid car number. (Cognizant) Note: The input other than 4 digit positive number [includes negative and 0] is considered as invalid. DECISION MAKING, ARRAYS, STRINGS AND POINTERS Two-way collection – Multi-way Collection – Concept of a Loop – Pre-test and Post-test Loops – Initialization and Updating – Controlled Loops – Other Statements Related to Looping – Looping Application - Arrays - Strings - Pointers – Pointer Applications – Processor Commands. Illustrative program: 1) You are playing an online game. In the game, a list of N numbers is given. The player has to arrange the numbers so that all the odd numbers of the list come after the even numbers. Write an algorithm to arrange the given list such that all the odd numbers of the list come after the even numbers. (Wipro 2022) Input <ul style="list-style-type: none"> • The first line of the input consists of an integer numbers, representing the size of the list (N). • The second line of the input consists of N space-separated integers representing the values of the list 	10
III	Output Print N space-separated integers such that all the odd numbers of the list come after the even numbers 2) Given an integer matrix of size N x N. Traverse it in a spiral form. (Wipro 2022) Input: The first line contains N, which represents the number of rows and columns of a matrix. The next N lines contain N values, each representing the values of the matrix. Output:	10


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Asinglelinecontainingintegerswithspace,representingthedesiredtraversal.Constraints:0<N<500

3) A digital machine generates binary data which consists of a string of 0s and 1s. A maximum signal M, in the data, consists of the maximum number of either 1s or 0s appearing consecutively in the data but M can't be at the beginning or end of the string. Design a way to find the length of the maximum signal. (Wipro 2022)

Input

The first line of the input consists of an integer N, representing the length of the binary string. These line consists of a string of length N consisting of 0s and 1s only.

Output

Print an integer representing the length of the maximum signal.

4) Given a string S(input consisting) of '*' and '#'. The length of the string is variable. The task is to find the minimum number of '*' or '#' to make it a valid string. The string is considered valid if the number of '*' and '#' are equal. The '*' and '#' can be at any position in the string. (TCS NQT 2022)

Note: The output will be a positive or negative integer based on number of '*' and '#' in the input string.

(*>#): positive integer

(#>*): negative integer

(#=*): 0

FUNCTIONS, STRUCTURES AND UNION

Designing Structured Programs – Functions in C – User defined functions – Inter-Function Communication – Standard Function – Passing Arrays to Functions – Passing Pointers to Function – Recursion – Passing an array to a function – typed of – Enumerated types - Structure – Union – Programming Application. Illustrative program: 1) The Caesar cipher is a type of substitution cipher in which each alphabet in the plaintext or messages is shifted by a number of places down the alphabet. For example, with a shift of 1, P would be replaced by Q, Q would become R, and so on. To pass an encrypted message from one person to another, it is first necessary that both parties have the 'Key' for the cipher, so that the sender may encrypt and the receiver may decrypt it. Key is the number of OFFSET to shift the cipher alphabet. Key can have basic shifts from 1 to 25 positions as there are 26 total alphabets. As we are designing custom Caesar Cipher, in addition to alphabets, we are considering numeric digits from 0 to 9. Digits can also be shifted by key places. For Example, if a given plain text contains any digit with values 5 and key y =2, then 5 will be replaced by 7, "-" (minus sign) will remain as it is. Key value less than 0 should result into "INVALID INPUT". Write a function Custom Caesar Cipher(int key, String message) which will accept plaintext and key as input parameters and returns its cipher text as output. (TCS NQT 2022)

IV

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Enter your Plain Text: All the best

Enter the Key: 1

The encrypted Text is: Bmmu if Cftu

BINARY INPUT/OUTPUT

Defining and Opening a file, closing a file - input/output operations on files - error handling during I/O operations - random access to files - Text versus Binary Streams – Standard Library Functions for Files – Converting File type. Illustrative program: 1) Write a C Program to merge contents of two files into a third file.

V

9

2) Write a program in C to delete a specific line from a file.

Total Instructional Hours

45

At the end of the course, the learner will be able to

Course
Outcome

CO1: Develop simple algorithms for arithmetic and logical problems.

CO2: Test and execute the programs and correct syntax and logical errors.

CO3: Implement conditional branching, iteration and recursion.

CO4: Decompose a problem into functions and synthesize a complete program and use arrays, pointers, strings and structures to formulate algorithms and programs.

CO5: Use files to perform read and write operations.

TEXTBOOKS:

T1: Byron Gottfried, "Programming with C", Schaum's Outlines Series, McGraw Hill Education, 3rd edition, 2017.

REFERENCE BOOKS:

R1: Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th edition, 2014.

R2: R. S. Bichkar, "Programming with C", Universities Press, 2nd edition 2012.

R3: Yashvant Kanetkar, "Exploring C", BPB Publishers, 2nd edition, 2003.

R4: W. Kernighan Brian, Dennis M. Ritchie, "The C Programming Language", PHI Learning, 2nd edition, 1988


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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22HE1071	UNIVERSAL HUMAN VALUES (Common to All Branches)	2	0	0	2

The student should be made

Course Objectives

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, Trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Unit	Description	Instructional Hours
I	Introduction to Value Education Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)-Understanding Value Education - Self-exploration as the Process for Value Education - Continuous Happiness and Prosperity – the Basic Human Aspirations - Happiness and Prosperity – Current Scenario -Method to Fulfill the Basic Human Aspirations	6
II	Harmony in the Human Being and Harmony in the Family Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body - The Body as an Instrument of the Self - Understanding Harmony in the Self- Harmony of the Self with the Body- Programme to ensure self-regulation and Health	6
III	Harmony in the Family and Society Harmony in the Family – the Basic Unit of Human Interaction. Values in Human to Human Relationship' Trust' – the Foundational Value in Relationship Values in Human to Human Relationship' Respect' – as the Right Evaluation Understanding Harmony in the Society	6
IV	Harmony in the Nature/Existence Understanding Harmony in the Nature. Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature- Understanding Existence as Co-existence of mutually interacting units in all pervasivespace Realizing Existence as Co-existence at All Levels The Holistic Perception of Harmony in Existence. Vision for the Universal Human Order	6
V	Implications of the Holistic Understanding – a Look at Professional Ethics Natural Acceptance of Human Values Definitiveness of (Ethical) Human Conduct A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models- Typical Case Studies Strategies for Transition towards Value-based Life and Profession	6
Total Instructional Hours		30

At the end of the course, the learner will be able

- Course Outcome
- CO1: To become more aware of holistic vision of life-themselves and their surroundings.
- CO2: To become more responsible in life, in the Society and in handling problems with sustainable Solutions.
- CO3: To sensitive towards their commitment towards what they understood towards environment and Socially responsible behavior.
- CO4: To able to apply what have learnt to their own self in different day-to-day settings in real life and In handling problems with sustainable solutions.
- CO5: To develop competence and capabilities for maintaining Health and Hygiene.

Reference Books:

- R1. A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
- R2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
- R3. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.


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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22HE1072	ENTREPRENEURSHIP & INNOVATION	1	0	0	1

(Common for all Branches)

The student should be made

Course Objectives

1. To acquire the knowledge and skills needed to manage the development of innovation.
2. To recognize and evaluate potential opportunities to monetize these innovations.
3. To plan specific and detailed method to exploit the opportunities.
4. To acquire the resources necessary to implement these plans.
5. To make students understand organizational performance and its importance.

Module

Description

- | | |
|----|---|
| 1 | Entrepreneurial Thinking |
| 2 | Innovation Management |
| 3 | Design Thinking |
| 4 | Opportunity Spotting/Opportunity Evaluation |
| 5 | Industry and Market Research |
| 6 | Innovation Strategy and Business Models |
| 7 | Financial Forecasting |
| 8 | Business Plans/Business Model Canvas |
| 9 | Entrepreneurial Finance |
| 10 | Pitching to Resources Providers/Pitch Deck |
| 11 | Negotiating Deals |
| 12 | New Venture Creation |
| 13 | Lean Start-ups |
| 14 | Entrepreneurial Ecosystem |
| 15 | Velocity Venture |

TOTAL INSTRUCTIONAL HOURS

15

Course Outcome

At the end of the course, the learner will be able to
 CO1: Understand the nature of business opportunities, resources, and industries in critical and creative aspects.
 CO2: Understand the processes by which innovation is fostered, managed, and commercialized.
 CO3: Remember effectively and efficiently the potential of new business opportunities.
 CO4: Assess the market potential for a new venture, including customer need, competitors, and industry attractiveness.
 CO5: Develop a business model for a new venture, including revenue, margins, operations, working capital, and investment

TEXTBOOKS

T1: Arya Kumar "Entrepreneurship—Creating and leading an Entrepreneurial Organization", Pearson, Second Edition (2012).
 T2: Emrah Yayici "Design Thinking Methodology", Artbiztech, First Edition (2016).

REFERENCE BOOKS

R1: Christopher Golis "Enterprise & Venture Capital", Allen & Unwin Publication, Fourth Edition (2007).
 R2: Thomas Lockwood & Edger Papke "Innovation by Design", Career Press, Second Edition (2017).
 R3: Jonathan Wilson "Essentials of Business Research", Sage Publication, First Edition (2010).

WEB RESOURCES

- W1: <https://blog.forgeforward.in/tagged/startup-lessons>
 W2: <https://blog.forgeforward.in/tagged/entrepreneurship>
 W3: <https://blog.forgeforward.in/tagged/minimum-viable-Product>
 W4: <https://blog.forgeforward.in/tagged/minimum-viable-Product>
 W5: <https://blog.forgeforward.in/tagged/innovation>


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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22MC1091	INDIAN CONSTITUTION (Common for all Branches)	2	0	0	0

The student should be made to

Course Objectives

1. Sensitization towards self, family (relationship), society and nature
2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals
3. Strengthening of self-reflection
4. Development of commitment and courage to act

Unit	Description	Instructional Hours
BASIC FEATURES AND FUNDAMENTAL PRINCIPLES		
I	Meaning of the constitution law and constitutionalism–Historical perspective of the constitution of India– salient features and characteristic of the constitution of India.	6
FUNDAMENTAL RIGHTS		
II	Scheme of the fundamental rights–fundamental duties and its legislative status– The directive principles of state policy–its importance and implementation– Federal structure and distribution of legislative and financial powers between the union and states.	6
PARLIAMENTARY FORM OF GOVERNMENT		
III	The constitution powers and the status of the president in India.–Amendment of the constitutional Powers and procedures–The historical perspective of the constitutional amendment of India– Emergency provisions: National emergency, President rule, Financial emergency.	6
LOCAL GOVERNANCE		
IV	Local self-government-Rural Local Government-Panchayath Raj, Elections of Panchayat- State Election Commission-Urban Local Government-Amendment Act, Urban Local Government Structures in India.	6
INDIAN SOCIETY		
V	Constitutional Remedies for citizens– Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.	6
Total Instructional Hours		30

Course Outcome

At the end of the course, the learner will be able to

CO1: Understand the functions of the Indian government.

CO2: Understand and abide the rules of the Indian Constitution

TEXTBOOKS:

- T1: Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi, 1997.
- T2: Agarwal R.C., "Indian Political System", S. Chand and Company, New Delhi, 1997.
- T3: Maciver and Page, "Society: An Introduction Analysis", Mac Milan India Ltd., New Delhi.
- T4: Sharma K.L., "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi, 1997.

REFERENCE BOOKS:

- R1- Sharma, Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi.
- R2- Gahai U.R., "Indian Political System", New Academic Publishing House, Jalaendhar.
- R3- Sharma R.N., "Indian Social Problems", Media Promoters and Publishers Pvt. Ltd.


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SEMESTER II

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./II	22MA2102	Differential Equations and Laplace Transform (ECE, EEE & EIE)	3	1	0	4

The learner should be able to

- Course Objective**
- Describe some methods to solve different types of first order differential equations.
 - Understand the various approach to find general solution of the ordinary differential equations
 - Evaluate the various types of Partial differential equations and methods to find solution.
 - Analyze the techniques of Laplace transform.
 - Analyze the techniques of Inverse Laplace transform.

Unit	Description	Instructional Hours
I	ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER Basic concepts, separable differential equations, exact differential equations, integrating factors, linear differential equations, Bernoulli equation.	12
II	LINEAR DIFFERENTIAL EQUATIONS OF SECOND ORDER Second order linear differential equations with constant with RHS of the form e^{ax} , x^n , $\sin ax$, $\cos ax$ – Cauchy’s linear equations– Method of variation of parameters.	12
III	PARTIAL DIFFERENTIAL EQUATIONS Formation of partial differential equations by eliminating arbitrary constants and functions – Solution of first order partial differential equations of the form $f(p,q)=0$, Clairaut’s equation – Lagrange’s equation.	12
IV	LAPLACE TRANSFORM Laplace transform–Basic properties –Transforms of derivatives and integrals of functions- Periodic functions - Unit step function - Dirac delta function.	12
V	INVERSE LAPLACE TRANSFORM Inverse Laplace transform–Convolution theorem (with out proof) –Solution of linear ODE of second order with constant coefficients using Laplace transforms..	12
Total Instructional Hours		60

At the end of the course, the learner will be able to

- Course Outcome**
- CO1: Apply few methods to solve different types of first order differential equations.
 CO2: Evaluate the solutions of higher order ordinary differential equations and its properties.
 CO3: Compute the solution of first order partial differential equations.
 CO4: Apply Laplace transform and its properties to solve periodic functions.
 CO5: Solve certain linear differential equations using inverse Laplace Transform.

TEXT BOOKS:

T1 - Erwin Kreyszig, “Advanced Engineering Mathematics”, 10th Edition, Wiley India Private Ltd., New Delhi, 2018

T2 - Bali. N.P and Manish Goyal & Watkins, "Advanced Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007

REFERENCE BOOKS :

R1- Thomas & Finney “ Calculus and Analytic Geometry” , Sixth Edition,,Narosa Publishing House, New Delhi.

R2 - Weir,M.D and Joel Hass, ‘ Thomas Calculus” 12thEdition,Pearson India 2016.

R3 - Grewal B.S, “Higher Engineering Mathematics”, 42nd Edition, Khanna Publications, Delhi, 2012.


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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. B.TECH / II	22CY2101	ENVIRONMENTAL STUDIES (Common to all branches except CSE,IT & AIML)	3	0	0	2

The learner should be able to

**Course
Objective**

1. Grasp the importance and issues related to ecosystem and biodiversity and their protection.
2. Acquire knowledge about environmental pollution – sources, effects and control measures of environmental pollution.
3. Identify the various natural resources, exploitation and its conservation
4. Gain knowledge on the scientific, technological, economic and political solutions to environmental problems.
5. Become aware on the national and international concern for environment and its protection

Unit

Description

**Instructio
nal Hours**

ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

I

Main objectives and scope of environmental studies-Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – food chain, food web and ecological pyramids - energy flow in the ecosystem – ecological succession processes - Introduction, types, characteristic features, structure and function of the forest and ponds ecosystem – Introduction to biodiversity definition: types and value of biodiversity – hot-spots of biodiversity – threats to biodiversity– endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

9

NATURAL RESOURCES

II

Renewable and Non renewable resources - Forest resources: Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forests and tribal people - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – Energy resources: Renewable and non renewable energy sources – Solar energy and wind energy - role of an individual in conservation of natural resources.

9

ENVIRONMENTAL POLLUTION

III

Definition – causes, effects and control measures of: Air pollution- Water pollution – Water quality parameters- Soil pollution - Noise pollution- Nuclear hazards – role of an individual in prevention of pollution.

9

SOCIAL ISSUES AND THE ENVIRONMENT

IV

From unsustainable to sustainable development – urban problems related to energy- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- Municipal solid waste management. Global issues – Climatic change, acid rain, greenhouse effect and ozone layer depletion – Disaster Management – Tsunami and cyclones.

9


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HUMAN POPULATION AND THE ENVIRONMENT

V	Population growth, variation among nations – population explosion – family welfare programme – environment and human health – effect of heavy metals – human rights – value education – HIV / AIDS – women and child welfare – Environmental impact analysis (EIA)- GIS-remote sensing-role of information technology in environment and human health.	9
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Total Instructional Hours 45

At the end of the course, the learner will be able to

Course
Outcome

CO1: Discuss the importance of ecosystem and biodiversity for maintaining ecological balance.

CO2: Identify the causes of environmental pollution and hazards due to manmade activities.

CO3: Develop an understanding of different natural resources including renewable resources.

CO4: Demonstrate an appreciation for need for sustainable development and understand the various social issues and solutions to solve the issues.

CO5: Describe about the importance of women and child education, existing technology to protect environment.

TEXT BOOKS:

T1 – S.Annadurai and P.N. Magudeswaran, “Environmental studies”, Cengage Learning India Pvt.Ltd, Delhi, 2020

T2 - Anubha Kaushik and C. P. Kaushik, “Perspectives in Environmental studies”, Sixth edition, New Age International Publishers, New Delhi, 2019.

REFERENCE BOOKS:

R1 - Erach Bharucha, “Textbook of environmental studies” University Press (I) Pvt.ltd, Hyderabad, 2015

R2 - G.Tyler Miller, Jr and Scott E. Spoolman“Environmental Science” Thirteenth Edition, Cengage Learning, 2010.

R3 – Gilbert M. Masters and Wendell P. Ela “Introduction to Environmental Engineering and Science”, 3rd edition, Pearson ,Education, 2013.


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Programme / Sem	Course Code	Name of the Course	L	T	P	C
BE/B.Tech/ II	22PH2151	PHYSICS FOR CIRCUIT ENGINEERING PROGRAMME (AIML, CSE, ECE, EEE, EIE, IT & BME)	2	0	2	3

- The student should be able to**
- Course Objective**
1. Gain knowledge about laser, their applications, become conversant with principles of optical fiber and its applications
 2. Enhance his fundamental knowledge about properties of matter
 3. Understand the concept of wave optics
 4. Gain knowledge about quantum mechanics to explore the behavior of sub atomic particles
 5. Acquire fundamental knowledge of Ultrasonics and their applications.

Unit	Description	Instructional Hours
I	LASER AND FIBER OPTICS Spontaneous emission and stimulated emission –Type of lasers – Nd:YAG laser - Laser Applications – Holography – Construction and reconstruction of images. Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index and modes) – Fiber optical communication link.	6+3
II	Determination of Wavelength and particle size using Laser PROPERTIES OF MATTER Elasticity – Hooke's law – Poisson's ratio – Bending moment – Depression of a cantilever – Determination of Young's modulus of the material of the beam by Uniform bending theory and experiment. Twisting couple - torsion pendulum: theory and experiment	6+3
III	Determination of Young's modulus by uniform bending method Determination of Rigidity modulus – Torsion pendulum WAVE OPTICS Interference of light – air wedge –Thickness of thin paper(Testing of thickness of surface) -Michelson interferometer - Diffraction of light –Fraunhofer diffraction at single slit – Diffraction grating - Plane Diffraction grating – Rayleigh's criterion of resolution power - resolving power of grating.	6+3
IV	Determination of wavelength of mercury spectrum – spectrometer grating Determination of thickness of a thin wire – Air wedge method QUANTUM PHYSICS Black body radiation –Compton effect: theory and experimental verification – wave particle duality –concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box .	6+3
V	ULTRASONICS Production – Piezoelectric generator – Properties of Ultrasonic waves. Determination of velocity using acoustic grating – Cavitation. Industrial applications – Drilling and welding – Non destructive testing (pulse echo system). Medical applications – Ultrasound Scanner – A – mode – B- mode and C –mode.	6+3
Total Instructional Hours		30
Total Lab Instructional Hours		15

After completion of the course the learner will be able to

- CO1: Understand the advanced technology of LASER and optical communication in the field of engineering
- Course Outcome**
- CO2: Illustrate the fundamental properties of matter
- CO3: Discuss the Oscillatory motions of particles
- CO4: Understand the dual nature of matter and the Necessity of quantum mechanics.
- CO5: Develop the Ultrasonics technology and its applications in NDT.


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TEXT BOOKS:

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.

T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

REFERENCE BOOKS:

R1 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S.Chand and Company Ltd., New Delhi 2016

R2 - Dr. G. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2021


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	22EI2251	ELECTRONIC DEVICES AND CIRCUITS	2	0	2	3

Course Objective	<ol style="list-style-type: none"> 1. Recall the basics of special semiconductor devices. 2. Interpret the structure, operation and characteristics of thyristors. 3. Analyze various configurations of small signal amplifiers. 4. Infer the basic concepts of large signal amplifiers. 5. Interpret the operations of feedback amplifiers and oscillators.
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Unit	Description	Instructional Hours
	SPECIAL SEMICONDUCTOR DEVICES	
I	PN Junction Diode - Structure, Operation and V-I Characteristics, Application of Diode - Display devices- Principal of operation and Characteristics of LED, Laser diodes, Tunnel Diode, CCD, Photodiode, Phototransistor, Photoconductive and Photovoltaic cells – LED, LCD. Characteristics of PN diode and LED.	9
	POWER SEMI-CONDUCTOR DEVICES	
II	Introduction to power semiconductor devices: JFET, MOSFET- structure, operation, characteristics and Biasing – SCR and IGBT- Structure and characteristics - Introduction to Driver and Snubber circuits. Characteristics of JFET.	9
	DESIGN AND ANALYSIS OF SMALL SIGNAL AMPLIFIER	
III	Transistor Modeling, Hybrid Equivalent Circuit, Small Signal Analysis - Low Frequency Model: CE, CB, CC configurations, Darlington connections, Differential Amplifier. Frequency Response Characteristics of a Common Emitter Amplifier.	9
	LARGE SIGNAL AMPLIFIERS	
IV	Classification of Power Amplifiers, Efficiency of Class A Amplifier, Class B Complementary – Symmetry and Class C - operation, Push - Pull Power Amplifiers- Crossover Distortion. Construct and Analyze the current series Feedback Amplifier.	9
	FEEDBACK AMPLIFIERS AND OSCILLATORS	
V	Advantages of Negative Feedback - Voltage / Current, Series, Shunt Feedback - Positive Feedback - Condition for Oscillations, RC Phase Shift - Hartley, Colpitts and Crystal Oscillators. Develop and testing of a RC phase shift Oscillator.	9
Total Instructional Hours		45

Course Outcome	<p>CO1: Explain the structure and operation of special semiconductor devices.</p> <p>CO2: Summarize the concepts of power electronic devices.</p> <p>CO3: Transform the acquired skill in designing a circuit.</p> <p>CO4: Illustrate the nature of large signal amplifiers.</p> <p>CO5: Outline the concepts of feedback amplifiers, conditions for oscillation and types of oscillators</p>
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TEXT BOOKS:

- T1 - David A. Bell, "Electronic Devices and Circuits", 5th Edition, Prentice Hall Publications, 2008.
T2- S.Salivahanan, "Electronic Devices and Circuits", 3rd Edition, Tata McGraw-Hill Education, 2012.

REFERENCE BOOKS:

- R1-Rashid, "Microelectronic Circuits: Analysis & Design" 2nd Edition , CL Engineering publishers, 2010.
R2-A P Godse, U A Bakshi, "Electronic Devices and Circuits", Technical Publications,2017.
R3-Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2006.
R4-Laboratory manual prepared by the Department of Electronics and Instrumentation Engineering, 2016.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E/B.Tech	22ME2001	Engineering Practices (Common to all branches)	0	0	4	2

Course Objective To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical and Electrical Engineering.

Unit

Description of the Experiments

GROUP A (CIVIL AND MECHANICAL)

- 1 Preparation of Single pipe line and Double pipe line connection by using valves, taps, couplings, unions, reducers and elbows.
- 2 Arrangement of bricks using English Bond for one brick thick wall for right angle corner junction and T- junction
- 3 Arrangement of bricks using English Bond for one and a half brick thick wall for right angle corner and T- junction
- 4 Preparation of arc welding of Butt joints, Lap joints and Tee joints.
- 5 Practice on sheet metal Models– Trays and funnels
- 6 Hands-on-exercise in wood work, joints by sawing, planing and cutting.
- 7 Practice on simple step turning, taper turning and drilling.
- 8 Demonstration on Smithy operation.
- 9 Demonstration on Foundry operation.
- 10 Demonstration on Power tools.

GROUP B (ELECTRICAL ENGINEERING)

- 1 Residential house wiring using switches, fuse, indicator, lamp and energy meter.
- 2 Fluorescent lamp wiring.
- 3 Stair case wiring.
- 4 Measurement of Electrical quantities – voltage, current, power & power factor in single phase circuits.
- 5 Measurement of energy using single phase energy meter.
- 6 Soldering practice using general purpose PCB.
- 7 Measurement of Time, Frequency and Peak Value of an Alternating Quantity using CRO and Function Generator.
- 8 Study of Energy Efficient Equipment's and Measuring Instruments.

Total Instructional Hours

45

Course Outcome

- Fabricate wooden components and pipe connections including plumbing works.
- Fabricate simple weld joints.
- Fabricate different electrical wiring circuits and understand the AC Circuits.


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Program me/ Sem	Course Code	Name of the Course	L	T	P	C
BE/B.TEC H II	22HE2071	DESIGN THINKING	2	0	0	2

The student should be able to

- Course Objective
1. To expose students to the design process
 2. To develop and test innovative ideas through a rapid iteration cycle.
 3. To provide an authentic opportunity for students to develop teamwork and leadership skills

Unit	Description	Instructional Hours
	DESIGN ABILITY	
I	Asking Designers about what they Do – Deconstructing what Designers Do – Watching what Designers Do – Thinking about what Designers Do – The Natural Intelligence of Design Sources	6
II	DESIGNING TO WIN Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods	5
III	DESIGN TO PLEASE AND DESIGNING TOGETHER Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.	6
IV	DESIGN EXPERTISE Design Process – Creative Design - Design Intelligence – Development of Expertise – Novice to Expert. Critical Thinking – Case studies: Brief history of Albert Einstein, Isaac Newton and Nikola Tesla	6
V	DESIGN THINKING TOOLS AND METHODS Purposeful Use of Tools and Alignment with Process - Journey Mapping - Value Chain Analysis - Mind Mapping – Brainstorming - Design Thinking Application: Design Thinking Applied to Product Development	7
Total Instructional Hours		30

After completion of the course the learner will be able to

- Course Outcome
- CO1: Develop a strong understanding of the Design Process
CO2: Learn to develop and test innovative ideas through a rapid iteration cycle.
CO3: Develop teamwork and leadership skills

TEXT BOOKS:

T1 - 1. Nigel Cross, "Design Thinking", Kindle Edition.

REFERENCE BOOKS:

- R1 - Tom Kelley, "Creative Confidence", 2013.
R2 - Tim Brown, "Change by Design", 2009.


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Program me/ Sem	Course Code	Name of the Course	L	T	P	C
BE/B.TEC H II	22HE2072	SOFT SKILLS AND APPTITUDE I	0	0	0	1

The student should be able to

- Course Objective
- To develop and nurture the soft skills of the students through instruction, knowledge acquisition, demonstration and practice.
 - To enhance the students ability to deal with numerical and quantitative skills.
 - To identify the core skills associated with critical thinking.
 - To develop and integrate the use of English language skills

Unit	Description	Instructional Hours
I	Lessons on excellence Skill introspection, Skill acquisition, consistent practice	2
II	Logical Reasoning Problem Solving - Critical Thinking- Lateral Thinking - Coding and Decoding – Series – Analogy - Odd Man Out - Visual Reasoning - Sudoku puzzles - Attention to detail	11
III	Quantitative Aptitude Addition and Subtraction of bigger numbers - Square and square roots - Cubes and cube roots - Vedic maths techniques - Multiplication Shortcuts - Multiplication of 3 and higher digit numbers – Simplifications - Comparing fractions - Shortcuts to find HCF and LCM - Divisibility tests shortcuts - Algebra and functions	11
IV	Recruitment Essentials Resume Building - Impression Management	4
V	Verbal Ability Nouns and Pronouns – Verbs - Subject-Verb Agreement - Pronoun- Antecedent – Agreement - Punctuations	4
Total Instructional Hours		30

After completion of the course the learner will be able to

- Course Outcome
- CO1: Students will analyze interpersonal communication skills. public speaking skills.
CO2: Students will exemplify tautology, contradiction and contingency by logical thinking.
CO3: Students will be able to develop an appropriate integral form to solve all sorts of quantitative problems.
CO4: Students can produce a resume that describes their education, skills, experiences and measurable achievements with proper grammar, format and brevity
CO5: Students will be developed to acquire the ability to use English language with an error while making optimum use of grammar

REFERENCE BOOKS:

- R1** - Quantitative Aptitude – Dr. R S Agarwal
R2 -Speed Mathematics: Secret Skills for Quick Calculation - Bill Handley
R3 -Verbal and Non – Verbal Reasoning – Dr. R S Agarwal
R4- Objective General English – S.P.Bakshi


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அலகு I மொழி மற்றும் இலக்கியம்:

3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி

இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை:

3

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளூர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:

3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின்

விளையாட்டுகள்.

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்:

3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:

3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிக்கள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.


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1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருளை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.


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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22MC2092	HERITAGE OF TAMIL	2	0	0	0

The learner should be able to

- | | |
|---------------------|--|
| Course
Objective | <ol style="list-style-type: none"> 1. Introduce students to the great History of Tamil literature. 2. Establish the heritage of various forms of Rock art and Sculpture art. 3. To study and understand the various folk and Martial arts of Tamil culture 4. Introduce students to Ancient Tamil concepts to understand the richness of Tamil literature. 5. To learn about the various influences or impacts of Tamil language in Indian culture. |
|---------------------|--|

Unit	Description	Instructional Hours
I Language and Literature	Language families in India – Dravidian Languages – Tamil as a classical language – Classical Literature in Tamil- Secular nature of Sangam Literature – Distributive justice in Sangam Literature – Management principles in Thirukural – Tamil epics and impacts of Buddhism & Jainism in Tamil and Bakthi literature of Azhwars and Nayanmars – Forms of minor poetry – Development of Modern literature in Tamil – Contribution of Bharathiyar and Bharathidasan.	6
II Heritage _ Rock Art Paintings to Modern Art – Sculpture	Hero Stone to Modern Sculpture – Bronze icons – Tribes and their handcrafts - Art of temple car making – Massive Terracotta sculptures, Village deities, Thiruvalluvar statue at Kanyakumari, Making of musical instruments – Mridangam, Parai, Yazh and Nadhaswaram - Role of Temples in social and economic life of Tamils.	6
III Folk and Martial Arts	Therukoothu, Karagattam, Villupattu, Kaniyan koothu, Oyilattam, Leather puppetry, Silambattam., Valari Tiger dance – Sports and Games of Tamils.	6
IV Thinai Concept of Tamils	Flora and Fauna of Tamils – Aham and Puram Concept from Tholkappiyam and Sangam Literature – Aram concept of Tamils – Education and Literacy during Sangam Age - Ancient cities and ports of Sangam age – Export and Import during Sangam age – Overseas conquest of Cholas.	6
V Contribution of Tamils to Indian National Movement and Indian Culture	Contribution of Tamils to Indian freedom struggle – The cultural influence of Tamils over the other parts of India – Self respect movement – Role of Siddha Medicine in indigenous systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil books.	6
Total Instructional Hours		30

At the end of the course, the learner will be able to

- | | |
|-------------------|---|
| Course
Outcome | <p>CO1: Learn about the works pertaining to Sangam age</p> <p>CO2: Aware of our Heritage in art from Stone sculpture to Modern Sculpture.</p> <p>CO3: Appreciate the role of Folk arts in preserving, sustaining and evolution of Tamil culture.</p> <p>CO4: Appreciate the intricacies of Tamil literature that had existed in the past.</p> <p>CO5: Understand the contribution of Tamil Literature to Indian Culture</p> |
|-------------------|---|

TEXTBOOKS:

- T1: Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
- T2: Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
- T3: Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)(Published by: International Institute of Tamil Studies).

REFERENCEBOOKS:

- R1-The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)
- R2- Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
- R3-Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.


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Programme	Course Code	Course Title	L	T	P	C
BE/BTECH	22MC2093	SOCIAL SERVICES AND COMMUNITY DEVELOPMENT	1	0	0	1

The student should be able to

- Course Objectives:**
1. Acquire the knowledge and active participate in social service and community development activities.
 2. Understand the concept of disaster management and role of NCC cadets in disaster management..
 3. Understand the concept thinking and reasoning process..
 4. Understand about maps and use of bearing and service protector
 5. Know about the principles of flight and Aero foil structure and ATC procedures.

Unit	Description	Instructional Hours
	SOCIAL SERVICES AND COMMUNITY DEVELOPMENT	
I	Basics of social services and its need-Rural development programs-Contribution of youth towards social welfare - NGOs in social services-Swach bharrath Abhiyan - Social evils - Mission Indra danush - Beti bacho Beti pado - Digital awareness - Constitution day.	3
	DISASTER MANAGEMENT	
II	Organization of Disaster management –Types of emergencies –Natural and manmade disasters - fire service and fire fighting - prevention of fire.	3
	PERSONALITY DEVELOPMENT	
III	Introduction to personality development-public speaking Intra and Interpersonal skills –self awareness-critical thinking-Decision making and problem solving.	3
	MAPREADING	
IV	Types of maps - conventional signs - scales and Grid system - relief and contour gradient - cardinal points - Types of North - types of bearing and use of service protector –Prismatic compass and its uses –setting of map –finding North and own position.	3
	PRINCIPLES OF FLIGHT AND AIRMANSHIP	
V	Introduction to principle of flight - Forces acting on the aircraft - Angle of attack – Angle of incidence -Newton's –law of motion -Bernauli's theorem and Venturi effect - Aerofoil –Air field layout -ATC(Air Traffic Control)-circuit procedures-Aviation medicine.	3
Total Instructional Hours		15

After completion of the course the learner will be able to

- Course Outcome :**
- CO1:Perform the social services on various occasions for better community and social life
- CO2:Appreciate the need and requirement for disaster management and NCC role in disaster management activities.
- CO3:Definethinking,reasoning,criticalthinkingandcreativethinking
- CO4:Use of bearing and service protector and locate the places and objects on the ground.
- CO5:Understand the principles of flight and Aerofoil structure

Reference:

1. UGC and AICTE circulated syllabus.

TextBooks:

1. NCC cadet Guide(SD/SW) Army
2. NCC cadet Guide(SD/SW) Airforce.
3. ANOs Guide(SD/SW) by DG NCC, Ministryof Defence, NewDelhi
4. DigitalForumApp1.0&2.0,byDGNCC DGNCC, Ministry of Defence,NewDelhi


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21MA3102	FOURIER ANALYSIS AND TRANSFORMS (EEE, ECE, E&I, AGRI, BIO MEDICAL & FOOD TECHNOLOGY)	3	1	0	4

- Course Objectives
1. Analyze Fourier series which is central to many applications in engineering.
 2. Apply the effective tools for the solutions of one dimensional boundary value problems.
 3. Apply the effective tools for the solutions of two dimensional heat equations.
 4. Apply Fourier transform techniques in various situations.
 5. Analyze Z transform techniques for discrete time systems.

Unit	Description	Instructional Hours
I	FOURIER SERIES Dirichlet's conditions- General Fourier Series – Odd and Even Functions – Half range sine and cosine series – Change of Interval - Parseval's Identity - Harmonic analysis.	12
II	BOUNDARY VALUE PROBLEMS Classification of PDE - Solutions of one dimensional wave equation - One dimensional equation of heat conduction (excluding insulated edges).	12
III	TWO DIMENSIONAL HEAT EQUATIONS Steady state solution of two dimensional equation of heat conduction in infinite plate and semicircular plate.	12
IV	FOURIER TRANSFORMS Fourier Transform Pairs - Fourier sine and cosine transforms – Properties - Transforms of Simple functions – Convolution Theorem (Statement only) – Parseval's identity(Statement only).	12
V	Z - TRANSFORMS AND DIFFERENCE EQUATIONS Z- Transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem (excluding proof)– Solution of difference equations using Z – transform.	12
Total Instructional Hours		60

- Course Outcome
- CO1: Understand the principles of Fourier series which helps them to solve physical problems of engineering.
CO2: Employ Fourier series in solving the boundary value problems.
CO3: Understand Fourier series in solving the two dimensional heat equations.
CO4: Apply Fourier transform techniques which extend its applications.
CO5: Illustrate the Z- transforms for analyzing discrete-time signals and systems.

TEXT BOOKS:

- T1 Veerarajan. T, "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012
T2 Bali. N.P and Manish Goyal & Watkins, "Advanced Engineering Mathematics", 7th Edition, Laxmi Publications Pvt. Ltd, 2007

REFERENCE BOOKS :

- R1 C.Roy Wylie " Advance Engineering Mathematics" Louis C. Barret, 6th Edition, Mc Graw Hill Education India Private Limited, New Delhi 2003
R2 Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics Volume III", S.Chand & Company Ltd., New Delhi, 1996
R3 Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2018
R4 Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2018.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21EI3201	ELECTRONIC DEVICES AND CIRCUITS (COMMON TO EIE AND EEE)	3	1	0	4

- Course Objective
1. Recall the basics about the electronic devices.
 2. Interpret the structure, operation and characteristics of transistors.
 3. Analyze various configurations of BJT amplifiers.
 4. Infer the basic concepts of large signal amplifiers.
 5. Interpret the operations of feedback amplifiers and oscillators.

Unit	Description	Instructional Hours
I	SEMICONDUCTOR DIODE PN Junction Diode - Structure, Operation and V-I Characteristics, Ideal diode, Diode Current Equation, Application of Diode - Rectifiers: Half Wave and Full Wave Rectifier, with capacitive filters, Display devices – LED, laser diodes, Zener Diode: Characteristics, Zener as Regulator	12
II	TRANSISTORS Junction transistor - BJT: CE, CB and CC configurations, Transistor Biasing Circuits - JFET: Output and Transfer Characteristics, Structure, Operation and Characteristics, of MOSFET and UJT.	12
III	DESIGN AND ANALYSIS OF SMALL SIGNAL AMPLIFIER BJT - Transistor Modeling, Hybrid Equivalent Circuit, Small Signal Analysis - Low Frequency Model: CE, CB, CC configurations, Darlington connections, Differential Amplifier - A.C and D.C Analysis, Single Tuned Amplifiers.	12
IV	LARGE SIGNAL AMPLIFIERS Classification of Power Amplifiers, Efficiency of Class A Amplifier, Class B Complementary – Symmetry and Class C - operation, Push - Pull Power Amplifiers- Calculation of Power Output, Efficiency and Power Dissipation - Crossover Distortion.	12
V	FEEDBACK AMPLIFIERS AND OSCILLATORS Advantages of Negative Feedback - Voltage / Current, Series, Shunt Feedback - Positive Feedback - Condition for Oscillations, RC Phase Shift - Wien bridge, Hartley, Colpitts and Crystal Oscillators.	12
Total Instructional Hours		60

- Course Outcome
- CO1: Apply the knowledge acquired about electronic devices.
 - CO2: Summarize the concepts of transistors.
 - CO3: Transform the acquired skill in designing a circuit.
 - CO4: Illustrate the nature of large signal amplifiers.
 - CO5: Outline the concepts of feedback amplifiers, conditions for oscillation and types of oscillators

TEXT BOOKS:

- T1 - David A. Bell, "Electronic Devices and Circuits", 5th Edition, Prentice Hall Publications, 2008.
T2-S.Salivahanan, "Electronic Devices and Circuits", 3rd Edition, Tata McGraw-Hill Education, 2012.

REFERENCE BOOKS:

- R1-Rashid, "Microelectronic Circuits: Analysis & Design" 2nd Edition, CL Engineering publishers, 2010.
R2-A P Godse, U A Bakshi, "Electronic Devices and Circuits", Technical Publications, 2017.
R3-Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2006.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21EI3202	SENSORS AND TRANSDUCERS	3	0	0	3

- Course Objective
1. Recall the fundamentals of Measurement System.
 2. Infer various resistive Transducers Operation with Industrial Parameters Measurement.
 3. Discuss the Principle of Working of various Inductive Transducers.
 4. Apply the Capacitive Transducer Working principle on Industrial Parameters Measurement.
 5. Illustrate the function of various Miscellaneous Transducers and Sensors.

Unit	Description	Instructional Hours
	IMPACT OF MEASUREMENTS AND CHARACTERISTICS OF MEASUREMENTS	
I	Generalized Measurement system - Methods of measurements - Units and standards - Errors in measurement - Characteristics of Transducer - Calibration methods - Statistical error analysis. Classification of Transducers - Mathematical Model of Transducer - Zero, First and Second order Transducer - Response to Impulse, Step, Ramp and Sinusoidal inputs.	9
	RESISTIVE TRANSDUCERS	
II	Resistance transducer - Principle of operation, construction, characteristics and application of Potentiometer, Strain Gauge, Thermistor, Resistance Temperature Detector, Thermocouple, Hot Wire Anemometer.	9
	INDUCTIVE TRANSDUCERS	
III	Inductance transducer- Principle of operation, construction, characteristics and application of LVDT, RVDT, Synchros, Variable Reluctance Transducer, Eddy Current Transducer.	9
	CAPACITIVE TRANSDUCERS	
IV	Capacitance Transducer - Variable Area Type, Variable Air Gap Type - Variable Permittivity Type; Capacitive Microphone - Frequency Response - Applications: Measurement of Pressure, Level, Thickness, Moisture and Density.	9
	MISCELLANEOUS TRANSDUCERS AND SENSORS	
V	Hall Effect Transducer - Piezoelectric Transducer - Magnetostrictive Transducer - Digital Transducer-Smart Sensors - Proximity Sensor - SQUID Sensor - Biosensors - IC Sensors - Safety Sensor : fire, smoke and gas leakage detection.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Definition of errors, error analysis and characteristics response of different order transducers.
CO2: In-depth knowledge about resistive transducers.
CO3: Outline an adequate knowledge about various inductive transducers.
CO4: Make use of capacitive transducers on industrial parameters measurement.
CO5: Summarize the role of different industrial transducers and sensors.

TEXT BOOKS:

- T1 - Sawhney. A.K, "A Course in Electrical and Electronics Measurements and Instrumentation", 19th Edition, Dhanpat Rai & Company Private Limited, 2011.
T2 - Renganathan. S, "Transducer Engineering", Allied Publishers, Chennai, 2003.

REFERENCE BOOKS:

- R1 - Ernest O.Doebelin, "Measurement systems", 6thEdition, Tata McGraw Hill, New Delhi, 2011.
R2 - Patranabis. D, "Sensors and Transducers", Prentice Hall of India, 2003.
R3 - Patranabis. D, "Principles of Industrial Instrumentation", Tata McGraw Hill, New Delhi, 2010.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21ME3231	FLUID MECHANICS AND THERMAL ENGINEERING	3	0	0	3

- Course Objective
1. To learn the fundamentals of fluids and its flow.
 2. To gain knowledge on hydraulic equipments.
 3. To impart knowledge basics of thermodynamics and its laws.
 4. To study the concepts of gas and vapour power cycles.
 5. To learn about thermal equipments.

Unit	Description	Instructional Hours
I	INTRODUCTION TO FLUIDS Dimensions - Properties of fluids– Equation of continuity, Momentum equation and Bernouli equation. Flow through pipes, Major and Minor loss, Flow measurements. Simple problems on flow losses and flow measurements.	9
II	FLUID MACHINES Pumps-types, performance, applications, selection, simple problems on power calculations. Hydraulic turbines- types, performance, applications and calculations.	9
III	FUNDAMENTALS OF THERMODYNAMICS Basic concepts - Zeroth law of thermodynamics. First Law and second Law of Thermodynamics- Application of laws for closed and open systems. Simple problems on energy calculations.	9
IV	GAS AND VAPOUR POWER CYCLES Gas cycles- Otto, Diesel, Semi Diesel and joule cycles. Vapour cycles- Rankine cycle, Reheat cycle. Simple problems on cycle analysis.	9
V	THERMAL EQUIPMENTS Boiler, steam turbines, compressors, fans, blowers, chillers, cooling Towers – Types and working principle.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Understand the fluid properties and its applications.
CO2: Quantify the energy conversion in various hydraulic systems.
CO3: Understand the thermodynamic principles and its applications.
CO4: Understand the process of air standard cycles.
CO5: Understand about the performance of Thermal and fluid machineries.

TEXT BOOKS:

- T1 -Bansal R.K., “Fluid Mechanics and Hydraulic Machine”s, 10thEd, Laxmi Publications, Delhi, 2018.
T2 -Rajput R.K., “Thermal Engineering”, 10thEdition, Laxmi Publication, Delhi, 2018.

REFERENCE BOOKS:

- R1 -Yahya S.M., “Turbines, Compressors and Fans”, 4thEdition, McGraw-Hill Education 2017.
R2 -Nag P.K., “Basic and Applied Thermodynamics”, 2ndEdition, Tata McGraw Hill Publication, 2017.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21EI3251	ELECTRICAL AND ELECTRONIC MEASUREMENTS (COMMON TO EIE AND EEE)	2	0	2	3

- Course Objective
1. Understand the Basics of Electrical Measuring Instruments.
 2. Examine the Various Bridges used for Measuring Electrical Parameters.
 3. Describe the Analog and Digital Electronic Instruments and it's Working
 4. Illustrate the function of Cathode Ray oscilloscope and Signal Generators.
 5. Outline Smart Instrumentation and Display Devices.

Unit	Description	Instructional Hours
	MEASUREMENT SYSTEM AND MEASURING INSTRUMENTS Generalized Measurement system, Classification of instruments, Error in measurement, Classification of errors.	
I	Principle, Construction, Operation of Moving Coil and Moving Iron Instruments - Ammeters and Voltmeters - Single phase Watt meters and Energy Meters - D.C & A.C Potentiometers - Instrument Transformers- Instruments for Measurement of Frequency and Phase- Calibration of watt meter.	6+3
	MEASUREMENT OF R,L,C USING BRIDGES D.C Bridges: Wheatstone - Kelvin double bridge- Megger – A.C Bridges: Anderson Bridge – Maxwell Bridge- Hay's Bridge and Schering bridge - Measurement of Unknown Capacitance using Schering Bridge.	6+3
	ELECTRONIC INSTRUMENTS Analog Meters: D.C Ammeter and Voltmeters - Multimeter - Q meter - True RMS Meter - Vector Impedance Meter - RF Voltage and Power Measurements - Instrumentation Amplifier. Digital Meters: Digital Tachometer – DMM-ADC: Successive Approximation, Dual Slope – DAC:Weighted Resistor, R-2R Ladder type- Digital Frequency Counters - LCR meter- Calibration of DC Ammeter and DC Voltmeter.	6+3
	DIGITAL STORAGE OSCILLOSCOPE AND SIGNAL GENERATORS Analog Storage Oscilloscope - Sampling Oscilloscopes - Digital Storage Oscilloscopes - Sine Wave Generator - Sweep Frequency Generator, Pulse and Square Wave Generator - Wave Analyzer: Harmonic Distortion Analyzer - Spectrum Analyzer- Measurement of frequency and voltage at different ac inputs using DSO.	6+3
	SMART INSTRUMENTS AND RECORDERS Serial, Parallel ports, USB–IEEE 488- Applications of Digital Instruments- Elements of Data Acquisition - Smart Sensor. Acquiring and Generating Signals using DAQ Card. Recording Devices: X-Y Plotters, Magnetic Tape Recording - Data Loggers- Display Devices: LED, LCD.	6+3
Total Instructional Hours		45

- Course Outcome
- CO1: Definition of errors, error analysis and characteristics response of different order transducers.
- CO2: In-depth knowledge about resistive transducers.
- CO3: Outline an adequate knowledge about various inductive transducers.
- CO4: Make use of capacitive transducers on industrial parameters measurement.
- CO5: Summarize the role of different industrial transducers and sensors.

TEXT BOOKS:

- T1 - Sawhney. A.K, "A Course in Electrical and Electronics – Measurement and Instrumentation", 19th Edition, Dhanpat Rai & Sons, 2014.
- T2 - Albert D. Helfrick and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2008.

REFERENCE BOOKS:

- R1 - J. B. Gupta, "A Course in Electronic and Electrical Measurements", S. K. Kataria & Sons, 2003.
- R2 - Kalsi.H.S, "Electronic Instrumentation", Tata McGraw Hill, 2010.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21EI3001	ELECTRONIC DEVICES AND CIRCUITS LABORATORY (COMMON TO EIE AND EEE)	0	0	3	1.5

Course Objective
 1. Apply the knowledge gained in designing basic electronic circuits
 2. Develop feedback amplifiers and oscillators
 3. Construct and test the power supply circuits.

Expt. No. Description of the Experiments

1. Characteristics of
 - a. Semi conductor diode
 - b. Zener diode
2. Characteristics of a NPN Transistor under
 - a. Common Emitter Configuration
 - b. Common Collector Configuration
 - c. Common Base Configurations
3. Characteristics of JFET & SCR
4. Characteristics of UJT
5. Implementation of Relaxation Oscillator
6. Frequency response characteristics of a Common Emitter amplifier
7. Construct and analyze the Current series Feedback Amplifier.
8. Develop and testing of transistor RC phase shift oscillator
9. Characteristics of photo diode and photo transistor
10. Construct and testing of Single Phase half-wave rectifier
11. Construct and testing Single Phase full wave rectifier

Total Practical Hours 45

Course Outcome
 CO1: Understand the characteristics of semiconductor devices.
 CO2: Develop various electronic circuit configurations.
 CO3: Demonstrate the frequency response of amplifiers.
 CO4: Examine the current series feedback amplifier and RC phase shift oscillator.
 CO5: Construct and testing the of rectifier circuits.

REFERENCES:

- R1. Poornachandra Rao S. and Sasikala B., —Handbook of experiments in Electronics and Communication EngineeringI, Vikas Publishing House Pvt. Ltd., New Delhi, 2007.
- R2. Laboratory manual prepared by the Department of Electronics and Instrumentation Engineering, 2016.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21MC3191	INDIAN CONSTITUTION	2	0	0	0

Course Objective	Objectives
	<ol style="list-style-type: none"> 1. Sensitization of student towards self, family (relationship), society and nature. 2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals. 3. Strengthening of self reflection. 4. Development of commitment and courage to act.

Unit	Description	Instructional Hours
	BASIC FEATURES AND FUNDAMENTAL PRINCIPLES	
I	Meaning of the constitution law and constitutionalism – Historical perspective of the constitution of India – salient features and characteristics of the constitution of India.	4
	FUNDAMENTAL RIGHTS	
II	Scheme of the fundamental rights – fundamental duties and its legislative status – The directive principles of state policy – its importance and implementation - Federal structure and distribution of legislative and financial powers between the union and states.	4
	PARLIAMENTARY FORM OF GOVERNMENT	
III	The constitution powers and the status of the president in India. – Amendment of the constitutional powers and procedures – The historical perspective of the constitutional amendment of India – Emergency provisions : National emergency, President rule, Financial emergency.	4
	LOCAL GOVERNANCE	
IV	Local self government -constitutional scheme of India – Scheme of fundamental right to equality – scheme of fundamental right to certain freedom under article 21 – scope of the right to life and personal liberty under article 21.	4
	INDIAN SOCIETY	
V	Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.	4
Total Instructional Hours		20

Course Outcome	CO1: Understand the functions of the Indian government
	CO2: Understand and abide the rules of the Indian constitution.

TEXT BOOKS:

- T1- Durga Das Basu, “Introduction to the Constitution of India”, Prentice Hall of India, New Delhi, 2197.
T2- R.C.Agarwal, “Indian Political System”, S.Chand and Company, New Delhi.2197.
T3-Maciver and Page, “ Society: An Introduction Analysis”, Laxmi Publications,2007.
T4-K.L.Sharma, “Social Stratification in India: Issues and Themes”,SAGE Publications Pvt. Ltd, 2197.

REFERENCE BOOKS:

- R1-Sharma, Brij Kishore, “ Introduction to the Constitution of India”, Prentice Hall of India, New Delhi,2017.
R2-U.R.Gahai, “Indian Political System “, New Academic Publishing House, Jalaendhar,2198.
R3-R.N. Sharma, “Indian Social Problems “, Media Promoters and Publishers Pvt. Ltd.2182.


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Course code

21HE3072

Pre-requisite

Course title

CAREER GUIDANCE LEVEL III
Personality, Aptitude and Career Development

None

L T P C
2 0 0 0

Syllabus version
1

Course Objectives:

- Solve Logical Reasoning questions of easy to intermediate level [SLO 6]
- Solve Quantitative Aptitude questions of easy to intermediate level [SLO 7]
- Solve Verbal Ability questions of easy to intermediate level [SLO 8]
- Display good writing skills while dealing with essays [SLO 12]

Expected Course Outcome:

Enable students to solve Aptitude questions of placement level with ease, as well as write effective essays.

Student Learning Outcomes (SLO): 6, 7, 8, 12

Module:1 Logical Reasoning
Clocks, calendars, Direction sense and Cubes

6 hours

SLO:6

- Clocks
- Calendars
- Direction Sense
- Cubes

Data interpretation and Data sufficiency

- Data Interpretation – Tables
- Data Interpretation - Pie Chart
- Data Interpretation - Bar Graph
- Data Sufficiency

Module:2 Quantitative Aptitude
Time and work

7 hours

SLO: 7

- Work with different efficiencies
- Pipes and cisterns
- Work equivalence
- Division of wages

Time, Speed and Distance

- Basics of time, speed and distance
- Relative speed
- Problems based on trains
- Problems based on boats and streams
- Problems based on races

Profit and loss, Partnerships and averages

- Basic terminologies in profit and loss
- Partnership
- Averages
- Weighted average


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Module:3 Verbal Ability

5 hours

SLO: 8

Sentence Correction

- Subject-Verb Agreement
- Modifiers
- Parallelism
- Pronoun-Antecedent Agreement
- Verb Time Sequences
- Comparisons
- Prepositions
- Determiners

Sentence Completion and Para-jumbles

- Pro-active thinking
- Reactive thinking (signpost words, root words, prefix suffix, sentence structure clues)
- Fixed jumbles
- Anchored jumbles

Module:4 Writing skills for placements

2 hours

SLO: 12

Essay writing

- Idea generation for topics
- Best practices
- Practice and feedback

Total Lecture hours: 20 hours

Mode of Evaluation: Assignments, 3 Assessments with End Semester (Computer Based Test)


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21HE3073	LEADERSHIP MANAGEMENT SKILLS	1	0	0	0

Course Objective`

1. To know about the leadership skills that is to be acquired for success.
2. To become a teamwork expert, real world problem solver, your views will be challenged
3. To gain global perspective and becoming an effective communicator
4. To understand about learning, negotiation and decision making
- 5: To get first hand information about the skills we possess and to work on improvement.

Module	Description	Instructional Hours
1.	Strategic thinking skills	
2.	Planning and Delivery skills	
3.	People management skills (Delegation)	
4.	Change management and Innovation skills	
5.	Communication skills	
6.	Persuasion and influencing skills	
7.	Learning Agility	
8.	Motivation	
9.	Personality	
10.	Emotions	
11.	Perception	
12.	Negotiation	
13.	Decision making	
14.	Problem solving	
15.	Building trust	

Total Instructional Hours 15

Course Outcome`

CO1: To practice essential leadership skills in day to day operations
CO2: To work on leadership skills in the study environment
CO3: To understand and develop the skills consciously.
CO4: To know about the real worth of all the skills for success
CO5: To Analyze the real worth of the person and suggestion for improvement

TEXT BOOKS

T1: A REVIEW OF LEADERSHIP THEORY AND COMPETENCY FRAMEWORKS, Bolden, R., Gosling, J., Marturano, A. and Dennison, P. June 2003
T2: LEADING FROM WITHIN: Building Organizational Leadership Capacity-David R. Kolzow, PhD, 2014

REFERENCE BOOKS

R1: Seven habits of highly effective people – Stephen R.Covey
R2: The Art of Business Leadership: Indian Experiences – G.Balasubramaniam
R3: DEVELOPING the LEADER WITHIN YOU-JOHN C. MAXWELL


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SEMESTER IV

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21MA4101	NUMERICAL METHODS (COMMON TO AERO, AUTO, MECH, MCTS,EEE & EIE)	3	1	0	4

Course Objectives

1. Solve algebraic, transcendental and system of linear equations by using various techniques.
2. Analyze various methods to find the intermediate values for the given data.
3. Explain concepts of numerical differentiation and numerical integration of the unknown functions.
4. Explain single and multi-step methods to solve Ordinary differential equations
5. Describe various methods to solve ordinary differential equations and partial differential equations.

Unit	Description	Instructional Hours
I	SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS Solution of Algebraic and Transcendental equations: Newton Raphson method . Solution of linear system: Gauss Elimination - Gauss Jordan method -Gauss seidel method. Matrix inversion by Gauss Jordan method.	12
II	INTERPOLATION Interpolation - Newton’s forward and backward difference formulae – Newton’s divided difference formula and Lagrangian interpolation for unequal intervals.	12
III	NUMERICAL DIFFERENTIATION AND INTEGRATION Numerical Differentiation: Newton’s forward and backward interpolation formulae for equal intervals –Newton’s divided difference formula for unequal intervals. Numerical integration: Trapezoidal and Simpson’s 1/3 rule - Double integration using Trapezoidal and Simpson’s rules.	12
IV	INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS Single step methods for solving first order equations: Taylor’s series method – Euler and Modified Euler methods – Fourth order Runge-kutta method -Multi step method: Milne’s predictor and corrector method.	12
V	BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS Solution of second order ordinary differential equation by Finite difference method – Solution of partial differential equation: one dimensional heat equation by Bender schmidt method – One dimensional Wave equation by Explicit method– Poisson Equations by Finite difference method.	12
Total Instructional		60

Hours

- CO1: Solve the system of linear algebraic equations which extends its applications in the field of engineering
- Course Outcomes
- CO2: Apply various methods to find the intermediate values for the given data.
- CO3: Identify various methods to perform numerical differentiation and integration
- CO4: Classify and solve ordinary differential equations by using single and multi step methods.
- CO5: Illustrate various methods to find the solution of ordinary and partial differential equations.

TEXT BOOKS:

- T1 - Erwin Kreyszig, “Advanced Engineering Mathematics”, 10th Edition, Wiley India Private Ltd., New Delhi, 2018.
- T2 - Kreyszig, E. “Advanced Engineering Mathematics”, Tenth Edition, John Wiley and sons (Asia) limited, 2017


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REFERENCE BOOKS :

- R1 - M.K.Jain,S.R.K.Iyengar, R.K.Jain “Numerical methods for Scientific and Engineering Computation”, Fifth Edition, New Age International publishers 2010.
- R2- Grewal B.S. and Grewal J.S. “Numerical Methods in Engineering and Science “, 6th Edition , Khanna publishers, New Delhi 2015.
- R3 - S.K.Gupta, Numerical Methods for Engineers”, New Age International Pvt.Ltd Publishers, 2015.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21EI4201	ELECTRICAL MACHINES	3	1	0	4

- Course Objective
1. Understand the principles of operations of Electrical Machines
 2. Define the construction details of Transformers
 3. Understand the construction of AC Electrical Machines
 4. Outline the phasor diagram of Various Machines
 5. Illustrate the function of various Special Electrical Machines

Unit	Description	Instructional Hours
	D.C. MACHINES	
I	D.C. Generator - Principle of Operation and Construction of DC Generator - EMF Equation - Characteristics - Armature Reaction - Commutation. D.C. Motor - Types - Torque Equation - Characteristics - Starting and Speed Control of D.C. Motor.	12
	TRANSFORMERS	
II	Principle - Theory of ideal transformer - EMF equation - Construction details of shell and core type transformers - Tests on transformers - Equivalent circuit - Phasor diagram - Regulation and efficiency of a transformer - Introduction to three-phase transformer connections.	12
	SYNCHRONOUS MACHINES	
III	Synchronous Generator - Principle of operation and construction - types - EMF Equation - Vector diagram. Synchronous motor- Starting Methods - Torque equation - V curves - Speed control - Hunting.	12
	INDUCTION MACHINES	
IV	Three phase Induction Motor-Principle of Operation - Types - Torque-Slip and Torque-Speed Characteristics - Starting Methods and Speed Control of Induction Motors - Single Phase Induction Motors - Introduction to Induction Generators.	12
	SPECIAL ELECTRICAL MACHINES (QUANTITATIVE TREATMENT ONLY)	
V	Repulsion Type Motor - Universal Motor - Hysteresis Motor - Switched Reluctance Motor - Brushless D.C Motor - Stepper Motor.	12
Total Instructional Hours		60

- Course Outcome
- CO1: State the principle of operation and construction of D.C. machines
CO2: Ability to write the transformers operation and construction
CO3: List the operation of synchronous machines
CO4: Explain the operation and control of induction machines
CO5: Illustrate the operation of special electrical machines

TEXT BOOKS:

T1 - Kothari D. P. and Nagrath I. J, "Electric Machines", Fourth Edition, McGraw Hill Education (India) Private Limited, 2015.

T2 - Deshpande M. V., "Electrical Machines", Prentice Hall of India Learning Pvt. Ltd., New Delhi, 2011.

REFERENCE BOOKS:

R1 - M.N.Bandyopadhyay, "Electrical Machines Theory and Practice", Prentice Hall of India Learning Pvt. Ltd., New Delhi, 2009.

R2 - B.L.Theraja and A.K.Theraja, "A Text Book of Electrical Technology" Volume II, S.Chand and Company, 2013.

R3 - C.A.Gross, "Electric Machines", CRC Press 2010.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21EI4202	INTEGRATED CIRCUITS AND ITS APPLICATIONS (COMMON TO EIE AND EEE)	3	0	0	3

Course Objective
1. Infer adequate knowledge on IC fabrication procedure. 2. Relate the characteristics of linear integrated circuits and their applications. 3. Apply OP-AMP on various applications like Timers, PLL circuits, ADC's and DAC's. 4. Impart the basic knowledge of regulator circuits and special function IC's 5. Summarize internal functional blocks of special function IC's.

Unit	Description	Instructional Hours
	IC FABRICATION	
I	Introduction - IC classification - chip size and circuit complexity - fundamental of monolithic IC technology - Silicon wafer preparation - Epitaxial growth – Oxidation - Photolithography - diffusion - Ion Implantation-Isolation Techniques-Metallization-Assembly Processing and packaging - Fabrication FET and CMOS.	9
	CHARACTERISTICS OF OP-AMP	
II	Basic information of OP-AMP – The Ideal OP-AMP characteristics - DC characteristics - AC characteristics - frequency response of OP-AMP - Slew Rate- Inverting and Non-inverting Amplifiers -Voltage Follower-Differential amplifier - Basic OP-AMP applications:Summer - Differentiator and Integrator - V/I & I/V converters- S/H circuit.	9
	APPLICATIONS OF OP-AMP	
III	Instrumentation amplifier - First order LPF - First order HPF - First order BPF and Band reject filters - Comparators - Multivibrators –Triangular wave generator – clippers – clampers - peak detector- - D/A converter : R- 2R ladder and weighted resistor types - A/D converters : Successive Approximations- Dual Slope.	9
	SPECIAL IC's	
IV	Functional block- characteristics & application circuits with IC 555 Timer - Application: Missing pulse detector, PWM, FSK Generator, PPM, SCHMITT Trigger - IC566 voltage controlled oscillator - IC565 - Phase Lock Loop IC - PLL application: frequency multiplication/division, AM Detection.	9
	APPLICATION IC's	
V	IC voltage regulators – LM78XX - 79XX Fixed voltage regulators - 723 General purpose regulator - switching regulator - Opto Coupler IC's- IC8038 function generator.	9
Total Instructional Hours		45

Course Outcome
CO1: Interpret the IC fabrication procedure.
CO2: Analyze the characteristics of operational amplifiers.
CO3: Outline the applications of OP-AMP.
CO4: Understand the working principle of special IC's.
CO5: Outline the function of voltage regulator as special IC's.

TEXT BOOKS:

- T1- D. Roy Choudhary, Shail B. Jain, "Linear Integrated Circuits", 5th Edition, New Age Publishers, 2018.
 T2-S Salivahanan, V S Kanchana Bhaaskaran, "Linear Integrated Circuits", 2nd Edition, TMH, 2017.

REFERENCE BOOKS:

- R1-Ramakant A. Gayakward, "Op-amps and Linear Integrated Circuits", IV edition, Pearson Education, 2015.
 R2-Robert F. Coughlin, Fredrick F. Driscoll, "Op-amp and Linear ICs", PHI Learning, 6th Edition, 2000.
 R3-Floyd, Buchla, "Fundamentals of Analog Circuits", Pearson, 2013.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21EI4203	INDUSTRIAL INSTRUMENTATION-I	3	0	0	3

- Course Objective
1. Infer the Concepts of Speed, Force and Torque Measurements in Instrumentation.
 2. Discuss the Methods of Acceleration, Vibration, Density and Viscosity Measurements.
 3. Illustrate Various Pressure Measurement Instruments.
 4. Demonstrate Various Temperature Measuring Instruments.
 5. Outline the Methods used for the Measurement of Temperature

Unit	Description	Instructional Hours
	PRESSURE MEASUREMENT	
I	Terminologies–Units - Manometer types – Elastic elements: Bourdon tube-Bellows- Diaphragm. Electrical Methods: elastic elements with LVDT and strain gauges-capacitive type pressure gauge -piezo resistive pressure sensors- Low pressure measurement: McLeod gauge-thermal conductivity gauges-Ionization gauge-Cold cathode and hot cathode types – Testing and calibration of pressure gauges: Dead weight tester.	9
	LEVEL MEASUREMENT	
II	Units - Sight glass – dip stick - Float type - level measurement in open and closed head tanks - bubbler method- differential pressure method- Mounting Issues - Purge system - Electrical methods of level measurement using resistance, capacitance, nuclear radiation and ultrasonic sensors - radar- tuning fork and displacer methods - Level switches.	9
	TEMPERATURE MEASUREMENT	
III	Units - Filled-in systems: Different types, sources of errors and their compensation, Bimetallic thermometer, Electrical methods of temperature measurement: RTD –Types of RTDs - 3 wire and 4 wire RTDs, thermistor – linearization, Diode type sensors - Integrated circuit sensors – Temperature switches and thermostats.	9
	THERMOCOUPLES AND RADIATION PYROMETERS	
IV	Thermocouple – Laws and types of thermocouple - fabrication of industrial thermocouples, signal conditioning, cold junction compensation, Thermocouple burnout detection, special techniques for measuring high temperature using thermocouples – Radiation methods of temperature measurement: Radiation fundamentals - Radiation pyrometers – Total radiation pyrometers, optical radiation pyrometers – ultrasonic thermometers – fiber optic temperature measurement.	9
	MEASUREMENT OF VISCOSITY, HUMIDITY, DENSITY AND MOISTURE	
V	Units- Viscosity -terminologies - Say bolt viscometer – rotameter type viscometer – humidity terms – dry and wet bulb psychrometers - hotwire electrode type hygrometer-dew cell – electrolysis type hygrometer – density measurement using weight, buoyancy, hydrostatic head and radiation-moisture measurement – electrical methods.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Interpret the measurement of pressure in instrumentation
 - CO2: Choose the instruments used for the measurement of level.
 - CO3: Identify the methods used for the measurement of temperature
 - CO4: Choose the High temperature measuring instruments
 - CO5: Classify the Instruments used for measurement of Viscosity, Humidity, Density and Moisture

TEXT BOOKS:

- T1 - E.O. Doebelin, “Measurement Systems – Application and Design”, Tata McGraw Hill Ltd., 2011.
T2 - R.K. Jain, “Mechanical and Industrial Measurements”, Khanna Publishers, New Delhi, 2011.

REFERENCE BOOKS:

- R1 - D. Patranabis, “Principles of Industrial Instrumentation”, Tata McGraw Hill Ltd., 2011.
R2 - A.K. Sawhney and P. Sawhney, “A Course on Mechanical Measurements, Instrumentation and Control”, Dhanpat Rai and Co, 2011.
R3 - S.K. Singh, “Industrial Instrumentation and Control”, Tata McGraw Hill, 2011.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21EI4251	DIGITAL LOGIC CIRCUITS (COMMON TO EIE AND EEE)	2	1	2	4

Course Objective	Objectives
	1. To understand different methods used for the simplification of Boolean functions 2. To study combinational circuits 3. To learn synchronous sequential circuits. 4. To infer the concepts of asynchronous sequential circuits and Programmable Logic Devices 5. To interpret the fundamentals of HDL.

Unit	Description	Instructional Hours
	MINIMIZATION TECHNIQUES AND LOGIC GATES	
I	Boolean algebra and laws – Demorgan’s Theorem—Minimization of Boolean Expressions. Minterm - Maxterm- Sum of Product (SOP) – Product of Sum(POS) - Karnaugh map minimization - Don’t care conditions. Simplification of Boolean expressions using logic gates: NAND and NOR - Implementation of Boolean Functions using K-map.	9+3
	COMBINATIONAL CIRCUITS	
II	Analysis and design of combinational circuits- Adders, Subtractors, Multiplier, -Code converters – Magnitude comparator – Decoder and Encoder- Multiplexer and De-multiplexer - Experiment Analysis of Adder and Subtractor circuits.	9+3
	SYNCHRONOUS SEQUENTIAL CIRCUITS	
III	Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering. Asynchronous and Synchronous type - counters –Modulo counters, Shift registers. Design of synchronous sequential circuits – Moore and Melay models- state diagram-state reduction- state assignment. Implementation of Code converters: Excess-3 to BCD and vice-versa.	9+3
	ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABLE LOGIC DEVICES	
IV	Analysis of Asynchronous sequential logic circuits-Transition table, flow table - race conditions, hazards and errors in digital circuits. Introduction to Programmable Logic Devices: PROM – PLA – PAL - Experimental analysis of race conditions in digital circuits.	9+3
	HDL	
V	Introduction to Hardware Description Language. HDL for combinational circuits: Adders - Subtractors –Decoder and Encoder- Multiplexer and De-multiplexer. HDL for Sequential Circuits: flip-flops – counters- Registers - Implementation of Multiplexer and De-multiplexer.	9+3
Total Instructional Hours		60

Course Outcome	Outcomes
	CO1: Apply the knowledge acquired about Boolean functions. CO2: Summarize the concepts of combinational circuits. CO3: Transform the acquired skill in designing the synchronous sequential circuits. CO4: Ability to understand and analyze the asynchronous sequential circuits. CO5: Outline the concepts of HDL.

TEXT BOOKS:

- T1 - Raj Kamal, ‘Digital systems-Principles and Design’, Pearson Education 1st Edition, 2012.
- T2 - M. Morris Mano, ‘Digital Design with an introduction to the VHDL’, Pearson Education, 2013.

REFERENCE BOOKS:

- R1-Floyd and Jain, ‘Digital Fundamentals’, 8th edition, Pearson Education, 2003.
- R2-Anand Kumar, Fundamentals of Digital Circuits,PHI,2013.
- R3-Charles H.Roth,Jr,LizyLizy Kurian John, ‘Digital System Design using VHDL, Cengage,2013.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21EI4001	ELECTRICAL MACHINES LABORATORY	0	0	3	1.5

Course Objective	<ol style="list-style-type: none"> 1. Apply the knowledge gained to conduct load test on D.C Machines. 2. Exposed to the Load Test on Single and Three Phase Induction Motor. 3. Familiar with the Operation of Starters.
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Expt. No.	Description of the Experiments
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- | | |
|-----|---|
| 1. | Open Circuit and Load Characteristics of Separately excited D.C. Shunt Generator. |
| 2. | Load Test on D.C. Shunt Motor. |
| 3. | Load Test on D.C. Series Motor. |
| 4. | Load Test on D.C. Compound Motor. |
| 5. | Swinburne's Test |
| 6. | Speed Control of D.C. Shunt Motor. |
| 7. | Load Test on Single Phase Transformer |
| 8. | Open circuit and Short Circuit test on Single Phase Transformer. |
| 9. | Load Test on Single Phase Induction Motor. |
| 10. | Load Test on Three phase Induction Motor. |
| 11. | Study of Starters |

Total Practical Hours 45

Course Outcome	<p>CO1: Demonstrate the principle of DC generators, DC motors.</p> <p>CO2: Explain the principle and to conduct test on transformers.</p> <p>CO3: Validate suitable test to compute the characteristics of motors.</p> <p>CO4: Establish suitable experiments on generators.</p> <p>CO5: Demonstrate about starting methods of motors.</p>
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REFERENCES:

- R1-Gupta B R, and Vandana Singhal, "Fundamentals of Electrical Machine", New Age International Publishers, Third Edition, 2010.
- R2- Laboratory manual prepared by the Department of Electronics and Instrumentation Engineering, 2016.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21EI4002	INTEGRATED CIRCUITS LABORATORY (COMMON TO EEE AND EIE)	0	0	3	1.5

Course Objective	1. Understand the performance characteristics of Op-amp. 2. Implement of Op-amp applications. 3. Construct and test waveform generation circuits
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S.No Description of the Experiments

1. Performance characteristics of Op-Amp IC.
2. Implementation of inverting and non-inverting amplifiers using Op-Amp.
3. Construct and testing of Adder and Subtractor using Op-Amp.
4. Implementation of differential amplifier and voltage follower using Op-Amp.
5. Implementation of Integrator and Differentiator using Op-Amp.
6. Frequency response characteristics of first order low pass and high pass filters.
7. Construct and testing of D/A and A/D Converter.
8. Construct and testing Astable and Monostable multivibrator using IC 555 timer.
9. Implementation of Schmitt Trigger.
10. Construct and testing of Regulated DC power supply using IC 723.
11. Study of VCO and PLL ICs.

Total Practical Hours 45

Course Outcome	CO1: Understand the performance characteristics of Op-amp. CO2: Implementation of various applications of Op-amp. CO3: Understand the performance of filters and converters. CO4: Construct multivibrator and regulated power supply circuits using IC CO4: Assimilate the knowledge on VCO and PLL ICS.
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REFERENCES:

- R1- Ramakant A. Gayakwad, "Lab manual for Op-amps and Linear Integrated Circuits", Prentice Hall, 2010.
 R2- Laboratory manual prepared by the Department of Electronics and Instrumentation Engineering, 2016.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21MC4191	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE/ VALUE EDUCATION	2	0	0	0

Course Objective

1. The course aims at imparting basic principles of thought process, reasoning and inferencing.
2. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
3. Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
4. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view, basic principles of Yoga and holistic health care system, Indian philosophical traditions, Indian linguistic tradition and Indian artistic tradition.

Unit	Description	Instructional Hours
I	Basic Structure of Indian Knowledge System	4
II	Modern Science and Indian Knowledge System	4
III	Yoga and Holistic Health care	4
IV	Philosophical tradition	4
V	Indian linguistic tradition (Phonology, Morphology, Syntax and semantics), Indian artistic tradition and Case Studies.	4
Total Instructional Hours		20

Course Outcome

CO1: Ability to understand the structure of Indian system of life.
CO2: Connect up and explain basics of Indian Traditional knowledge in modern scientific perspective.

REFERENCE BOOKS:

- R1 -V.Sivaramakrishna (Ed.), "Cultural Heritage of India-Course Material", Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.
R2 - Swami Jitatananda, "Modern physics and Vedanta", Bharatiya Vidya Bhavan, 2186.
R3 - Fritjof Capra, The Tao of Physics
R4- Fritjof Capra, The wave of Life.
R5- V N Jha, Tarkasangraha of Annambhatta, International Chinmaya Foundation, Vellianad, Ernakulam.
R6- Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta.
R7- GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi, 2016.
R8- RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016.
R9- P R Sharma (English translation), Shodashang Hridayam.


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Course code	Course title	L	T	P	C
21HE4072	CAREER GUIDANCE LEVEL IV	2	0	0	0
Pre-requisite	Personality, Aptitude and Career Development	Syllabus version			
	None	1			

Course Objectives:

- Solve Logical Reasoning questions of easy to intermediate level [SLO 6]
- Solve Quantitative Aptitude questions of easy to intermediate level [SLO 7]
- Solve Verbal Ability questions of easy to intermediate level [SLO 8]
- Crack mock interviews with ease [SLO 13]
- Be introduced to problem-solving techniques and algorithms [SLO 14]

Expected Course Outcome:

Enable students to solve Aptitude questions of placement level with ease, as well as write effective essays.

Student Learning Outcomes (SLO): 6, 7, 8, 13, 14

Module:1 Logical Reasoning 3 hours SLO:6

Logical connectives, Syllogism and Venn diagrams

- Logical Connectives
- Syllogisms
- Venn Diagrams – Interpretation
- Venn Diagrams - Solving

Module:2 Quantitative Aptitude 6 hours SLO: 7

Logarithms, Progressions, Geometry and Quadratic equations

- Logarithm
- Arithmetic Progression
- Geometric Progression
- Geometry
- Mensuration
- Coded inequalities
- Quadratic Equations

Permutation, Combination and Probability

- Fundamental Counting Principle
- Permutation and Combination
- Computation of Permutation
- Circular Permutations
- Computation of Combination
- Probability

Module:3 Verbal Ability 2 hours SLO: 8

Critical Reasoning

- Argument – Identifying the Different Parts (Premise, assumption, conclusion)
- Strengthening statement
- Weakening statement
- Mimic the pattern


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Module:4 Recruitment Essentials

1 hour

SLO: 12

Cracking interviews - demonstration through a few mocks

Sample mock interviews to demonstrate how to crack the:

- HR interview
- MR interview
- Technical interview

Cracking other kinds of interviews

- Skype/ Telephonic interviews
- Panel interviews
- Stress interviews

Resume building – workshop

A workshop to make students write an accurate resume

Module:5 Problem solving and Algorithmic skills

8 hours

SLO: 12

- Logical methods to solve problem statements in Programming
- Basic algorithms introduced

Total Lecture hours: 20 hours

Mode of Evaluation: Assignments, Mock interviews, 3 Assessments with End Semester (Computer Based Test)

Recommended by Board of Studies

Approved by Academic Council

Date


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	21HE4073	IDEATION SKILLS	1	0	0	0

- Course Objective**
- To study the importance of ideation.
 - To learn about the various tools for Ideation.
 - To provide an insight in Prototyping and its significance.

Unit	Description	Instructional Hours
IDEATION: INTRODUCTION TO DESIGN THINKING METHODOLOGY		
I	Design Thinking Methodology and how it can be used as a powerful tool for developing new and innovative solutions - Inspiration – Implementation - Disruptive technology.	4
IDEATION: TOOLS FOR IDEATION		
II	Various resources to kindle new ideas for innovation. Explore the types of ideas in the past – Effect of the ideas and innovation of past on the world – Innovation Thinking – Case studies.	4
IDEATION: INTRODUCTION TO CUSTOMER DISCOVERY		
III	Intro to Customer Discovery - development of customer discovery plan that can lead to powerful business innovation - Customer Discovery Plan	4
PROTOTYPING AND PRODUCT IDEATION		
IV	Introduction to Prototyping - minimum viable product - High fidelity prototype vs low fidelity prototype – Prototyping tools	3
Total Instructional Hours		15

- Course Outcome**
- Upon completion of the course, students will be able to
- CO1: Develop a strong understanding and importance of ideation
CO2: Learn about the different kinds of tools for Ideation.
CO3: Learn the need and significance of prototyping and its significance.

TEXT BOOKS:

- T1 - Mark Baskinger and William Bardel, “Drawing Ideas: A Hand-Drawn Approach for Better Design”,2013
T2 - Nigel Cross, “Design Thinking”, Kindle Edition

REFERENCE BOOKS:

- R1 - Kurt Hanks and Larry Belliston, “Rapid Viz : A New Method for the Rapid Visualization of Ideas”, 2008.
R2 - Kathryn McElroy , “Prototyping for Designers: Developing the Best Digital and Physical Products”, 2017.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI5201	INDUSTRIAL INSTRUMENTATION-II	3	0	0	3

Course Objective	Objectives
	1. Understand the concepts of force and torque measurements.
	2. Illustrate the principle and operation of mechanical flow meter with installation techniques.
	3. Illustrate the operation of electrical and other flow meter.
	4. Discuss displacement and angle measuring Instruments.
	5. Outline the measurement concepts of speed, velocity, sound and overview of industrial hazards safety measures.

Unit	Description	Instructional Hours
	FORCE AND TORQUE MEASUREMENT	
I	Force (Weight) Measurement: Mechanical balances- Electromagnetic balances- Mechanical load cells – Elastic deflection force transducers – Gyroscopic & Vibrating wire force measurement- Nuclear radiation weight sensor. Torque measurement: Rotating torque, stationary and proximity sensors- Prony brake torque measurement. – DC cradled dynamometer torque measurement – Torsion bar torque meter.	9
	MECHANICAL FLOW MEASUREMENT	
II	Theory of fixed restriction variable head type flow meter- Orifice flow meter, Venturi tubes, Flow nozzle, Dall tube, - Installation of head flow meters.- Pitot tube - Differential pressure transmitters - Quantity meters, Inferential flow meters, Mass flow meters-Smart flow meter.	9
	ELECTRICAL FLOW MEASUREMENT	
III	Electromagnetic flow meter, Ultrasonic flow meter, Laser Doppler anemometer – Purge flow regulators, Cross correlation flow meter, Solid flow measurement, Vortex shedding flow meters – Flow switches – Anemometers –Mechanical anemometer. Flow meter calibration – Flow meter	9
	DISPLACEMENT & ANGLE MEASUREMENT	
IV	Classification – Plig and Snap gages, Vernier caliper, Dial indicator, Comparator, Optical Flats, Interferometer, Toolmakers microscope, Autocollimator, Coordinate autocollimator. Displacement transducer: Elastic, Sliding contact, Variable self inductance, Variable mutual inductance, LVDT, Rotational variable differential transformer. Angle measurement : Protractors, Sinebars, Goniometers, and Clinometers.	9
	MEASUREMENT OF SPEED, VELOCITY, SOUND AND SAFETY FOR HAZARDS.	
V	Hand held optical, stroboscopic, Eddy current drag cup tachometer. AC and DC tachometer generator. Induction and magnetic type speed sensor. Translational velocity transducer – Mechanical fly ball angular velocity. Sound parameters- Microphone , Sound level meter-Classification of Hazards & Occupancy hazards - Hazard of contents – Methods of Fire Fighting.	9
Total Instructional Hours		45

Course Outcome	Outcomes
	CO1: Identify the methods of force and torque measurements
	CO2: Understand the operation of mechanical flow meter.
	CO3: Understand the operation of electrical and other flow meter.
	CO4: Choose the instruments for displacement and angle measurement
	CO5: Differentiate the speed and velocity measuring instruments. Outline sound measurement.

TEXT BOOKS:

- T1 - E.O. Doebelin, "Measurement Systems – Application and Design", Tata McGraw Hill Ltd., 2011.
T2 - R.K. Jain, "Mechanical and Industrial Measurements", Khanna Publishers, New Delhi, 2011.

REFERENCE BOOKS:

- R1 - K.Krishnaswamy and S.Vijayachitra "Industrial Instrumentation", New Age International, 2010.
R2 - D. Patranabis, "Principles of Industrial Instrumentation", 3rd Edition Tata McGraw Hill Ltd.,2017.
R3 -Chennakesava R.Alavala, "Principles of Industrial Instrumentation and Control Systems", Cengage 2008.
R4- Bahadori, A.. Hazardous area classification in petroleum and chemical plants: a guide tomitigating risk, CRC Press,2013.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19E15202	CONTROL SYSTEMS	3	1	0	4

- Course Objective
1. Learn the basics of modeling of control systems and its components.
 2. Discuss time domain system analysis.
 3. Explain about frequency domain system analysis.
 4. Establish methods of stability analysis and controller compensators.
 5. Outline on state space and sampled data control systems.

Unit	Description	Instructional Hours
	CONTROL SYSTEMS MODELLING	
I	Basic elements in control system – Open loop and closed loop systems – Transfer Function models – Mechanical and Electrical systems – Analogies: Force – voltage, Force - current & Torque – voltage, Torque - current – Synchros – AC and DC servomotors.	12
	TIME DOMAIN ANALYSIS	
II	Block diagram reduction techniques – Signal flow graphs – Standard test signals – Order of a system –step, impulse response of first order systems – second order system – Time domain specifications – Static Error constants – Steady state error.	12
	FREQUENCY DOMAIN ANALYSIS	
III	Frequency response –Advantages – Frequency domain specifications – Bode plot – Polar plot – M and N Circles -Phase margin and gain margin - Correlation between frequency and time domain specifications.	12
	STABILITY AND COMPENSATOR DESIGN	
IV	Characteristics equation – Routh Hurwitz criterion – Relative and conditional stability, Root locus, construction, stability criterion - Effects of P,PI,PID controller modes– Applications of P,PI and PID controllers ,Compensator – Types – Lag, lead and lag-lead networks – Lag-Lead compensator design using Bode plot.	
	STATE MODELS AND SAMPLED DATA SYSTEMS	
V	Concept of state and state models – State models for linear and time invariant Systems – State model of Armature and Field control system –State feedback - Concept of Controllability and Observability.	12
	Introduction to digital control system, Introduction of Digital Controllers (Qualitative Treatment only).	
	Total Instructional Hours	60

- Course Outcome
- CO1: Apply the gained knowledge for modeling of mechanical, electrical control systems.
- CO2: Deduct the different order systems with various inputs and their response.
- CO3: Estimate the various frequency domain specifications by phase analysis.
- CO4: Investigate the control systems stability and compensator design.
- CO5: Develop a state models and discrete control systems for any application.

TEXT BOOKS:

- T1 - Nagarath, I.J. and Gopal, M., “Control Systems Engineering”, New Age International Publishers, 2017.
- T2 - Katsuhiko Ogata, “Modern Control Engineering”, PHI, 5th Edition, 2010.

REFERENCE BOOKS:

- R1 - Richard C. Dorf and Robert H. Bishop, “Modern Control Systems”, Prentice Hall of India, 2012.
- R2 - M.Gopal, “Digital Control and State Variable Methods”, Tata McGraw-Hill, New Delhi, 2003.
- R3- Nagoor Kani A “ Control Systems Engineering,” RBA publications, Chennai, 2006.
- R4-M.Gopal, “Control System: Principle and design”, McGraw Hill Education, 2012.

WEB REFERENCES:

1. <https://nptel.ac.in/courses/108/106/108106098/>
2. <https://nptel.ac.in/courses/108/102/108102043/>


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Programme	Course Code	Name of the course	L	T	P	C
B.E.	19EI5203	MICROPROCESSORS AND MICROCONTROLLERS (COMMON TO EEE AND EIE)	3	0	0	3

Course Objectives	Objectives
	1 Understand the fundamental components of 8085 architecture.
	2 Understand the concept of peripheral's interfacing with assembly language programming.
	3 Study the fundamental architecture of 8051 microcontroller and its programming concepts.
	4 Understand the fundamental and programming concepts of arduino uno controller.
	5 Learn the architecture study of advance microprocessors and microcontrollers.

Unit	Description	Instructional Hours
	Intel 8085 PROCESSOR	
I	8085 architecture– Pin diagram - Memory & I/O Interfacing – Interrupts - Vendors in microprocessors - Addressing Modes - Instruction set - Stack and Subroutine Instructions - Simple Assembly Language Programming	9
	8085 INTERFACING	
II	Study of Architecture and Programming of Peripheral IC's:8255 PPI, 8259 PIC, 8251 USART,8279 Keyboard Display Controller and 8253 Timer/ Counter - Interfacing with 8085:A/D & D/A converter.	9
	8051MICROCONTROLLER	
III	Functional block diagram - Instruction format and addressing modes – Interrupt structure – Timer –I/O ports –Interfacing: LED – 7 segment display – Keypad - Simple programming	9
	ARDUNIO UNO CONTROLLER	
IV	AVR Architecture – pin diagram – communication – Concept of digital and analogports – Arduino interfacing digital and analog and Sensors - Programming concepts IDE: Arduino data types – Variables and constants – Arrays and strings- Functions –Simple programming examples.	9
	MICROCONTROLLER APPLICATIONS	
V	Keyboard and Display interfacing, Closed Loop Control of Servo Motor, Stepper Motor and Washing Machine Control - Arduino based Control of Street Lights, Home Automation System and temperature controller-Introduction to Raspberry pi.	9
Total Instructional Hours		45

Course Outcomes	Outcomes
	CO1 Study the architecture of 8085 microprocessor and programming concept involved in 8085.
	CO2 Understand the commonly used peripheral/ interfacing IC's with its programming.
	CO3 Understand the architecture and programming concepts of 8051 microcontroller.
	CO4 Learn the advanced controller fundamentals and programming.
	CO5 Understand the applications and role of advanced microcontrollers.

TEXT BOOKS:

- T1 R. S. Gaonkar, "Microprocessor Architecture Programming and Application", Penram International Publishing Private limited, 6th edition, Oct 2013.
- T2 Jeremy Blum, "Exploring Arduino: Tools and Techniques for Engineering Wizardry", John Wiley & Sons, Inc.2nd Edition, Oct 2019.

REFERENCE BOOKS:

- R1 Muhammad Ali Mazidi, Janice GillispieMazidi, RolinD.Mckinlay, "The 8051 microcontroller and embedded systems using assembly and C", 2nd Edition, Pearson Education, 2011.
- R2 Krishna Kant, "Microprocessors and Microcontrollers", Prentice –Hall of India, New Delhi, 2017.
- R3 J. M. Hughes, "Arduino: A Technical Reference", 1st Edition, O'Reilly Media, Inc, USA, 2016.
- Simon Monk, "Programming Arduino Getting Started with Sketches", 1st Edition, McGraw-Hill Education, USA, 2012.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI5204	ANALYTICAL INSTRUMENTATION	3	0	0	3

- Course Objective
1. Understand various methods of analysis in electromagnetic spectrum.
 2. Study important methods of analysis of in chromatography.
 3. Interpret the fundamentals of industrial Gas Analyzers .
 4. Infer the knowledge about pH meters and safety Measures.
 5. Gain knowledge about Microscopic techniques.

Unit	Description	Instructional Hours
	SPECTROPHOTOMETERS	
I	Elements of Analytical Instruments - Beer-Lambert law - Single and double beam instruments- FTIR spectrophotometers - Flame photometers - Atomic absorption spectrophotometers – Raman Spectrometer- Sources and Detectors- UV, Visible, IR, FTIR spectrophotometers.	9
	CHROMATOGRAPHY	
II	Gas chromatography - Basic parts - Chromatographic column - Sources – Detectors – Liquid Chromatography - Types - Column chromatography- Thin layer Chromatography - Paper partition Chromatography-Applications - High pressure liquid chromatography.	9
	INDUSTRIAL GAS ANALYZERS	
III	Types of gas analyzers – Paramagnetic oxygen analyzer – Electrochemical methods – Infrared gas analyzers – Thermal conductivity analyzers – Analyzers based on gas density – Method based on ionization of gases-Sodium analyzer.	9
	pH METERS AND SAFETY MEASURES	
IV	Principle of pH measurement - Hydrogen electrode, Glass electrode, Reference electrode - Selective Ion electrode, ammonia electrodes – Safety Measures: Safety in handling of industrial gases and maintenance of the associated equipment and instruments.	9
	NUCLEAR MAGNETIC RESONANCE AND MICROSCOPIC TECHNIQUES	
V	Principle of NMR - Types - Construction and applications - Scanning Electron Microscope (SEM) - Basic principles, Instrumentation and applications. Transmission Electron Microscope (TEM) - Basic principles, Instrumentation and applications. Mass spectrometers - Types and applications.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Understand the principle of Spectrophotometers
CO2: Identify liquid and gas chromatographic techniques.
CO3: Gain knowledge about industrial gas analyzers.
CO4: Analyze pH measurements and Impart awareness on safety Measures
CO5: Explain the principle of nuclear magnetic resonance and microscopic techniques.

TEXT BOOKS:

T1 - R.S. Khandpur, “Handbook of Analytical Instruments”, McGraw Hill Education (India) Private Limited, Third edition, 2015.

T2 - Willard H.H., Merritt L.L., Dean J.A., and Settle F.A. “Instrumental Methods of Analysis”, 7th Edition, CBS Publishing & Distribution, New Delhi, 2012.

REFERENCE BOOKS:

R1 -Bela G. Liptak, “Process Measurement and Analysis”, Volume I, CRC Press, Forth edition, 2003.

R2 - G.W. Ewing, “Instrumental Methods of Analysis”, 6th Edition, Mc Graw Hill, 2007.

R3 -Braun, R.D., “Introduction to Instrumental Analysis”, Pharma Book Syndicate, Singapore, 2006.

R4-Robert E. Sherman., “Analytical Instrumentation”, Instruments Society of America, 1996.

WEB REFERENCE:

<https://nptel.ac.in/courses/103/108/103108100/>


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Programme	Course Code	Name of the course	L	T	P	C
B.E.	19EI5251	PROGRAMMABLE LOGIC CONTROLLERS AND SCADA	2	0	2	3

- Course Objectives
1. Understand the basics of PLC and its components.
 2. Infer the knowledge on developing PLC logical programs for various conditions.
 3. Introduce on various PLC program instruction sets.
 4. Establish the communication protocols used in PLC's.
 5. Cite the applications of PLC's in industrial automation.

Unit	Description	Instructional Hours
I	INTRODUCTION History and Evolution of PLC – need for PLC – PLC sizes – Scan time –PLC architecture – Hardware components: Analog and Discrete I/O modules – power supply –memory - PLC Interlocking – Latching relays.	6
II	PROGRAMMING OF PLC Basics of PLC programming – types: Ladder logics(LD),Functional block diagram(FBD),Sequential function chart(SFC),Structured Text(ST) and Instruction List(IL) PLC Timers: ON Delay, OFF Delay and Retentive Timers- Counters: UP Counter, DOWN Counter and UP DOWN Counters - ladder examples- Construct a PLC ladder program for parking garage counting.	6+3
III	PLC INSTRUCTIONS Program control instructions – Data handling and Data manipulation instructions - Math instructions - Sequencer and shift register – program subroutines - motor controls - Use of PC as PLC - programming examples - Construct a ladder diagram for Celsius temperature to Fahrenheit conversion- Construct PLC ladder logic to control temperature of Oven.	6+6
IV	PLC COMMUNICATION, SCADA AND DCS PLC communication ports – serial communications – RS232– communication between several PLCs – PLC field bus– PLC troubleshooting - Introduction to Supervisory control and data acquisition systems (SCADA) – RTU and Master station - DCS – architecture – DCS programming.	6
V	APPLICATIONS OF PLC IN INDUSTRIAL AUTOMATION PLC traffic light control – stepper motor control – Elevator control – Bottle filling system – Pneumatic Stamping system – PLC in process control systems. Need for automation in industries – Role of PLC and SCADA in industrial automation - Develop a PLC Program for automating bottle filling systems, Develop PLC ladder logic program to control the Speed of a motor.	9+3
Total Instructional Hours		45

- Course Outcomes
- CO1 Describe the architecture of PLCs with the analogy of relay logic components
 - CO2 Develop ladder logic program for any applications
 - CO3 Characterize the different instructions available in PLC and implement them.
 - CO4 Explain on SCADA, DCS and its networking with PLC.
 - CO5 Summarize the impact on PLC and SCADA for various industrial automation processes.

TEXT BOOKS:

- T1 - Frank D. Petruzella, “Programmable Logic Controllers”, McGraw-Hill, 3rdEdition, March 2013
- T2 - John W. Webb and Ronald A.Reis, “Programmable Logic Controllers – Principles and Applications”, Prentice Hall Inc., New Jersey, 5th Edition, 2002.

REFERENCE BOOKS:

- R1 –John R. Hackworth and Frederick D. Hackworth Jr, “Programmable Logic Controllers”, Pearson, 2004.
- R2- David Bailey, Edwin Wright, “Practical SCADA for Industry”, Elsevier, 2003.
- R3 – Michael P. Lukas, “Distributed Control Systems: Their Evaluation and Design”, Van Nostrand, 1986


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Programme	Course Code	Name of the course	L	T	P	C
B.E.	19EI5001	INDUSTRIAL INSTRUMENTATION LABORATORY	0	0	3	1.5

Course Objective	<ol style="list-style-type: none"> Analyze various measurement schemes that meet the desired specifications and requirements. Interpret the principles of level and flow measurements. Demonstrate various bio medical equipments.
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Expt. No.	Description of the Experiments
1.	Discharge coefficient of a.Orifice plate. b. Venturi Tube. c.Pitot Tube.
2.	Testing of pressure gauge using dead weight tester.
3.	Measurement of viscosity of test solutions.
4.	Characteristics of vacuum pressure measurement.
5.	Level measurement using d/p transmitter and capacitance based level measurement.
6.	Measurement of absorbance and transmittance of test solutions using UV – Visible spectrophotometer.
7.	pH meter standardization and measurement of pH values of solutions.
8.	Measurements of conductivity of test solutions.
9.	Study of Control valve characteristics.
10.	ECG and pulse rate measurement.
11.	Respiration rate and blood pressure measurement using oscillometric method
Total Practical Hours	
45	

Course Outcome	<p>CO1: Illustrate the characteristics of Pressure, Temperature, flow, level, density and viscosity measurements.</p> <p>CO2: Analyze the measured value for displaying or controlling the physical variables</p> <p>CO3: Categorise different field instruments for different applications.</p> <p>CO4: Demonstrate the principles involved in different measuring techniques.</p> <p>CO5: Examine the bio medical related measuring devices.</p>
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REFERENCES:

- R1-William C. Dunn, “Fundamentals of Industrial instrumentation and Process Control, Mc-Graw Hill, Professional, Second Edition,2018.
- R2- Laboratory manual prepared by the Department of Electronics and Instrumentation Engineering, 2017.


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Programme	Course Code	Name of the course	L	T	P	C
B.E.	19EI5002	MICROPROCESSORS AND MICROCONTROLLERS LABORATORY (COMMON TO EEE AND EIE)	0	0	3	1.5

- Course Objective
1. Understand the assembly language programming with simple examples using 8085.
 2. Study the concept of peripheral's interfacing with assembly language programming using 8085.
 3. Learn the assembly language programming with simple examples using 8051.
 4. Practice the basic programming concept and interfacing sensor of Arduino.
 5. Propose the concepts of Industrial drive interfacing concepts with programming.

Expt. No.

Description of the Experiments

1. Arithmetic operations using 8085 microprocessor: 8-bit Basic Arithmetic operations.
2. 8085 Programming: Sorting Operations & Max / Min of numbers.
3. A/D interfacing and D/A interfacing with microprocessor.
4. Keyboard and 7-segment display interface with 8279 Interfacing.
5. Programming demonstration of basic function with 8051 microcontroller execution.
6. Simple basic programming of Arduino microcontroller.
7. Digital and Analog interfacing using Arduino microcontroller.
8. Interface the stepper motor to perform clockwise and anti-clock wise rotation.
9. Traffic light control interfacing with 8051.
10. Study on Raspberry pi.

Total Practical Hours 45

- Course Outcome
- CO1: Understand the 8085 architecture and its programming execution.
CO2: Learn interfacing knowledge with different applications.
CO3: Study the simple and interfacing programming concepts of 8051.
CO4: Understand the Interfacing and basic programming concept of Arduino.
CO5: Understand the industrial application of microcontroller by various programming concepts.


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Programme	Course Code	Course Title	L	T	P	C
B.E.	19HE5071	SOFT SKILLS - I	1	0	0	1

Course Objectives:

- 1.To employ soft skills to enhance employability and ensure workplace and career success.
- 2.To enrich students' numerical ability of an individual and is available in technical flavor.
- 3.To interpret things objectively, to be able to perceive and interpret trends to make generalizations and be able to analyze assumptions behind an argument/statement.

Unit	Description	Instructional Hours
I	Introduction to Soft Skills: Introduction- Objective -Hard vs Soft Skills - Measuring Soft Skills- Structure of the Soft Skills -Self Management-Critical Thinking-Reflective thinking and writing- p2p Interaction	3
II	Art of Communication: Verbal Communication - Effective Communication - Active listening –Paraphrasing - Feedback - Non-Verbal Communication – Roles-Types- How nonverbal communication can go wrong- How to Improve nonverbal Communication - Importance of feelings in communication - dealing with feelings in communication.	4
III	World of Teams: Self Enhancement - importance of developing assertive skills- developing self-confidence – developing emotional intelligence - Importance of Team work – Team vs. Group - Attributes of a successful team – Barriers involved - Working with Groups – Dealing with People- Group Decision Making.	3
IV	Quantitative Aptitude: Averages - Profit and loss - Partnerships - Time and work - Time, Speed and Distance - Problems based on trains - Problems based on boats and streams	3
V	Logical Reasoning: Clocks - Calendars - Direction Sense - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency	2
Course Outcome:	CO1: Students will have clarity on their career exploration process and to match their skills and interests with a chosen career path. CO2: Students will develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others CO3: Students will understand how teamwork can support leadership skills CO4: Students will be able to make sense of problems, develop strategies to find solutions, and persevere in solving them. CO5: Students will demonstrate an enhanced ability to draw logical conclusions and implications to solve logical problems.	

REFERENCE BOOKS:

- R1: Soft Skills Training: A Workbook to Develop Skills for Employment - Frederick H. Wentz
R2: How to prepare for data interpretation for CAT by Arun Sharma.
R3: How to Crack TEST OF REASONING in all competitive examinations by Jaikishan and Premkishan.
R4: A New Approach To Reasoning Verbal & Non-Verbal By B.S. Sijwali
R5: Quantitative Aptitude for Competitive Examinations - Dr. R.S. Aggarwal, S. Chand


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19HE5072	DESIGN THINKING	1	0	0	1

Course Objective

1. To expose students to the design process
2. To develop and test innovative ideas through a rapid iteration cycle.
3. To provide an authentic opportunity for students to develop teamwork and leadership skills

Unit	Description	Instructional Hours
DESIGN ABILITY		
I	Asking Designers about what they Do – Deconstructing what Designers Do – Watching what Designers Do – Thinking about what Designers Do – The Natural Intelligence of Design Sources	4
DESIGNING TO WIN		
II	Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods	4
DESIGN TO PLEASE AND DESIGNING TOGETHER		
III	Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.	4
DESIGN EXPERTISE		
IV	Design Process – Creative Design - Design Intelligence – Development of Expertise – Novice to Expert. Critical Thinking – Case studies: Brief history of Albert Einstein, Isaac Newton and Nikola Tesla	3
Total Instructional Hours		15

Course Outcome

Upon completion of the course, students will be able to

CO1: Develop a strong understanding of the Design Process

CO2: Learn to develop and test innovative ideas through a rapid iteration cycle.

CO3: Develop teamwork and leadership skills

TEXT BOOKS:

T1 - 1. Nigel Cross, “Design Thinking”, Kindle Edition.

REFERENCE BOOKS:

R1 - Tom Kelley, “Creative Confidence”, 2013.

R2 - 3. Tim Brown, “Change by Design”, 2009.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI6181	INDUSTRIAL SAFETY MANAGEMENT (COMMON TO EEE AND EIE)	3	0	0	3

- Course Objective
1. Educate on Engineering Safety.
 2. Understand the basics of Safety measures.
 3. Enumerate about industrial accident investigation.
 4. Illustrate on safety performance analysis.
 5. Outline on safety Instrumentation systems.

Unit	Description	Instructional Hours
	INTRODUCTION TO SAFETY ENGINEERING	
I	Evolution of modern safety concept – Need for safety - Introduction to Safety systems Engineering(SSE) - safety standards – types - safety audit – reason, benefits ,audit programs – safety performance monitoring; Important Acts: factories act 1948, Environment act 1986; Safety in industries : machine guarding, welding process, cold and hot working process and its	9
	SAFETY MANAGEMENT	
II	Functions of safety management – safety organizing, controlling – safety management principles – “The permit- to- work” system – management responsibilities – safety versus health - safety life cycle (SLC):concept, types, examples -safety policy – OSHA Regulations – standards , OSHA inspection – IEC61508 & ISA84.01 standards -safety inspection,computers and safety.	9
	ACCIDENT INVESTIGATION	
III	Cause of Accidents in industries – Learning from accidents - Accident ratio - reportable and non reportable accidents, Accident recall – methods, recall aids - NEMIRR systems – benefits - Supervisory role - Overall accident investigation process –Major Disasters: The Bhopal disaster 1984 - The Flixborough disaster 1974 – HAZOP(Qualitative treatment only).	9
	.SAFETY PERFORMANCE ANALYSIS, TRAINING	
IV	Safety performance monitoring – roles – performance and review, evaluation – Recordkeeping, inspection of records, maintenance –Incident rate, accident rate - Fatal Accident rate (FAR) – problems. Importance of training - occupational safety and health training – Personal protective equipment (PPE), types, breathing and respiratory protection - “In-situ” safety training – Brainstorming - motivation, communication.	9
	SAFETY INSTRUMENTATION SYSTEMS(SIS)	
V	Electrical office hazards, prevention of office hazards, fire prevention – managing fire safety – fire safety design - Electrical safety checklist – OSHA regulation for Portable (power operated) and Electrical equipment safety. Safety Instrumentation Systems (SIS): Alarms – regulations and standards – Safety integrity level - Emergency shutdown	9
Total Instructional Hours		45

- Course Outcome
- CO1: Explain the concepts of Engineering Safety and its acts.
 - CO2: Understand and apply the various industrial safety standards and regulations.
 - CO3: Appraise the accident investigation strategies for an industry.
 - CO4: Summarize the various Safety performance monitoring and apply them.
 - CO5: Elaborate the various electrical hazards prevention systems and its methods.

TEXT BOOKS:

- T1 – Ron C.McKinnon “ Safety management Near miss identification” CRC press 2012.
T2 - L M Deshmukh, “Industrial safety management”, Tata McGraw Hill, 2010.

REFERENCE BOOKS:

- R1 -Edward Marszal, Eric W. Scharpf, “Safety Integrity Level Selection: Systematic Methods Including Layer of Protection Analysis”, ISA, 2002.
R2 - “The Factories Act 1948”, Madras Book Agency, Chennai, 2000.
R3 – “Relevant India Acts and Rules”, Government of India.
R4 - King, R “Safety in the process industries”. Elsevier,2016.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI6201	PROCESS CONTROL	3	0	0	3

- Course Objective
1. Understand the basics of mathematical modeling of any physical process.
 2. Observe the characteristics of various controllers and its form.
 3. Illustrate the various types of final control elements in process control.
 4. Establish an evaluation criterion and different controller tuning methods.
 5. Build a multi loop control schemes for suitable applications.

Unit	Description	Instructional Hours
	PROCESS MODELING AND DYNAMICS	
I	Introduction to Process control - Need for process control - Degrees of freedom – systems with dead time- Mathematical model of Flow, Level, Pressure and Thermal processes - Interacting and non-interacting systems - Continuous and batch processes - Self regulation - Servo and regulatory operations - Linearization of nonlinear systems.	9
	CONTROL ACTIONS AND CONTROLLERS	
II	Characteristic of on-off, floating, proportional, integral and derivative controllers – Composite Control: P+I,P+D and P+I+D control modes – Electronic PID controller, controller design problems - PID Bumpless,Auto/manual transfer–Reset Wind-up - Proportional and Derivative kick - Practical forms of PID.	9
	FINAL CONTROL ELEMENTS	
III	I/P converter - Pneumatic and electric actuators - Valve Positioner - Control Valves - Characteristic of Control Valves:- Inherent and Installed characteristics - Valve body:- Commercial valve bodies - Types - Control valve sizing: ISA S 75.01 – valve sizing calculations - Cavitation and flashing - Selection of control valves.	9
	CONTROLLER TUNING	
IV	Evaluation Criteria - IAE, ISE, ITAE and ¼ decay ratio - Tuning: - Process reaction curve method, Ziegler-Nichols method, Tyreus-Luyben method and Damped oscillation method - Determination of optimum settings for mathematically described processes using frequency response approach – Autotuning.	9
	MULTILOOP PROCESS CONTROL	
V	Feed-forward control - Cascade control - Ratio control - Split-range control – Averaging control - Inferential control and Introduction to multivariable control - MIMO systems, Examples - IMC - MPC - Adaptive control. Case Studies: Distillation column - Boiler drum level control - P&ID diagram.	9
Total Instructional Hours		45

Course Outcome	CO1: Develop a mathematical model for any process control systems.
	CO2: Classify the different controller modes and its design methodologies.
	CO3: Distinguish the valves, positioner and their operation on environment.
	CO4: Choose a proper tuning method for P, I, D controllers and capable to simulate them.
	CO5: Implementing conventional control architectures with advanced multi-loop technique with piping and instrumentation diagrams.

TEXT BOOKS:

T1 - Stephanopoulos. G, “Chemical Process Control - An Introduction to Theory and Practice”, Prentice Hall of India, 2008.

T2 - Bequette. B.W, “Process Control Modeling, Design and Simulation”, Prentice Hall of India, 2004.

REFERENCE BOOKS:

R1 –Johnson .C.D, “Process Control Instrument Technology”, 8th Edition, Pearson Education, 2006.

R2 – D.E. Seborg, T.F. Edger, “Process Dynamics and Contro”, John Wiley and Sons, 2ndEdition, 2004.

R3 – Krishnaswamy.K, “Process Control”, New Age International Publishers, 2015.

R4-Thomas E. Marlin, “Process Control – Designing Processes and Controlsystems for Dynamic Performance”, Mc-Graw-Hill, 2000.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI6202	DISCRETE TIME AND SIGNAL PROCESSING	3	0	0	3

- Course Objective
1. Enumerate signals, systems, time and frequency domain concepts.
 2. Recall the concepts of z-transforms.
 3. Interpret fundamental mathematical tools of DSP techniques.
 4. Classify digital filters for processing of discrete time signals.
 5. Categorize programmable digital signal processor and its applications.

Unit	Description	Instructional Hours
	SIGNALS AND SYSTEMS	
I	Introduction - Classification of Discrete time signals and systems - analysis of discrete-time linear time - invariant systems - discrete time systems described by difference equations - implementation of discrete time systems- correlation - Sampling and quantization.	9
	DISCRETE TIME SYSTEM ANALYSIS	
II	Definition - properties of z-transform - region of convergence - inverse z - transform - computation of the convolution sum of finite length sequences - analysis of linear time invariant systems in the z domain - one sided z transform - Frequency analysis of discrete time signals.	9
	DISCRETE FOURIER TRANSFORM AND COMPUTATION	
III	DFT - properties - IDFT -convolution- overlap add and save method - Efficient computation of the DFT using Radix - 2 FFT algorithms - Decimation in time - Decimation in frequency.	9
	DESIGN OF DIGITAL FILTERS	
IV	Design of IIR filters - characteristics of commonly used analog filters - Butterworth and Chebyshev filters - digital design using impulse invariant and bilinear transformation. Design of FIR filters - Symmetric and Antisymmetric FIR filters - Windowing techniques - Structures realization of digital filters.	9
	DIGITAL SIGNAL PROCESSORS	
V	General and special purpose digital signal processors - Introduction to programmable DSPs - Architecture of TMS320C5X - assembly language instructions - instruction pipelining in C5x - application programs in C5x - DSP applications.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Understand about discrete time signals and systems.
CO2: Demonstrate the use of z transforms for signal processing applications.
CO3: Apply mathematical tools for all DSP techniques.
CO4: Analyse linear digital filters both FIR and IIR using different techniques and their associated structures.
CO5: Illustrate the selection of DSP processors for different applications.

TEXT BOOKS:

- T1 - J.G. Proakis and D.G. Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Fourth Edition, Prentice Hall of India Learning Private Limited, 2008.
T2 - B.Venkataramani, M.Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications", Tata McGraw Hill, 2003.

REFERENCE BOOKS:

- R1 –Andreas Antonious, "Digital Signal Processing – Signals, Systems and Filter", Tata McGraw Hill , 2006.
R2 – Emmanuel C. Ifeachor, Barrie W.Jervis, "Digital Signal Processing, a practical approach", Pearson 2004.
R3 – S.K. Mitra, "Digital Signal Processing", Third Edition, Tata McGraw Hill, 2006.
R4- Alan V.Oppenheim, Ronald W.Schafer with John R.Buck, "Discrete Time Signal Processing", Second Edition, Pearson Education, 2009.

WEB REFERENCE:

<https://nptel.ac.in/courses/117/102/117102060/>


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI6251	EMBEDDED SYSTEMS (COMMON TO EEE AND EIE)	2	0	2	3

- Course Objective
1. Understand the general purpose system and embedded system.
 2. Describe the components and compilation techniques in an embedded system.
 3. Impart Knowledge in Various processor scheduling algorithms.
 4. Differentiate the RTOS concepts to design and develop real time projects.
 5. Develop Process flow to design and implement an embedded system using case studies.

Unit	Description	Instructional Hours
I	INTRODUCTION TO EMBEDDED SYSTEM Basics of Developing and Functional building block of embedded system - Characteristics of embedded system applications - Structural units in Embedded processor -Challenges in embedded system design.- PCB Designing of simple electronic circuits	6+3
II	ARCHITECTURE OF EMBEDDED SYSTEM PIC Microcontroller – Architecture of PIC 16F8xx -Supervisor mode, Exceptions & Traps, Co-processors, - CPU bus - Memory devices - I/O devices -Assembly and linking - Basic compilation techniques – Program optimization – FSR – Reset action – Oscillatory Circuit- Interfacing Of LED and LCD	9
III	OS FOR EMBEDDED SYSTEMS Introduction to RTOS, Multiple tasks and multiple processes - Context switching - Operating system - Scheduling policies - Task communication, Inter process communication mechanisms -Introduction to μ C/ OS II- Sending And Receiving Messages By Using Zig Bee Module.	9
IV	DEVELOPMENT ENVIRONMENT AND PERFORMANCE ISSUES Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modeling of EDLC; issues in Hardware-software Co-design, Energy and power - Evaluating operating system performance -Real time kernels- issues in real time kernel-Structure of a real-time kernel– Design of Traffic Light Controller.	9
V	REAL TIME APPLICATIONS&IMPLEMENTATION Development and debugging –Testing - Program validation and Testing, - Distributed embedded architecture Design examples: Cell phones, Digital Still Cameras, Elevator Controller, Smart card applications- Creation of Mailbox.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Understand The Basic Structure of Embedded Processors.
 CO2: Acquire the knowledge in the architecture of Embedded System.
 CO3: Articulate the knowledge in operating systems for embedded process.
 CO4: Outline RTOS concepts and issues in embedded system design process.
 CO5: Demonstrate the design and implementation process of real time products

TEXT BOOKS:

- T1 - J.Wayne Wolf, “Computers as Components: Principles of Embedded Computer Systems Design”, Reed Elsevier Publications, Gurgaon, Haryana, 2008
 T2 - Rajkamal, “Embedded Systems – Architecture, Programming and Design”, Tata McGraw-Hill, New Delhi, 2010

REFERENCE BOOKS:

- R1 –David E Simon, “An Embedded Software Primer”, Pearson Education India, New Delhi, 2004.
 R2 – Sriram V Iyer, Pankaj Gupta, “Embedded Real-time Systems Programming”, Tata McGraw-Hill,2012.
 R3 – Ajay V Deshmukh,“ Microcontroller Theory and Applications” Tata McGraw Hill,2012.
 R4 -K.V.K..Prasad,“Embedded Real-Time Systems: Concepts, Design and Programming” Dream tech 2012.

WEB REFERENCE:

<https://nptel.ac.in/courses/108/102/108102045/>


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI6001	PROCESS CONTROL LABORATORY	0	0	3	1.5

Course Objective	Description
	<ol style="list-style-type: none"> 1. Apply the knowledge gained in control of various physical systems. 2. To be exposed for design of multi loop process control. 3. To be familiar with the working of P, PI, PID Controllers and Tuning. 4. To experimentally verify the design and implementation of controllers for various physical processes.

Expt. No.	Description of the Experiments
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Simulation Based Experiments:

1. Response of First Order and Second order Systems with and without transportation lag.
2. Response of Second Order System with and without PID Controller.
3. Design and tuning of PID controller using Ziegler-Nichols and Cohen-Coon Method.
4. Design and Implementation of Practical Forms of PID Controller on the simulated model of a Typical Industrial Process.
5. Wireless remote monitoring of process control plant using IoT

Hardware Based Experiments (Experiments carried out on the skid mounted plants):

6. (i) Study of a Process Control systems and Piping & Instrumentation diagram of a plant.
(ii) Study the characteristic of Step and Impulse response of Interacting and Non-interacting Systems.
7. Characteristics of Pneumatically Actuated Control Valve (with and without Positioner).
8. (i) Closed loop control of Level process for Servo and Regulator Operation.
(ii) Closed loop control of Flow process for Servo and Regulator Operation.
9. Closed loop control of Pressure process for Servo and Regulator Operation.
10. Closed loop control of ON/OFF controlled Thermal process.
11. (i) Design and implementation of Complex Control system (Ratio/Cascade/Feed forward).
(ii) Study of AC and DC drives.

Total Practical Hours 45

Course Outcome	Description
	CO1: Infer the effect of different control modes on various processes.
	CO2: Design the controller parameters using different tuning process.
	CO3: Evaluate the servo and regulator response for various process control systems.
	CO4: Analyze and verify the complex multi loop control system characteristics.
	CO5: Demonstrate the control system response for servo motor applications

REFERENCES:

- R1-George Stephanopoulos, Chemical Process Control: An Introduction to theory and Practice, Pearson 2008.
R2- Laboratory manual prepared by the Department of Electronics and Instrumentation Engineering, 2016.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI6002	VIRTUAL INSTRUMENTATION LABORATORY	0	0	3	1.5

Course Objective	<ol style="list-style-type: none"> 1. Observe the basic graphical programming knowledge using LabVIEW platform. 2. Make use of data acquisition concept to interface real time instruments. 3. Design the programming for process control and other applications
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Expt. No.	Description of the Experiments
1.	Verification of Arithmetic and Boolean operations.
2.	Program to find Addition of first “n” natural numbers using FOR and WHILE loop.
3.	Implementation of Array functions.
4.	Implementation of Cluster functions.
5.	Program for implementing Seven segment displays.
6.	Program to perform Traffic light control.
7.	Generation of Waveform and its measurements.
8.	Design of Low and High Pass Filter using MULTISIM.
9.	Using NI ELVISmx , Design and verify the characteristics of <ol style="list-style-type: none"> a. Rectifier. b. Differentiator. c. Integrator circuit.
10.	Program to control Temperature by using Thermocouple and DAQ.
11.	Program for controlling the speed of a DC motor using PID tool box.

Total Practical Hours 45

Course Outcome	<p>CO1: Discuss about basic concepts of virtual instrumentation and its programming.</p> <p>CO2: Generalize the graphical programming knowledge with data flow concept.</p> <p>CO3: Compose the data acquisition concepts for interfacing real-instrument.</p> <p>CO4: Transform the circuit simulation concept to the hardware implementation using NI MULTISIM and ELVISmx</p> <p>CO5: Evaluate the process control applications with graphical programming environment.</p>
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REFERENCES:

- R1-Jovitha Jerome, “Virtual Instrumentation using LabVIEW”, PHI Learning Pvt. Ltd., 2010
R2- Laboratory manual prepared by the Department of Electronics and Instrumentation Engineering, 2017.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI6701	INTERNSHIP TRAINING	0	0	0	1

- Course Objectives
1. Apply the gained knowledge and skills acquired on campus in a real-life work situation.
 2. Create opportunities for practical, hands-on learning from practitioners in the students' field of study
 3. Establish an exposure for the students to the work environment, common practices, employment opportunities and work ethics in the relevant field.

The student shall undergo Internship / Industrial Training and the credits earned will be indicated in the grade sheet. The student is allowed to undergo a **minimum of 3 weeks** Internship / Industrial Training from third semester to sixth semester. The Internship / Industrial Training shall carry 100 marks and shall be evaluated at end semester examination.

At the end of Sixth semester, a three member Departmental Committee constituted by Controller of Examinations will evaluate the report, conduct Viva Voce Examination and award credit points.

The evaluation will be made based on this report and a viva-voce examination, conducted internally by a three member Departmental Committee constituted by the Controller of Examinations.

- Course Outcomes
- CO1: Employ the skills to communicate efficiently and gain management skills related to industry / research organizations.
 - CO2: Extend the boundaries of knowledge through research and development.
 - CO3: Discriminate the knowledge and skills acquired at the workplace to their on-campus studies.
 - CO4: Develop greater clarity about academic and career goals.
 - CO5: Define and Visualize the impact of engineering solutions to the society.


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Programme	Course Code	Course Title	L	T	P	C
B.E.	19HE6071	SOFT SKILLS-II	1	0	0	1

Course Objectives:

1. To make the students aware of the importance, the role and the content of softskills through instruction, knowledge acquisition, demonstration and practice.
2. To learn everything from equations to probability with a completely different approach.
3. To make the students learn on an increased ability to explain the problem comprehensively.

Unit	Description	Instructional Hours
I	Group Discussion & Presentation Skills: GD skills – Understanding the objective and skills tested in a GD – General types of GDs – Roles in a GD – Do’s & Don’ts – Mock GD & Feedback. - Presentation Skills – Stages involved in an effective presentation – selection of topic, content, aids – Engaging the audience – Time management – Mock Presentations & Feedback	4
II	Interview Skills and Personality Skills: Interview handling Skills – Self preparation checklist – Grooming tips: do’s & don’ts – mock interview & feedback - Interpersonal skills-creative thinking-problem solving-analytical skills	3
III	Business Etiquette & Ethics: Etiquette – Telephone & E-mail etiquette – Dining etiquette – do’s & Don’ts in a formal setting – how to impress. Ethics – Importance of Ethics and Values – Choices and Dilemmas faced – Discussions from news headlines.	3
IV	Quantitative Aptitude: Permutation, Combination - Probability - Logarithm - Quadratic Equations - Algebra - Progression - Geometry - Mensuration.	3
V	Logical Reasoning: Logical Connectives - Syllogisms - Venn Diagrams – Cubes - Coded inequalities - Conditions and Grouping	2

Course Outcome:

- CO1: Students will have learnt to keep going according to plan, coping with the unfamiliar, managing disappointment and dealing with conflict.
- CO2: Students will Actively participate meetings, Group Discussions / interviews and prepare & deliver presentations
- CO3: Students will define professional behavior and suggest standards for appearance, actions and attitude in a Business environment
- CO4: Students will be able to apply quantitative reasoning and mathematical analysis methodologies to understand and solve problems.
- CO5: Students will excel in complex reasoning.

REFERENCE BOOKS:

- R1: Bridging the Soft Skills Gap: How to Teach the Missing Basics to Today's Young Talent- Bruce Tulgan
- R2: Quantitative Aptitude for Competitive Examinations (5th Edition) - Abhjit Guha
- R3: How to crack test of Reasoning - Jaikishan and Premkishan
- R4: The hand on guide to Analytical Reasoning and Logical Reasoning - Peeyush Bhardwaj


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Programme	Course Code	Course Title	L	T	P	C
B.E.	19HE6072	INTELLECTUAL PROPERTY RIGHTS (IPR)	1	0	0	1

Course Objectives:	
	1. To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.
	2. To disseminate knowledge on patents, patent regime in India and abroad and registration aspects.
	3. To disseminate knowledge on copyrights and its related rights and registration aspects.
	4. To disseminate knowledge on trademarks and registration aspects.
	5. To disseminate knowledge on Design, Geographical Indication (GI) and their registration aspects.

Unit	Description	Instructional Hours
	INTRODUCTION TO INTELLECTUAL PROPERTY	
I	Introduction, Types of Intellectual Property, International Organizations, Agencies and Treaties, Importance of Intellectual Property Rights.	3
	PATENTS	
II	Patents -Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application -Non -Patentable Subject Matter -Registration Procedure, Rights and Duties of Patentee, Assignment and license.	3
	COPYRIGHTS	
III	Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.	3
	TRADEMARKS	
IV	Concept of Trademarks -Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) -Non-Registrable Trademarks - Registration of Trademarks.	3
	DESIGN AND GEOGRAPHICAL INDICATION	
V	Design: meaning and concept of novel and original -Procedure for registration. Geographical indication: meaning, and difference between GI and trademarks -Procedure for registration.	3

Course Outcome:	
	CO1: Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.
	CO2: Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.
	CO3: Identify, apply and assess ownership rights and marketing protection under intellectual property law as applicable to information, ideas, new products and product marketing.
	CO4: Identify different types of trademarks and procedure for registration
	CO5: Recognize the concept of design, geographical indication and procedure for registration

TEXT BOOKS:

- T1- Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.
T2- V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt. Ltd, 2012.

REFERENCE BOOKS:

- R1- Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.
R2-Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.


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PROFESSIONAL ELECTIVE I

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI5301	POWER PLANT INSTRUMENTATION	3	0	0	3

Course Objective	<ol style="list-style-type: none"> 1. Discuss the types of various methods of power generation. 2. Analyse the parameter for monitoring and controlling power plant. 3. Distinguish the various control loops available in boiler. 4. Discuss the operation of turbines and various control methods. 5. Interpret the operation of nuclear power plants.
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Unit	Description	Instructional Hours
	POWER PLANT INSTRUMENTATION BASICS	
I	Methods of power generation :- hydro, thermal, nuclear, solar and wind power Piping and instrumentation diagram of a thermal power plant, basic process of a boiler, Fuel measurement-review of pressure and temperature measurement steam and water flow measurement – instrument applications in power stations: review of indicating and recording instruments, for power stations-instrument maintenance aspects.	9
	MEASUREMENTS IN POWER PLANTS	
II	Measurement of feed water flow, air flow, steam flow and coal flow – Drum level measurement – Steam pressure and temperature measurement – Turbine speed and vibration measurement – Flue gas analyzer – Fuel composition analyzer.	9
	BOILER CONTROL – I	
III	Combustion of fuel and excess air – Firing rate demand – Steam temperature control – Control of deaerator – Drum level control – Single, two and three element control – Furnace draft control – implosion – flue gas dew point control – Trimming of combustion air – Soot blowing.	9
	BOILER CONTROL – II	
IV	Burners for liquid and solid fuels – Burner management – Furnace safety interlocks – Coal pulverizer control – Combustion control for liquid and solid fuel fired boilers – air/fuel ratio control – fluidized bed boiler – Cyclone furnace.	9
	CONTROL OF TURBINE	
V	Types of steam turbines – impulse and reaction turbines – compounding – Turbine governing system – Speed and Load control – Transient speed rise – Free governor mode operation – Automatic Load Frequency Control – Turbine oil system – Oil pressure drop relay – Oil cooling system – Turbine run up system.	9
Total Instructional Hours		45

Course Outcome	<p>CO1: Outline the various methods of power generation.</p> <p>CO2: Correlate the important measurement of various parameters instruments associated with power plants.</p> <p>CO3: Identify the appropriate control loop in boilers.</p> <p>CO4: Appraise the burner and furnace management for boilers.</p> <p>CO5: Outline the operation of turbines.</p>
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TEXT BOOKS:

- T1 - Sam Dukelow. G “The control of Boilers”, Instrument Society of America, 1991.
 T2 - Krishnaswamy.K and Ponnibala.M., “Power Plant Instrumentation”, PHI Learning Pvt.Ltd.,2013.

REFERENCE BOOKS:

- R1 - Elonka. S.M and Kohan.A.L, “Standard Boilers Operations”, McGraw Hill, New Delhi, 1994.
 R2 - S.N. Singh, “Electrical Power Generation, Transmission and Distribution”, Prentice Hall of India, 2011.
 R3- P.K.Nag, “Power Plant Engineering”, Tata McGraw-Hill Education, 4th edition, 2014.
 R4-Tamilmani, “Power Plant Instrumentation”, Sams Publishers, 2016.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19E15302	COMMUNICATION THEORY	3	0	0	3

Course Objective	Description
1.	Interpret the basic concepts involved in amplitude modulation.
2.	Discuss about the angle and discrete modulation systems.
3.	Analyze the source code information theory and coding techniques.
4.	Discuss the multiple access techniques involved in wire and wireless Communication.
5.	Categorize the evolution of communication systems.

Unit	Description	Instructional Hours
AMPLITUDE MODULATION		
I	Amplitude Modulation - Generation of AM waves - DSB- DSB/SC – SSB -VSB - AM Transmitter - AM Receiver - TRF, Super Heterodyne Receivers.	9
ANGLE AND DISCRETE MODULATION SYSTEMS		
II	Phase and Frequency Modulation – Narrow and Wide band FM –Generation of FM Waves - Introduction to Pulse Modulation – PAM,PWM,PPM - Sampling and Quantization - Comparisons of Pulse Modulation Technique.	9
INFORMATION THEORY AND CODING		
III	Primary Communication - Entropy - Shannon Fano Coding - Huffman Coding - Line Encoding - BW-SNR Trade Off Codes - Error Control Codes: Convolution Codes and Linear Block Codes.	9
MULTIPLE ACCESS TECHNIQUE		
IV	Spread Spectrum and Multiple Access Techniques : FDMA - TDMA - CDMA - SDMA - Applications in Wire and Wireless Communication.	9
EVOLUTION OF COMMUNICATION TECHNOLOGY		
V	Evolution of communication technologies:2G,3G,4G,5G, Global System for Mobile Communications (GSM), GPS –Satellite Communication – Optical Communication	9
Total Instructional Hours		45

Course Outcome	Description
CO1:	Describe the concept and generation methods involved in amplitude modulation system.
CO2:	Compare the phase, frequency and pulse modulation techniques.
CO3:	Determine the amount of information in a high bit rate transmission.
CO4:	Elaborate the multiple access techniques involved in communication.
CO5:	Innovate various medium for digital communication.

TEXT BOOKS:

T1 - Simon Haykin, “An Introduction to Analog and Digital Communication Systems”, 2nd Edition, Wiley,2012.
T2-Theodore S Rappaport, “Wireless Communications: Principles and Practice”, 2nd Edition, Pearson Education, 2007.

REFERENCE BOOKS:

R1 – Simon Haykin, “Communication Systems”, 4th Edition, John Wiley & Sons, 2014.
R2 – Taub H and Schilling D.L, “Principles of Communication Systems”, 4th Edition, Tata McGraw Hill, 2014.
R3 –B.Sklar “Digital communications: Fundamentals and Applications”, 2nd Edition, Pearson Education, 2012.
R4 -B.P.Lathi, “Modern Digital and Analog Communication Systems”, 3rd edition, Oxford University Press, 2007.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19IT5331	FUNDAMENTALS OF JAVA PROGRAMMING	3	0	0	3

- Course Objective
1. To understand Object Oriented Programming concepts and basic characteristics of Java
 2. To know the principles of packages, inheritance and interfaces
 3. To define exceptions and use I/O streams
 4. To understand multithread programming logic
 5. To design and build simple Graphical User Interfaces

Unit	Description	Instructional Hours
I	INTRODUCTION Object oriented programming concepts – objects-classes- methods and messages- abstraction and encapsulation-inheritance- abstract classes- polymorphism-Benefits of OOP, Application of OOP-Java Evolution-Features of Java-Difference of Java from C and C++.	9
II	OVERVIEW OF JAVA LANGUAGES Basics of Java programming, Data types, constants -Variables and Arrays, Operators and expressions , Decision making and branching –looping –Classes, Objects and Methods- access specifiers – static members –Constructors-this keyword-finalize method	9
III	PACKAGES AND INTERFACES Java API Packages –Naming conventions-creating, accessing, using Packages-Inheritance– Method Overriding- Abstract class Interfaces: Multiple inheritance-defining, extending, implementing interfaces- -final keyword	9
IV	EXCEPTION HANDLING Fundamentals-Exception types –Uncaught exceptions-Using try and catch-Multiple Catch-Nested try-Throws-Finally-Built in Exceptions-Throwing own exceptions - Creating Threads- Extending thread class-Stopping and Blocking Thread-Life cycle –Using Thread-Thread Exceptions-Thread priority-Synchronization-Runnable Interface-Inter thread communication	9
V	EVENT DRIVEN PROGRAMMING Graphics programming – Frame – Components – working with 2D shapes – Using color, fonts, and images – Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT event hierarchy	9
Total Instructional Hours		45

Upon completion of this course, the students will be able to

Course Outcome	CO1	Understand the concepts of OOPs
	CO2	Remember the syntax, semantics and classes in Java language
	CO3	Understand object inheritance and its use.
	CO4	Understand various types of Exception handling and the use of multithreaded programming.
	CO5	Understand to build simple Graphical User Interfaces.

TEXT BOOKS:

T1- Herbert Schild, “Java The Complete Reference”, Eighth Edition, McGraw Hill, 2011.

T2- Ali Bahrami, “Object Oriented Systems Development”, Pearson Education, 2008.

REFERENCE BOOKS:

R1-E Balagurusamy, “Programming with JAVA”, Fifth Edition, McGraw Hill, 2015.

R2-Michael Blaha, James Rumbaugh, “Object-Oriented Modeling and Design With UML”, Second Edition, Pearson Education, 2008.

R3 - C. Thomas Wu, “An introduction to Object-oriented programming with Java”, Fourth Edition, Tata McGraw-Hill Publishing company Ltd., 2006.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19E15303	INDUSTRIAL CHEMICAL PROCESS	3	0	0	3

- Course Objective
1. Study the unit operation involved for transportation of solids and liquids.
 2. Understand the basic operations on Industrial combustion process
 3. Gain adequate knowledge on other processes involved in chemical plant.
 4. Impart knowledge on various process industrial operations.
 5. Infer the various control operation and mechanisms involved in refineries.

Unit	Description	Instructional Hours
	UNIT OPERATIONS	
I	Operation on Solids: General characteristics of solids, storage and conveying of solids. Operation on Liquids: Transport of liquids, solids and gases adjusting particle size of bulk solids – Mixing processes – Separation: Electrostatic and magnetic separators– Chemicals from petroleum products.	9
	COMBUSTION PROCESSES	
II	Combustion processes – fluidized bed combustion - Heat exchangers – Energy balance - Material balance – Evaporators – Crystallization.	9
	OTHER OPERATIONS	
III	Drying – Distillation - Absorption – Filtration – Refrigeration process – pH measurement and control – Chemical reactions.	9
	CASE STUDY – I	
IV	Operations in the manufacture of paper, pulp and sugar – Operations in steel industry - Fertilizer industry.	9
	CASE STUDY – II	
V	Operations in thermal power plant – Operations in pharmaceutical industry - Petroleum and leather industry.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Apply the gained knowledge on solids and fluids to handle raw materials.
CO2: Explain the various combustion techniques and its advantages
CO3: Identifies the contemporary technologies used for drying, distillation and refrigeration processes in chemical plants.
CO4: Analyze chemical processes and economics involved in the paper, pulp and fertilizer industries.
CO5: Analyze and formulate the relevant mechanism to control of refineries.

TEXT BOOKS:

- T1 - McCabe W.L. and Smith J.C. "Unit operations in Chemical Engineering", McGraw Hill, 2014
T2- Balchen J G and Mumme K I, "Process Control Structures and Applications", Van Nostrand Reinhold Co., New York, 1995.

REFERENCE BOOKS:

- R1– Liptak B G, "Instrument Engineers Handbook: Process Measurement and Analysis", Butterworth Heinemann, 2003.
R2 – Luyben W C, "Process Modelling, Simulation and Control for Chemical Engineers", McGraw Hill, 1990.
R3 –Austin G T, "Shreve's Chemical Process Industries", McGraw Hill, 1985
R4- Waddams A L, "Chemicals from Petroleum", John Murray Publishers, 1978.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI5304	OPERATING SYSTEMS	3	0	0	3

- Course Objective
1. Outline the basic concepts and structure of operating systems.
 2. Illustrate the different processes, scheduling algorithms and deadlocks.
 3. Interpret various memory management schemes.
 4. Classify I/O management and file systems.
 5. Outline the characteristics of distributed operating systems.

Unit	Description	Instructional Hours
	OPERATING SYSTEMS OVERVIEW	
I	Introduction –operating systems overview- Evolution of Operating System.- Computer System Organization-Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.	9
	PROCESS MANAGEMENT	
II	Processes-Process Concept, Process Scheduling, Inter-process Communication; Threads- Overview, Multicore Programming, Multithreading Models. Process Synchronization - Critical Section Problem, Mutex Locks, Semaphores, Monitors; CPU Scheduling and Deadlocks.	9
	STORAGE MANAGEMENT	
III	Main Memory-Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory- Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory.	9
	FILE SYSTEM IMPLEMENTATION & MASS STORAGE STRUCTURE	
IV	Mass Storage Structure- Overview, Disk Scheduling and Management; File System Storage-File Concepts, Directory and Disk Structure, Sharing and Protection; File System Implementation- File System Structure, Directory implementation, Allocation Methods, Free Space Management.	9
	CASE STUDY: LINUX	
V	Linux system – History- Design Principles – Kernel Modules – Process Management – Scheduling – Memory Management – File Systems – Input and output – Inter-process Communication- Network Structure – Security-Virtualization- Basic Concepts.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Understand the basic concepts and structures of operating systems
- CO2: Design various Scheduling algorithms and deadlock prevention and avoidance algorithms.
- CO3: Contrast various memory management schemes.
- CO4: Understand different prototype file systems.
- CO5: Demonstrate the distributed operating systems.

TEXT BOOKS:

T1 - Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 9thEdition, John Wiley and Sons Inc., 2012.

T2- Tom Adelstein, Bill Lubanovic , “Linux System Administration Solve Real-life Linux Problems Quickly”, 2nd Edition, O’Reilly Media, 2009.

REFERENCE BOOKS:

R1 –Andrew S. Tanenbaum, “Modern Operating Systems”, 4thEdition , Pearson Publications, 2014.

R2 – Charles Crowley, “Operating Systems: A Design-Oriented Approach”, Tata McGraw Hill, 1996.

R3 –D M Dhamdhare, “Operating Systems: A Concept-Based Approach”, 2nd Edition, Tata McGraw-Hill 2007.

R4– Harvey M.Deitel-Operating systems,3rdEdition, Pearson/Prentice Hall,2004.

WEB REFERENCE:

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PROFESSIONAL ELECTIVE II

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI6301	VLSI DESIGN	3	0	0	3
Course Objective	1. Infer the basic concepts of CMOS technology. 2. Recall the concepts of combinational logic circuits. 3. Relate the fundamentals of sequential logic circuits. 4. Implement the chip design using programming devices. 5. Write VHDL program for digital circuits.					
Unit	Description	Instructional Hours				
CMOS TECHNOLOGY						
I	Fabrication Technology - Electrical Properties of CMOS Circuits - Scaling Principles and Fundamental Limits - Layout Design Rules - Stick Diagram.	9				
COMBINATIONAL LOGIC CIRCUITS						
II	Examples of Combinational Logic Design - Elmore's Constant, Pass Transistor Logic - Transmission Gates - Static and Dynamic CMOS Design - Power Dissipation - Low Power Design Principles.	9				
SEQUENTIAL LOGIC CIRCUITS						
III	Static and Dynamic latches and registers - Timing Issues - Pipelines, Clock Strategies - Memory Architecture and Memory Control Circuits - Low Power Memory Circuits.	9				
VHDL PROGRAMMING						
IV	RTL Design - Combinational Logic Types - Operators - Packages - Sequential circuits - Subprograms - Test Benches (Adders, Flip Flop, Counters, FSM, Multiplexer, Demultiplexer).	9				
IMPLEMENTATION STRATEGIES						
V	Full custom and Semi Custom Design, Standard Cell Design and Cell Libraries -FPGA Building Block Architecture - FPGA Interconnect Routing Procedures.	9				
Total Instructional Hours						45

Course Outcome	Description
CO1:	Explain the fabrication of basic CMOS circuit.
CO2:	Design combinational logic circuits.
CO3:	Demonstrate sequential CMOS logic circuits.
CO4:	Build VHDL programming for digital circuits.
CO5:	Establish digital system using FPGA.

TEXT BOOKS:

- T1 - N. H. Weste, Principles of CMOS VLSI Design 4th Edition, Pearson, 2017.
 T2 - Charles. H. Roth, "Digital System Design using VHDL", Thomson learning, 2004.

REFERENCE BOOKS:

- R1 – Weste and Harris, "CMOS VLSI Design", Pearson Education, 4th Edition, 2005
 R2 - R. Jacob Baker, Harry W.LI., David E. Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hall of India, 2005.
 R3 - A. Pucknell, Kamran Eshraghian, "Basic VLSI Design", Third Edition, Prentice Hall of India, 2007.
 R4 - M.J. Smith, "Application Specific Integrated Circuits", Addison Wesley, 1997

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI6302	MICRO ELECTRO MECHANICAL SYSTEMS	3	0	0	3

- Course Objective
1. Infer the basic concepts in MEMS.
 2. Recall the working of sensors and actuators.
 3. Interpret the micro fabrication and manufacturing technique.
 4. Infer the design of a micro system.
 5. List various applications of polymer and optical MEMS.

Unit	Description	Instructional Hours
	INTRODUCTION	
I	MEMS and Microsystems - Evolution of Micro Fabrication - Microsystems and Microelectronics - Multidisciplinary Nature of Micro System Design and Manufacture - Materials for MEMS and Microsystems - Scaling Laws in Miniaturization.	9
	SENSORS AND ACTUATORS	
II	Working Principles of Micro Systems, Micro Sensors- Acoustic Sensor, Biomedical Sensor, Chemical Sensor ,Optical Sensor, Pressure Sensor, Thermal Sensor, Micro Actuation Techniques - Actuation using Thermal Forces, SMA, piezoelectric effect, Actuation using electrostatic forces - Micro Gripper, Micro Motor, Micro Valve, Micro Accelerometers.	9
	MICRO FABRICATION AND MICRO MANUFACTURING TECHNIQUES	
III	Materials for Micro Systems, Photolithography, Oxidation, Diffusion, CVD, PVD, etching, Micro Manufacturing: Bulk Micro Manufacturing, Surface Micromachining, LIGA Process, Packaging Techniques: Die Preparation, Surface Bonding, Sealing.	9
	MICRO SYSTEMS DESIGN	
IV	Introduction - Design Considerations - Process Design - Mechanical Design, Mechanical design using Finite Element Method - Design of Micro Fluidic Network Systems.	9
	POLYMER AND OPTICAL MEMS	
V	Polymers in MEMS - Polimide - SU-8 - Liquid Crystal Polymer (LCP) - PDMS -PMMA - Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors, Actuators for Active Optical MEMS.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Summarize the concepts of semiconductors and solid mechanics to fabricate MEMS device.
 - CO2: Analyze the suitable sensors and actuators for various applications.
 - CO3: Outline the rudiments of micro fabrication techniques.
 - CO4: Illustrate the design of micro system.
 - CO5: Implement polymer and optical MEMS in various applications.

TEXT BOOKS:

- T1 - Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2002.
T2 - Nitaigour Premchand Mahalik “MEMS” Tata McGraw Hill,2007.

REFERENCE BOOKS:

- R1 - Nadim Maluf,“ An Introduction to Micro Electro Mechanical System Design”, Artech House, 2000.
R2 - Mohamed Gad-el-Hak, Editor, “ The MEMS Handbook”, CRC press Baco Raton, 2000.
R3 - Julian w. Gardner, Vijay K. Varadan, Osama O. Awadelkarim, “Micro Sensors MEMS and Smart Devices”, John Wiley & Son LTD,2002.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI6303	INDUSTRIAL DATA COMMUNICATION	3	0	0	3

Course Objective	Description
1.	Understand the fundamentals of data networks.
2.	Interpret MODBUS and HART standards.
3.	Impart knowledge about the importance of FIELD BUS and PROFIBUS.
4.	Analyze the characteristics of interface and Ethernet.
5.	Illustrate the use of wireless communication in various applications.

Unit	Description	Instructional Hours
I	DATA NETWORK FUNDAMENTALS ISO/OSI Reference model - TCP/IP Protocol Stack- EIA 232 interface standard – EIA 485 interface standard - Media access protocol: Command/response, CSMA/CD — IEEE 802.3 Ethernet standard Bridges –Routers – TCP/IP - Gateways – Standard ETHERNET Configuration.	9
II	MODBUS AND HART Evolution of industrial data communication standards - MODBUS:- Protocol structure, Function codes - HART communication protocol, Communication modes, HART Networks, HART commands, HART applications & Troubleshooting.	9
III	HART AND FIELDBUS HART communication protocol - HART networks - HART commands - HART applications - Fieldbus - Introduction -General Fieldbus architecture - Basic requirements of Fieldbus standard - Fieldbus topology- Interoperability - Interchangeability - OLE for process control (OPC).	9
IV	MODBUS AND PROFIBUS PA/DP/FMS AND FF MODBUS protocol structure - function codes - troubleshooting Profibus: Introduction, protocol stack, communication model - communication objects - system operation - troubleshooting.	9
V	INDUSTRIAL ETHERNET AND WIRELESS COMMUNICATION Industrial Ethernet, 10 Mbps Ethernet, 100 Mbps Ethernet - Radio and wireless communication, components of radio link - radio spectrum and frequency allocation - radio MODEMs-Introduction to wireless HART and ISA100.	9
Total Instructional Hours		45

Course Outcome	Description
CO1:	Outline the basics of data networks.
CO2:	Appraise about MODBUS and HART protocol in networking
CO3:	Understand the importance of FIELD BUS and PROFIBUS in networking.
CO4:	Associate appropriate internetworking standards for data transfer.
CO5:	Outline various standards and applications of wireless communication.

TEXT BOOKS:

- T1 - Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, “Practical Industrial Data Networks Design, Installation and Troubleshooting”, Newnes Publication, Elsevier First Edition, 2004.
- T2 – Behrouz Forouzan, “Data Communication & Networking”, Tata McGraw Hill, Third edition, 2006.

REFERENCE BOOKS:

- R1 - Andrew S. Tanenbaum, David J. Wetherall, “Computer Networks”, PHI, Fifth Edition. 2011.
- R2 – Lawrence, M. Thompson and Tim Shaw, “Industrial Data Communications”, 5th Edition ISA Press, 2015.
- R3 - Theodore S Rappaport, “Wireless Communication: Principles and Practice”, PHI, 2nd Edition, 2001.
- R4 - William Stallings, “Wireless Communication & Networks”, Prentice Hall of India, Second Edition, 2005.

WEB REFERENCE:

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI6304	DIGITAL IMAGE PROCESSING	3	0	0	3

- Course Objective
1. Interpret the fundamentals of digital image.
 2. Infer the basics of image enhancement technique.
 3. Apply the image restoration and segmentation technique.
 4. Analyze the wavelets and image reconstruction process.
 5. Infer the image representation and Recognition technique.

Unit	Description	Instructional Hours
	DIGITAL IMAGE FUNDAMENTALS	
I	Digital Image Representation - Elements of Digital Image Processing system -Elements of Visual Perception - Image Sampling and Quantization - Relationship between Pixels - Color Models.	9
	IMAGE ENHANCEMENT	
II	Spatial Domain: Point Operation, Histogram Modelling, Basics of Spatial Filtering - Smoothing and Sharpening Spatial Filter - Multispectral Image Enhancement.	9
	IMAGE RESTORATION AND SEGMENTATION	
III	Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering Segmentation: Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation-Morphological processing- erosion and dilation.	9
	WAVELETS AND IMAGE COMPRESSION	
IV	Wavelets – Subband coding - Multiresolution expansions - Compression: Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards.	9
	IMAGE REPRESENTATION AND RECOGNITION	
V	Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier Descriptor, moments- Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Summarize the fundamentals of digital image processing.
CO2: Apply the spatial and multispectral enhancement techniques in an image.
CO3: Construct the segmentation algorithm for restoration of digital image.
CO4: Establish the image compression techniques.
CO5: Assess the image Representation and Recognition techniques.

TEXT BOOKS:

- T1 -Anil Jain.K “Fundamentals of Digital Image Processing”, Prentice Hall of India Learning Pvt.Ltd,2011.
T2 - Rafeal C. Gonzalez, Richard E. Woods “Digital Image Processing” Third Edition, Pearson 2016.

REFERENCE BOOKS:

- R1 - S.Jayaraman, E.Esakkirajan and T.Veerakumar, “Digital Image Processing” Tata McGraw Hill Education Private Ltd, 2009.
R2 - William K. Pratt, “Digital Image Processing: PIKS Scientific Inside”, Wiley Student Edition, 2010.
R3- Munesh.C.Trivedi and Dr. Sanjay. M. Shah, “Digital Image Processing”, Khanna publications, 2012.
R4 - Kenneth R Castleman “Digital Image Processing”, Pearson education 2007.

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1. <https://nptel.ac.in/courses/117/105/117105079/>
2. <https://nptel.ac.in/courses/117/105/117105079/>


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI6305	INTRODUCTION TO SOFT COMPUTING	3	0	0	3

Course Objective	Description
	1. Basics of artificial neural network.
	2. Concepts of modelling and control of neural and fuzzy control schemes
	3. Impart knowledge of fuzzy set theory
	4. Methods of modelling and control of fuzzy control schemes
	5. Features of hybrid control schemes.

Unit	Description	Instructional Hours
	ARTIFICIAL NEURAL NETWORK	
I	Review of fundamentals – Biological neuron, artificial neuron, activation function- single layer perceptron – Limitation – Multi layer perceptron – Back Propagation Algorithm (BPA) – Recurrent Neural Network (RNN) – Adaptive Resonance Theory (ART) based network – Radial basis function network – online learning algorithms, – Reinforcement learning.	9
	NEURAL NETWORKS FOR MODELING AND CONTROL	
II	Modelling of non-linear systems using ANN – Generation of training data – Optimal architecture– Model validation – Control of non-linear systems using ANN – Direct and indirect neuro control schemes – Adaptive neuro controller- other neural nets – Neo cognition.	9
	FUZZY SET THEORY	
III	Fuzzy set theory – Fuzzy sets – Operation on fuzzy sets – Scalar cardinality, fuzzy cardinality, union and intersection, complement (Yager and Sugeno), equilibrium points, aggregation, projection, composition, cylindrical extension, fuzzy relation – Fuzzy membership functions.	9
	FUZZY LOGIC FOR MODELING AND CONTROL	
IV	Modelling of non-linear systems using fuzzy models – TSK model – Fuzzy logic controller – Fuzzification – Decision making logic – Defuzzification – Adaptive fuzzy systems - Design of Fuzzy logic control systems using MATLAB	9
	HYBRID CONTROL SCHEMES	
V	Fuzzification and rule base using ANN – Neuro fuzzy systems – ANFIS – Fuzzy neuron– GA – Optimization of membership function and rule base using Genetic Algorithm – Introduction to other evolutionary optimization techniques, support vector machine.	9
Total Instructional Hours		45

Course Outcome	Description
	CO1: Understand the concepts of ANN, different features of fuzzy logic and their modelling, control aspects and different hybrid control schemes
	CO2: Understand the basics of artificial neural network.
	CO3: Remember the modelling and control of neural network
	CO4: Remember on modelling and control of fuzzy control schemes.
	CO5: Acquire knowledge on hybrid control schemes.

TEXT BOOKS:

T1 - Laurence Fausett, "Fundamentals of Neural Networks", Prentice Hall, Englewood Cliffs, N.J., 1992.

T2 - Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill Inc., 2000.

REFERENCE BOOKS:

R1 - Goldberg, "Genetic Algorithm in Search, Optimization and Machine learning", Addison Wesley Publishing Company Inc. 1989.

R2 - Millon W.T., Sutton R.S. and Webrose P.J., "Neural Networks for Control", MIT press, 1992.

R3-EthemAlpaydin, "Introduction to Machine learning (Adaptive Computation and Machine Learning series)', MIT Press, Second Edition, 2010.

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2. <https://nptel.ac.in/courses/106/105/106105173/>


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OPEN ELECTIVE

Programme	Course code	Name of the Course	L	T	P	C
B.E.	19EI6401	SMART SENSORS FOR ENGINEERING APPLICATIONS	3	0	0	3

Course Objective	<ol style="list-style-type: none"> 1. Interpret the basic concepts of sensors and measurements. 2. Infer the basics of strain and pressure measurement 3. Summarize the concepts of motion and light radiation sensors. 4. Impart the working of heat and thermal sensor 5. Interpret the functions of electronic sensors.
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Unit	Description	Instructional Hours
	MEASURING SYSTEM	
I	Sensor Systems- Classification of sensors- Factors in making the measurements-accuracy, precision, resolution, repeatability, reproducibility, hysteresis, sensitivity, range, selection and standard of sensors – SI Units – Base units of SI - Errors in Measurement – Types of errors - Calibration techniques	9
	STRAIN AND PRESSURE MEASUREMENT	
II	Resistance strain gauge, Piezoelectric pressure gauge, characteristics- Electronic circuits for strain gauge, Load cells Interferometer, Fibre optic methods- Pressure gauges, Aneroid Capacitance pressure gauge, Ionization gauge - Transducer Applications.	9
	MOTION AND RADIATION SENSORS	
III	Motion Sensors: Capacitor plate sensor, inductive sensors, LVDT accelerometer systems, rotation sensors drag cup devices, piezoelectric devices. Rotary encoders. Light Radiation: Light flux, Photo sensors, Photomultiplier, Photo resistor and Photoconductors, Photodiodes, Phototransistors, Photovoltaic Devices, Fiber-optic applications	9
	HEAT AND TEMPERATURE SENSORS	
IV	Heat and Temperature: Bimetallic strip, Bourdon temperature gauge, thermocouples, Resistance thermometers, Thermistors, PTC thermistors, Thermostat, Bolometer, Pyroelectric detector.	9
	ELECTRONIC SENSORS	
V	Proximity detectors: Inductive and capacitive, ultrasonic, photo beam detectors reed switch, magnet and Hall-effect units, doppler detectors, liquid level detectors, flow sensors, smoke sensors, Biosensor.	9
Total Instructional Hours		45

Course Outcome	<p>CO1:Describe the concept and characteristics involved in sensors and measurements.</p> <p>CO2:Explain the methods for the measurement of strain and pressure.</p> <p>CO3:Describe the methods of measurement for motion and radiation</p> <p>CO4:Identify and select suitable measurement instruments for measuring heat and temperature.</p> <p>CO5: Elaborate the functions of electronic sensors</p>
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TEXT BOOKS:

- T1 - Doebelin. E. O., “Measurement Systems: Applications and Design”, McGraw-Hill Publications., 2008.
- T2 - Ian R Sinclair, “Sensors and Transducers”, Third Edition, Newnes publishers, 2001.

REFERENCE BOOKS :

- R1 - Patranabis. D., “Sensors and Transducers”, 2nd Edition, Prentice Hall India Pvt. Ltd, 2010.
- R2 - Murthy. D. V. S., “Transducers and instrumentation”, 2nd Edition, Prentice Hall of India Pvt. Ltd.,2010
- R3 -Jack P Holman, “Experimental Methods for Engineers”, Seventh Edition, McGraw Hill, USA, 2001.
- R4 - Julian w. Gardner, Vijay K. Varadan, Osama O. Awadelkarim, “Micro Sensors MEMS and Smart Devices”, John Wiley & Son Ltd,2002.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	19EI6402	ELECTRICAL ENERGY MANAGEMENT AND AUDIT	3	0	0	3

Course Objective	Objectives
	<ol style="list-style-type: none"> 1. Learn the fundamentals of Boilers, Furnace and Steam. . 2. Understand and analyze the energy conservation methods. 3. Infer the Concepts of energy management system and role of energy manager. 4. Acquire Skills and techniques required to implement energy audit 5. Implement techniques required for energy audit.

Unit	Description	Instructional Hours
	INTRODUCTION TO BOILERS, FURNACES AND STEAM	
I	Boiler systems – Classification – Performance evaluation of Boilers- Boiler blow down – Furnaces: Types and classification – Furnace performance and standards – Steam systems: properties, utilization, selection and maintenance - Energy sources and their availability - Renewable energy sources – Types – Cogeneration.	9
	ENERGY CONSERVATION	
II	Introduction - Load curve - cost of electrical energy - need for electrical energy conservation methods - Power factor improvement - concept of distributed generation - Deregulation - Need for Restructuring. Indian Energy Conservation Act - BEE star rating - List of Energy Intensive Industries - Rules for Efficient Energy Conservation.	9
	ENERGY MANAGEMENT	
III	Definition and objectives of energy management - Energy management strategy - Key elements - Responsibility and duties of energy manager - Energy efficient programs - Energy monitoring systems - Importance of SCADA - Analysis technique.	9
	ENERGY AUDIT	
IV	Aim of Energy audit - Energy flow diagram - Strategy of energy audit - comparison with standards - Energy management team - Considerations in implementing energy conservation programmes - Periodic progress review	9
	ENERGY AUDIT FOR VARIOUS APPLICATIONS	
V	Types of Energy Audit : Internal Audit, External Audit, Walk through Energy Audit, Preliminary Energy Audit, Detailed Energy Audit, Residential Energy Audit. Instruments for energy audits - Energy audit for Illumination system - Electrical system - Heating - Ventilation - Air conditioning system - Buildings - Economic analysis.	9
Total Instructional Hours		45

Course Outcome	Outcomes
	<p>CO1: Classify the types of Boilers, furnaces and properties of steam.</p> <p>CO2: Outline the importance of energy conservation and aware of energy conservation act.</p> <p>CO3: Identify the role and responsibilities of energy manager.</p> <p>CO4: Outline the fundamentals of energy audit.</p> <p>CO5: Implement energy audit for several applications.</p>

TEXT BOOKS:

- T1- B.R. Gupta, “ Generation of Electrical Energy ” , S.Chand Publications , New Delhi , 2014.
T2 - Energy Audit and Management, Volume-I, IECC Press, 2005

REFERENCE BOOKS:

- R1- G.D.Rai, “ Non Conventional Energy Sources ” , Khanna publishers , New Delhi , 2014.
R2- W.C. Turner, “Energy Management Handbook”, 6th Edition, CRC press, 2006.
R3 - Amit K. Tyagi, “Handbook on Energy Audits and Management”, TERI, 2003
R4- S. Sivanagaraju, “ Generation and Utilization of Electrical Energy ” Pearson, New Delhi 2010


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SEMESTER VII

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI7201	COMPUTER CONTROL OF PROCESS	3	0	0	3
Course Objective	1. Infer the basic concepts of sampled data control system 2. Interpret the response, design concepts and stability of sampled data system. 3. Summarize the concepts of process dynamics. 4. Discuss on process modeling and identification 5. Outline the fundamentals of multi variable control system					
Unit	Description					Instructional Hours
I	ELEMENTS OF COMPUTER PROCESS CONTROL - I Review of conventional process control -Single loop computer control - Mathematical representation of the sampling process- Z-Transformation-Pulse transfer functions – Data holds.					9
II	ELEMENTS OF COMPUTER PROCESS CONTROL – II Open loop response of sampled data system - closed loop response of sampled data system -Design of sampled data control systems - Stability of sampled data control systems – Schurr cohn stability criterion. Modified Z transforms.					9
III	PROCESS DYNAMICS Basics elements of dynamic analysis- Process Model – Dynamic behavior of linear lower and linear higher order systems. Frequency response analysis-Inverse response systems, Time delay systems.					9
IV	PROCESS MODELLING AND IDENTIFICATION Theoretical process modeling: Development, Examples, Parameter estimation and Validation. Process Identification: Principle of empirical modeling - Step, Impulse, Frequency response.					9
V	MULTI VARIABLE PROCESS CONTROL Introduction to multi variable systems – Interaction analysis and multiple single loop design – Design of multivariable controller.					9
Total Instructional Hours					45	

Course Outcome	CO1: Summarize the need of computer in process industry.
	CO2: Demonstrate the use of z transforms for signal processing applications.
	CO3: Build the concepts of process dynamics.
	CO4: Understand the modeling and identification of process.
	CO5: Explain the concepts of multivariable regulatory control

TEXT BOOKS:

- T1 - P.B.Deshpande and R.H.Ash, "Computer Process Control", International Society of Automation publication, USA, 1995
 T2 - Babatunde A. Ogunnaike and W. Harmon ray, "Process dynamics, modeling and control". Oxford university press, 1994.

REFERENCE BOOKS:

- R1 – Shanthi Sasidharan, "Computer control of process", CBA Publishers, Third edition, 2015.
 R2 – M. Chidambaram, "Computer control of processes", Narosa publishing house, 2006.
 R3 – Dale Seborg. E, Thomas. F, Edgar, Duncan. A, Mellichamp, "Process Dynamics and Control", Willey India, 2006.
 R4- Karl J Astrom and Bjorn Wittenmark, "Adaptive Control", Pearson Education Inc, Second Edition, 2008.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI7202	INDUSTRIAL ELECTRONICS	3	0	0	3
Course Objective	1. Discuss the operation of power semiconductor devices and their switching characteristics 2. Design controlled converter circuits. 3. Differentiate the operation of various chopper circuits. 4. Analyse the operation of inverter circuits for 120° mode and 180° mode operation. 5. Classify AC to AC converter circuits based on its operation.					
Unit	Description	Instructional Hours				
I	POWER SEMICONDUCTOR DEVICES Power Diode, SCR, TRIAC, GTO, BJT, MCT, MOSFET, IGBT, Power Integrated Circuits(PIC's) - Static and Dynamic characteristics - Triggering and commutation circuit for SCR - Design of Driver and snubber circuit-protection circuits- Simulation tools.	9				
II	PHASE CONTROLLED CONVERTERS 2 pulse, 3 pulse and 6 pulse converters - performance parameters - Effect of source inductance - Dual converters - steady state analysis-Introduction to matrix converters and cycloconverters.	9				
III	DC TO DC CONVERTER Step down and step up chopper - control strategy - Commutation in choppers - Switched mode regulators - Buck, Boost, Buck- Boost converter - Resonant Converters and its topologies.	9				
IV	INVERTERS Inverters Basics - PWM techniques - Single phase and Three Phase Voltage Source Inverters (120° mode and 180° mode) - Current Source Inverter - Voltage and Harmonic Control - Space Vector Modulation techniques for inverters- introduction to multilevel inverters..	9				
V	DRIVES AND CONTROL Static and Dynamic equations of dc and ac machines – Electrical breaking – Rectifier and chopper control of DC drives – Principles of v/f control of AC drives – Open loop and Closed loop schemes for DC and AC drives(Block diagram approach only) – Introduction to vector control of AC drives.	9				
Total Instructional Hours						45

Course Outcome	CO1: Outline the operation of power semiconductor devices and their switching characteristics.
	CO2: Illustrate the operation of power electronic rectifier circuits.
	CO3: Identify the appropriate chopper circuit for various applications.
	CO4: Choose the appropriate mode of operation of inverter.
	CO5: Compile the operation of AC to AC converters.

TEXT BOOKS:

- T1 - M. H. Rashid, "Power Electronics: Circuits, Devices and Applications", Pearson Education, Fourth Edition, New Delhi, 2017.
 T2 - P. S. Bhimbra "Power Electronics", Khanna Publishers, Fourth Edition, 2017.

REFERENCE BOOKS:

- R1 – Joseph Vithayathil, "Power Electronics, Principles and Applications", McGraw Hill, 7th Reprint, 2015.
 R2 – Ned Mohan, Tore. M. Undel and, William. P. Robbins, "Power Electronics: Converters, Applications and Design", John Wiley and sons, Third Edition, 2018
 R3 – M. D. Singh and K.B. Khanchandani, "Power Electronics," McGraw Hill India, 2014.
 R4 - MS Jamil Asghar " Power Electronics", PHI Learning 2009.

WEB REFERENCE:

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI7251	BIO-MEDICAL INSTRUMENTATION	2	0	2	3

- Course Objective
1. Recall fundamentals of human physiology.
 2. Discuss about the Biopotential and its electrode.
 3. Outline the recording and monitoring biomedical instruments.
 4. Infer the basic principles in medical imaging techniques.
 5. Generalize about life assisting and therapeutic devices.

Unit	Description	Instructional Hours
	HUMAN PHYSIOLOGY	
I	Human Body Overview: Introduction, Cell, Body fluids - Musculoskeletal, Gastrointestinal, Endocrine system. Heart and circulatory system – The human respiratory system The human nervous system. Identify and assemble the parts in Respiratory, Nervous, Circulatory, Musculoskeletal & Gastro intestinal system models.	6+3
	BIO POTENTIALS AND BIOPOTENTIAL ELECTRODES	
II	Sources of bio electric potential -The origin of biopotentials : Electrical activity of excitable cells - ENG, EMG, ECG, ERG, EEG, MEG Electrode Theory - Biopotential electrodes : Electrode – electrolyte interface –Polarizable and non polarizable electrodes. Body surface recording electrodes, Internal electrodes, Electrode arrays, Micro electrode. Identify and measure the signals from the Metal plate, Disposable foam pad, Flexible, Internal, Implantable, Micro and Array type electrodes.	6+3
	RECORDING AND MONITORING INSTRUMENTS	
III	Biomedical recorders – Patient monitoring systems – Arrhythmia and ambulatory monitoring instruments – Foetal monitoring instruments – Oximeters –Blood flowmeters – Cardiac output measurement – Pulmonary function analysers – Blood gas analyzers – Blood cell counters – Audiometers. Experimental study of recording and monitoring of ECG or EMG or ERG or EEG.	6+3
	MODERN IMAGING SYSTEMS	
IV	X-ray machines and digital radiography –X-ray computed tomography – Nuclear medical imaging systems – Magnetic resonance imaging system- Ultrasonic Imaging systems – Thermal imaging systems. Identification, inference & diagnostic study of imaging reports from X-Ray, Ultrasonic and Thermal Imaging systems.	6+3
	THERAPEUTIC EQUIPMENTS	
V	Cardiac pacemakers – Cardiac defibrillators – Instruments for surgery – Physiotherapy and electro therapy equipment- Haemodialysis machines- Lithotriptors – Anaesthesia machine – Ventilators – Radiotherapy equipment – Automatic drug delivery systems. Field study report on certain Recording & Monitoring instruments, Imaging systems & Therapeutic equipments at Hospital.	6+3
Total Instructional Hours		45

- Course Outcome
- CO1: Summarize the concepts of physiology.
 - CO2: Elaboration on biopotential and electrodes.
 - CO3: Understand the measurement techniques of biomedical recording and monitoring instruments.
 - CO4: Elaborate the basic principles in imaging techniques.
 - CO5: Infer basic knowledge in life assisting and therapeutic devices.

TEXT BOOKS:

- T1 - R.S.Khandpur, "Hand Book of Bio-Medical instrumentation", Tata McGraw Hill, 2011.
T2 - Joseph J.Carr and John M .Brown, "Introduction to Biomedical Equipment Technology", Fourth edition, Pearson Education Inc, 2013.

REFERENCE BOOKS:

- R1 –John G.Webster, "Medical Instrumentation: Application and Design",3rd Edition, Wiley Pvt Ltd., 2008.
R2–Leslie cromwell, Fred J Weibell, Erich A.Pfeiffer., "Bio medical Instrumentation and Measurements", 2nd edition, PHI Learning Pvt Ltd, 2012.
R3 – Myer Kutz, "Standard Handbook of Biomedical Engineering & Design",Mc Graw Hill, 2003.
R4 -M.Arumugam, "Bio-Medical Instrumentation", 2nd edition, Anuradha Publications, 2015.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI7001	COMPUTER CONTROL OF PROCESS LABORATORY	0	0	3	1.5

Course Objective
1. Simulation of the linear systems for various physical processes.
2. Design and simulate the computer based controller algorithms.
3. Categorized response of computer control for liquid and thermal systems.
4. Outline the basic PLC programming logic with timers and counters
5. Be familiar with applications of PLC Programming.

Expt. No. Description of the Experiments

1. Digital Simulation of Linear system.
Simulate the response of the following discrete system
2.
 - a. First Order Discrete System With and Without Dead time.
 - b. Second Order Discrete System With and Without Dead time.
3. Design and simulation of Dead beat controller algorithms.
4. Design and simulation of Dahlin's controller algorithms.
5. Design of Lag and Lead Compensator using Bode Plot.
6. Design and simulation of IMC/MPC structure for higher order systems.
7. Design and simulation the response of a system with and without fuzzy logic controller.
8. Response of computer controlled liquid level system with PID algorithm.
9. Response of computer controlled thermal system with PID algorithm.
10. Programming for pneumatic stamping control system using PLC.
11. Programming for Chemical Mixing Process and Bottle filling system using PLC.
12. Programming for spray painting system using PLC.

Total Practical Hours 45

Course Outcome
CO1: Compare various linear system simulated responses.
CO2: Evaluate the discrete controller parameters using different tuning process.
CO3: Compile various discrete controller algorithms for different systems.
CO4: Practice of basic PLC programming using ladder diagram.
CO5: Demonstrate PLC based control applications and it's working in real time.

REFERENCES:

- R1-George Stephanopoulos, Chemical Process Control: An Introduction to theory and Practice, Pearson Education, 2008
- R2- Laboratory manual prepared by the Department of Electronics and Instrumentation Engineering, 2017.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI7002	INSTRUMENTATION SYSTEM DESIGN LABORATORY	0	0	3	1.5

Course Objective	<ol style="list-style-type: none"> 1. To gain knowledge in designing electronic circuits. 2. To predict the performance of various instruments. 3. To design appropriate controller for various instruments.
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Expt. No.	Description of the Experiments
1.	Design of Instrumentation Amplifier
2.	Design of Active Filters <ol style="list-style-type: none"> a. Low Pass and High Pass b. Band Pass and Band Reject
3.	Design of Regulated Power Supply
4.	Design of V/I And I/V Converters
5.	Design of <ol style="list-style-type: none"> a. Linearizing Circuits for Thermocouple. b. Cold Junction Compensation Circuit for Thermocouple.
6.	Design of Signal Conditioning Circuit for <ol style="list-style-type: none"> a. Strain Gauge. b. RTD.
7.	Design of Orifice Plate and Rotameter.
8.	Design of Control Valve Flow Lift Characteristics(with and without positioner)
9.	Design of PID Controller (Using Operational Amplifier)
10.	Design of A Multi Channel Data Acquisition System
11.	Design of Multi Range DP Transmitter
12.	Characteristics of Control Valve Sizing

Total Practical Hours 45

Course Outcome	<p>CO1 : Design various types of filter circuits and amplifiers.</p> <p>CO2 : Suggest a suitable power supply circuit.</p> <p>CO3 : Able to analyse the performance of thermocouple, strain gauge and RTD.</p> <p>CO4 : Plot the performance of control valve.</p> <p>CO5 : Design a data acquisition system.</p>
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REFERENCES:

- R1-Gregory K Mc Millan Douglas M Considine, —Process/ Industrial Instruments and Controls Handbook, Tata McGraw Hill, 2009.
- R2- Laboratory manual prepared by the Department of Electronics and Instrumentation Engineering, 2017.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI7901	PROJECT WORK - PHASE I	0	0	4	2

- Course Objectives
1. Apply a gained knowledge and methodology to select a good project and able to work in a team.
 2. Transform the ideas behind the project into a product.
 3. Validate the technical report.

A candidate shall be permitted to work on projects in an Industrial / Research Organization, on the recommendations of the Head of the Department concerned.

A project must be selected either from research literature published list or the students themselves may propose suitable topics in consultation with their guide.

The aim of the project work is to strengthen the comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation or a design problem.

The project work shall be supervised by a supervisor of the department, (and an expert in industry if it is a industrial project), and the student shall be instructed to meet the supervisor periodically and to attend the review committee meeting for evaluation of the progress.

In case of candidates not completing Phase-I of project work successfully, the candidates can undertake Phase-I again in the subsequent semester. In such cases the candidates can enroll for Phase-II, only after successful completion of Phase-I.

The Project report shall be prepared and submitted according to the approved guidelines as given by the Controller of Examination and bonafied duly signed by Supervisor and the Head of the Department.

- Course Outcome
- CO1: Realize the skills acquired in the previous semesters to solve complex engineering problems.
 - CO2: Develop an innovative model / prototype of an idea related to the field of specialization.
 - CO3: Create the work individually to identify, troubleshoot and build products for environmental and Societal issues.
 - CO4: Create effective presentation of ideas with clarity.
 - CO5: Evaluate surveys towards developing a product which helps in life time learning.


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SEMESTER VIII

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI8901	PROJECT WORK - PHASE II	0	0	16	8

Course Objectives	<ol style="list-style-type: none">1. Apply a methodology to extend a project ideas and able to work in a team.2. Transform the ideas behind the project into a product.3. Test and validate the technical report.
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The Project work (Phase II) shall be pursued for a minimum prescribed period as per regulation.

The project work shall be supervised by a supervisor of the department, (and an expert in industry if it is a industrial project), and the student shall be instructed to meet the supervisor periodically and to attend the review committee meeting for evaluation of the progress.

The Project report shall be prepared and submitted according to the approved guidelines as given by the Controller of Examination and bonafied duly signed by Supervisor and the Head of the Department.

Course Outcome	<p>CO1: Implement the skills acquired in the previous semesters to solve complex engineering problems. CO2: Develop a model / prototype of an idea related to the field of specialization. CO3: Establish the work individually or in a team to identify, troubleshoot and build products for environmental and societal issues. CO4: Perform presentation of ideas with clarity. CO5: Evaluate surveys towards developing a product which helps in life time learning.</p>
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PROFESSIONAL ELECTIVE III

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI7301	NON-LINEAR CONTROL SYSTEM	3	0	0	3

- Course Objective
1. Understand the common non-linearities which exist among all the systems.
 2. Generalise describing function based approach of non-linear analysis.
 3. Explain about Lyapunov Theory and it's methods
 4. Discover on Linearization schemes on SISO, MIMO systems.
 5. Highlight on Sliding Mode Control.

Unit	Description	Instructional Hours
I	<p>INTRODUCTION TO NON-LINEAR CONTROL THEORY</p> <p>Linear versus nonlinear systems - Common Nonlinear behavior, Examples - Types of Nonlinearities - Autonomy - Equilibrium points of nonlinear systems, Feedback Linearization, Series Approximation Methods.</p>	9
II	<p>DESCRIBING FUNCTION</p> <p>Describing function analysis: Fundamentals, common nonlinearities (saturation, dead - zone, on - off Non - linearity, backlash, hysteresis) and their describing functions. Compensation and design of nonlinear system using describing function, Limit Cycle.</p>	9
III	<p>LYAPUNOV THEORY</p> <p>Lyapunov's stability, concept, Lyapunov's Direct Method - Positive definite Functions and Lyapunov Functions - Krasovski's Method - Variable Gradient Method - Control Design based on Lyapunov's Direct Method.</p>	9
IV	<p>FEEDBACK LINEARIZATION</p> <p>Feedback Linearization and the Canonical Form - Mathematical Tools-Input - State Linearization of SISO Systems - input-Output Linearization of SISO Systems - Generating a Linear Input - Output Relation-Stabilization and Tracking - Feedback Linearization of MIMO Systems.</p>	9
V	<p>SLIDING MODE CONTROL</p> <p>Sliding Surfaces - Continuous approximations of Switching Control laws - The Modeling and Performance Trade-Offs - MIMO Systems – examples.</p> <p>Case Study - Sliding mode approach to speed control of dc motors, applications.</p>	9
Total Instructional Hours		45

- Course Outcome
- CO1: Classify the linear/non-linear system theory and their types.
 - CO2: Understand and analyze the various non-linear systems with describing functions.
 - CO3: Appraise the stability for various nonlinear functions using lyapunov method.
 - CO4: Design the SISO, MIMO system with feedback linearization.
 - CO5: Implement sliding mode control approach to various non-linear applications

TEXT BOOKS:

- T1 - Katsuhiko Ogata, "Modern Control Engineering", Pearson Education, 5th Edition 2010.
 T2 -Torkel Glad and Lennart Ljung, "Control Theory – Multivariable and Nonlinear Methods", Taylor & Francis, 2002.

REFERENCE BOOKS:

- R1 - Jean-Jacques E. Slotine, Weiping Li, "Applied nonlinear Control", Prentice Hall of India , 2004.
 R2 - Richard C Dorf and Robert H Bishop, "Modern Control Systems," 11th Edition, Pearson,2008.
 R3 - A.Nagoor Kani, "Advanced Control System", 2nd Edition, RBA publications, 2014.

WEB REFERENCE:

<https://nptel.ac.in/courses/108/106/108106024/>


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI7302	INDUSTRIAL IOT	3	0	0	3

- Course Objective
1. Outline the basic concepts of Industrial Internet of Things.
 2. Illustrate the different network technologies and protocols.
 3. Educate the concepts of middleware components.
 4. Relate the security and privacy issues in IIoT.
 5. Interpret IIoT and Cyber manufacturing systems.

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Introduction – Industrial Internet use -cases - Technical and business innovators of the industrial - internet – IIoT reference architecture – Industrial Internet Architecture Framework (IIAF)- Functional View point – Three -Tier topology – Key function characteristics.	9
	NETWORK TECHNOLOGY AND PROTOCOLS	
II	Proximity network – WSN Edge Node – Legacy Industrial Protocols – Modern communication protocols – wireless communication technologies - Single Node Architecture – Hardware Components, Network delay modeling– Gateways – Access Network.	9
	IIoT MIDDLEWARE CONCEPTS	
III	Middle ware Transport protocols : TCP/IP, UDP, RTP CoAP – Middleware software patterns- Publish/Subscribe pattern: MQTT, XMPP, AMQP, DDS, DTN - Middleware platforms – IIoT WAN technologies.	9
	SECURITY AND PRIVACY IN IIoT	
IV	Security analysis and advanced threats – Secured Interconnection mechanisms – Advanced Protection techniques – Privacy issues in Industrial connected networks – Application Scenarios.	9
	IIOT AND CYBER MANUFACTURING SYSTEMS	
V	Industrial Cyber-Physical Systems – Modelling for CPS and CMS – Architectural Design Patterns for CMS and IIoT – User Driven CPS – IIoT in healthcare, power plant and process industries.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Summarize the basic concepts of IIoT.
- CO2: Explain the different network technologies and protocols.
- CO3: Describe about the middleware patterns and platforms.
- CO4: Interpret the security and privacy issues in IIoT.
- CO5: Recognize the pattern for IIoT and Cyber Manufacturing Systems.

TEXT BOOKS:

- T1 - Alasdair Gilchrist, “Industry 4.0- The Industrial Internet of Things”, Apress, First Edition, 2016.
- T2 - Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat, “Industrial Internet of Things – Cyber manufacturing Systems”, Springer- Series in wireless Technology, 2017.

REFERENCE BOOKS:

- R1 - Cristina Alcaraz, “Security and Privacy Trends in the Industrial Internet of Things”, Springer – Advanced Sciences and Technologies for security applications, 2019
- R2 - Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, First Edition, CRC Press, 2013.
- R3 - Andrian McEwen, Hakim Cassimally, “Designing the Internet of Things”, First Edition, John Wiley & Sons Ltd, 2014.

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1. <https://nptel.ac.in/courses/106/105/106105166/>
2. <https://nptel.ac.in/courses/106/105/106105195/>


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI7303	ROBOTICS AND AUTOMATION	3	0	0	3

Course Objective	Description
	1. Infer the fundamentals of robotics.
	2. Recall the concepts of sensors and vision system.
	3. Outline the working of robot dynamics and grippers.
	4. Write program for developing a robot.
	5. Enumerate robotics applications and its principles..

Unit	Description	Instructional Hours
	INTRODUCTION TO ROBOTS	
I	Origin & various generation of robot – Laws of robots - Robotic System Components - Classification of robots – Need of sensors in robots - Degree of freedom – End effectors – Robotic manipulators - Need for automation – types of automation - robot part’s and their functions- need for robots-applications.	9
	ROBOT KINEMATICS	
II	Forward kinematics, inverse kinematics and the difference: forward kinematics and inverse Kinematics of Manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) – Trajectory planning – Robot Dynamics - Homogeneous transformation matrices, translation and rotation matrices Dennaivit and Hartenberg transformation.	9
	ROBOT DRIVE SYSTEMS AND END EFFECTORS	
III	Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison. Various Control schemes of robots - End Effectors – Grippers – selection and design considerations of a gripper - gripper force calculation and analysis.	9
	SENSORS IN ROBOTICS	
IV	Force sensors, touch and tactile sensors, proximity sensors, non-contact sensors, safety considerations in robotic cell, proximity sensors, Robotic Machine vision system - camera, frame grabber, sensing and digitizing image data – signal conversion, image storage, lighting techniques, image processing and analysis – data reduction, segmentation, feature extraction, object recognition, applications – Inspection, identification, visual serving and navigation.	9
	PROGRAMMING AND APPLICATIONS OF ROBOT	
V	Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effectors Command, and simple programs - Intelligent Robots - Role of robots in inspection, assembly, material handling, underwater, space and medical fields.	9
Total Instructional Hours		45

Course Outcome	Description
	CO1: Illustrate the fundamentals of robots.
	CO2: Apply knowledge on sensors and robotic vision system.
	CO3: Develop robots with differential motion and control.
	CO4: Build programs for robots in various applications.
	CO5: Familiarize on Various Robotic programming and applications.

TEXT BOOKS:

- T1 -M.P.Groover, M. Weiss, R.N. Nageland N. G.Odrej, “Industrial Robotics”, McGraw-Hill,1996.
- T2 - Deb S R and Deb S, —Robotics Technology and Flexible Automationl, Tata McGraw Hill Pvt. Ltd, 2010.

REFERENCE BOOKS:

- R1 - D.K. Pratihar, “Fundamentals of Robotics”, Narosa Publishing House, New Delhi ,2017
- R2 - K.S Fu, R.C Gonzalez, C.S.G Lee, “ Robotics”, McGraw-Hill 1987.
- R3 - Ghosh, “Control in Robotics and Automation: Sensor Based Integration”, Allied Publishers,1999.

WEB REFERENCE:

https://onlinecourses.nptel.ac.in/noc20_me56/preview


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI7304	MICROCONTROLLER BASED SYSTEM DESIGN	3	0	0	3

Course Objective	Objectives
	1. Infer the fundamental components of the PIC microcontroller.
	2. Educate the PIC micro controller Interrupts and Timers.
	3. Integrate the concept of peripherals and interfacing of microcontroller-based embedded systems.
	4. Propose the architecture of arm processor
	5. Introduce the concept of arm organization

Unit	Description	Instructional Hours
	INTRODUCTION TO PIC MICROCONTROLLER	
I	Introduction to PIC Microcontroller – PIC 16C6x and PIC16C7x Architecture – PIC16cxx – Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes – Simple Operations.	9
	INTERRUPTS AND TIMER	
II	PIC micro controller Interrupts -- External Interrupts – Timers – Timer modules – Front panel I/O-Soft Keys – State machines and key switches – Display of Constant and Variable strings.	9
	PERIPHERALS AND INTERFACING	
III	I ² C Bus for Peripherals Chip Access – Bus operation-- Bus subroutines – Serial EEPROM – Baud rate selection – LCD and keyboard Interfacing – ADC – DAC -- and Sensor Interfacing.	9
	INTRODUCTION TO ARM PROCESSOR	
IV	ARM Architecture – ARM programmer’s model – ARM Development tools -- Memory Hierarchy – ARM Assembly Language Programming – Simple Examples – Architectural Support for Operating systems.	9
	ARM ORGANIZATION	
V	3-Stage Pipeline ARM Organization – 5 Stage Pipeline ARM Organization – ARM Instruction Execution -- ARM Implementation – ARM Instruction Set – ARM coprocessor interface – Embedded ARM Applications	9
Total Instructional Hours		45

Course Outcome	Outcomes
	CO1: Understand the working of the architecture for PIC microcontrollers
	CO2: Identify the factors for data transfer in interrupts and understand the timer function of PIC microcontroller
	CO3: Observe the peripherals and interfacing of microcontroller-based embedded systems.
	CO4: Interpret the ARM Architecture and Assembly Language Programming
	CO5: Employ the role of arm organization

TEXT BOOKS:

- T1 -Peatman,J.B., “Design with PIC Micro Controllers”PearsonEducation,3rdEdition, 2004.
- T2 - Furber,S., “ARM System on Chip Architecture” Addison Wesley trade Computer Publication, 2000.

REFERENCE BOOKS:

- R1 - Mazidi, M.A.,“PIC Microcontroller” Rollin Mckinlay, Danny causey Printice Hall of India, 2007.
- R2-Ajay V.Deshmukh, “Microcontroller - Theory and application”.PHI 2002.
- R3 - Valder – Perez, “Microcontroller – Fundamentals and Applications with Pic,” Yeesdee Publishers, Tayler & Francis, 2013.
- R4-C.Ravichandran. M. Arulaalan, “Microcontroller Based System Design,” Suchitra Publications, 2016.

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- 2. <https://nptel.ac.in/courses/108/102/108102045/>


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI7305	NEURAL NETWORKS AND FUZZY SYSTEMS	3	0	0	3

- Course Objective
1. Introduce about neural networks for pattern classification and association.
 2. Classify on various neural network.
 3. To learn about fuzzy systems.
 4. Gain knowledge about fuzzy logic control design.
 5. Build application on neural networks and fuzzy systems.

Unit	Description	Instructional Hours
I	NEURAL NETWORKS – I Artificial neural network (ANN): Introduction, fundamental concept, basic models of ANN, terminologies, McCulloch pitts neuron, Linear seperability, Hebb Network. Supervised learning Network: Perceptron networks, Adaline, back propagation network, radial basis function network.	9
II	NEURAL NETWORKS - II Associative memory networks: Training algorithms for pattern association. Auto associative, Hetero associative, Bidirectional associative memories- Hopfield and iterative auto associative memory networks. Unsupervised Learning networks: Fixed weight competitive nets, Kohonen self organizing feature map, Counter propagation network, Adaptive resonance theory network.	9
III	FUZZY SYSTEMS- I Introduction to fuzzy logic, classical sets, fuzzy sets. Classical relations and fuzzy relations- Tolerance and equivalence relation. - Membership functions – Defuzzification.	9
IV	FUZZY SYSTEMS -II Fuzzy arithmetic and fuzzy measures- Fuzzy rule base and approximate reasoning - Fuzzy decision making - Fuzzy logic control systems.	9
V	APPLICATIONS OF FUZZY LOGIC AND NEURAL NETWORKS Engineering and miscellaneous applications of fuzzy: Civil, mechanical, industrial, computer, robotics, medicine and economics. Neural network for pattern classification and pattern association.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Infer the concepts of artificial neural networks.
 CO2: Summarize the various neural networks architectures and its training algorithms
 CO3: Discover the concept of fuzzy logic set theory.
 CO4: Implement the fuzzy mechanism for suitable control problems.
 CO5: Design the neural network/fuzzy logic control for real time applications.

TEXT BOOKS:

- T1 – Laurene V. Fausett, “Fundamentals of Neural Networks:Architectures, algorithms and applications”, Pearson Education, New Delhi, 2004.
 T2 - Timothy J Ross, “Fuzzy Logic with Engineering Applications”, John Willey and Sons, 2005.

REFERENCE BOOKS:

- R1 – S.N.Sivanandam, S.N Deepa., “Principles of soft computing” ,2nd edition, Wiley India Pvt Ltd , 2013.
 R2 – George J.Klir, Bo.Yuan, “Fuzzy Sets and Fuzzy logic: Theory and Applications”, PHI,2012
 R3 - Zimmerman H.J., “Fuzzy set theory and its Applications”, Allied Publishers, 2001.
 R4 - Jack M. Zurada, “Introduction to Artificial Neural Systems”, PWS Publishing Co, 2002.

WEB REFERENCE :

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PROFESSIONAL ELECTIVE IV

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI8301	FIBER OPTICS AND LASER INSTRUMENTS	3	0	0	3

- Course Objective
1. Recall the fundamentals of optical fiber and its properties.
 2. Infer the industrial applications of optical fiber.
 3. Relate the concepts of lasers fundamentals.
 4. Apply lasers in various applications.
 5. Interpret hologram and medical applications.

Unit	Description	Instructional Hours
I	OPTICAL FIBRES AND THEIR PROPERTIES Principles of light propagation through a fiber - Different types of fibers and their properties, fiber characteristics - Absorption losses - Scattering losses - Dispersion - Fiber Optic Connectors - Splices- Fiber termination - Optical sources - Optical detectors.	9
II	INDUSTRIAL APPLICATIONS OF OPTICAL FIBRES Sensors - Fiber optic instrumentation system - Different types of modulators - Interferometric method of measurement of length - Moire fringes - Measurement of pressure, temperature, current, voltage, liquid level and strain.	9
III	LASER FUNDAMENTALS Fundamental characteristics of lasers - Laser Levels - Properties of laser - Laser modes - Resonator configuration Q-switching and mode locking - Cavity damping - Types of lasers- gas lasers, solid lasers, liquid lasers, semi conductor lasers.	9
IV	INDUSTRIAL APPLICATION OF LASERS Laser for measurement of distance, length, velocity, acceleration, current, voltage and Atmospheric effect - Material processing - Laser heating, welding, melting and trimming of material, removal and vaporization.	9
V	HOLOGRAM AND MEDICAL APPLICATIONS Holography - Basic principle - Methods - Holographic interferometry and application, Holography for non-destructive testing - Holographic components - Medical applications of lasers - laser and tissue interactive - Laser instruments for surgery - Removal of tumors of vocal cards - Brain surgery - Plastic surgery - Gynaecology and Oncology.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Apply the basic concepts of optical fibers in applications.
 CO2: Demonstrate fibre optic instrumentation system in industrial applications.
 CO3: Develop applications based on lasers.
 CO4: Validate the industrial applications of lasers
 CO5: Establish industrial application of holography and medical applications of lasers

TEXT BOOKS:

- T1 - R.P.Khare, "Fiber Optics and Optoelectronics", Oxford university press, 2008.
 T2 - John and Harry, "Industrial lasers and their application", McGraw-Hill, 2002.

REFERENCE BOOKS:

- R1- J.M. Senior, "Optical Fiber Communication –Principles and Practice", Prentice Hall of India, 2010.
 R2 - Asu Ram Jha, "Fiber Optic Technology Applications to commercial, Industrial, Military and Space Optical systems", Prentice Hall of India learning Private limited, 2009.
 R3 - M. Arumugam, "Optical Fiber Communication and Sensors", Anuradha Publication, 2002.
 R4 - John F. Read, "Industrial Applications of Lasers", Academic Press, 2012.

WEB REFERENCE:

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI8302	INSTRUMENTATION IN PETROCHEMICAL INDUSTRIES	3	0	0	3

Course Objective	Description
	1. Interpret the process involved in oil extraction.
	2. Categorize the petroleum refining process.
	3. Discuss the various products available from petroleum
	4. Classify the control loops available in petrochemical industry.
	5. Observe various safety instrumentation systems available in petrochemical industry.

Unit	Description	Instructional Hours
PETROLEUM PROCESSING		
I	Petroleum exploration – seismic survey -Recovery techniques – Oil – Gas separation - Processing wet gases – Refining of crude oil.	9
OPERATIONS IN PETROLEUM INDUSTRY		
II	Thermal cracking – Catalytic cracking – Catalytic reforming – Polymerisation – Alkylation – Isomerization – Production of ethylene, acetylene and propylene from petroleum.	9
CHEMICALS FROM PETROLEUM PRODUCTS		
III	Chemicals from petroleum – Methane derivatives – Acetylene derivatives – Ethylene derivatives – Propylene derivatives – Other products	9
MEASUREMENTS IN PETROCHEMICAL INDUSTRY		
IV	Parameters to be measured in refinery and petrochemical industry – Selection and maintenance of measuring instruments – Intrinsic safety of Instruments.	9
CONTROL LOOPS IN PETROCHEMICAL INDUSTRY		
V	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.	9
Total Instructional Hours		45

Course Outcome	Description
	CO1: Outline the process involved in oil extraction.
	CO2: Outline the methods of oil refining.
	CO3: Discuss the various products available from petroleum industry.
	CO4: Identify the appropriate control loop existing in the petrochemical industry.
	CO5: Appraise various safety instrumentation systems existing in petrochemical industry.

TEXT BOOKS:

- T1 - Ram Prasad, "Petroleum Refining Technology", Khanna Publishers, New Delhi, 2000.
T2 - J.H.Gary, J.E.Handwork, M.J.Kaiser, "Petroleum Refining (Technology and Economics)", CRC Press, 2007.

REFERENCE BOOKS:

- R1 - B.G.Liptak, "Instrumentation in Process Industries", Chilton Book Company, 2005.
R2 - A.L.Waddams, "Chemicals from Petroleum", Butter and Janner Ltd., 2000.
R3 - Oil and Gas Production Handbook, ABB, 2013.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI8303	INSTRUMENTATION SYSTEM DESIGN	3	0	0	3

- Course Objective
1. Infer the basic concepts of instrument design.
 2. Outline the design aspects of instruments.
 3. Design printed circuit board.
 4. Discuss about the control panel design.
 5. Interpret the reliability concepts.

Unit	Description	Instructional Hours
	BASIC CONCEPTS ON INSTRUMENT DESIGN	
I	Functional Requirements and Specification - Operational Environment - Commercial, Industrial, Military - NEMA, DIN, BIS And ANSI Standards with special reference packaging - One Line Diagram of Hydraulic, Pneumatic and Electrical Instrumentation System - Instruments Symbols and Signals.	9
	DESIGN ASPECTS	
II	Performance Characteristics and Selection Criteria for Flow, Temperature, Pressure and Level Transducers - Range, Specification Standards and Recommended Practice for Instruments - Interface Primary Element with End Devices - Engineering Display- Calibrating and Testing Standards for Instruments and Transducers.	9
	PRINTED CIRCUIT BOARD DESIGN	
III	Design Guideline - General Components, Layout Scheme, PCB Size, Design Rules for Digital Circuit and Analog Circuit PCB's Single and Multiplayer Boards - Automation and Computer in PCB Design - Artwork and CAD Packages and Tools - Electronic Circuit and Minimum System Design by using PCB Design Software Packages.	9
	CONTROL PANEL DESIGN	
IV	Operating Console and Control Room Panel Design - Control Room Environment for Electronic Equipment - Requirement of Instrument Quality, Air Heat Dissipation, Forced Air Circulation and Humidity Consideration - Enclosure Design Guidelines - Grounding and Shielding Techniques - Packaging for Various Operational Environments including IP-51, IP-54 and IP-67.	9
	RELIABILITY CONCEPTS	
V	MTTR - MTBF - Concepts of Availability - Instrument Evaluation (Test/Inspection Method) - Failure Rate Analysis - Product Quality Variance Report - Control Charts - SQC - TQM Principles - ISO Series - Quality Standards Procedure - Certifications Policies - Quality Audit.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Apply acquired skill in designing instrument.
CO2: Analyze various design aspects involved in manufacturing instruments.
CO3: Demonstrate printed circuit board.
CO4: Summarize the concepts of designing a control panel.
CO5: Illustrate various reliability concepts involved in the design and operation of instruments.

TEXT BOOKS:

- T1 - Warren Boxleitner, "Electrostatic Discharge and Electronic Equipment", IEEE press., 1988.
T2 - E. Balguruswamy, "Reliability Engineering", Tata Mc Graw Hill, 2013.

REFERENCE BOOKS:

- R1 - B.G. Liptak, "Process control", CRC Press, 2005.
R2 - Christopher.T. Robertson, "Printed Circuit Boards", Prentice Hall of India, 2015.
R3 - R.S. Khandpur, "Printed Circuit Boards", Tata Mc Graw Hill, 2005.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI8304	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	3	0	0	3

- Course Objective
1. learn the basics of Artificial Intelligent systems
 2. Describe about knowledge representations in AI.
 3. Educate on AI inferences.
 4. Understand on Machine Learning
 5. Know the application areas of AI & ML.

Unit	Description	Instructional Hours
I	INTRODUCTION TO ARTIFICIAL INTELLIGENCE Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics - Problem solving methods - Problem graphs, Matching, Indexing and Heuristic functions –Hill Climbing-Depth first and Breath first, Constraints satisfaction - Related algorithms, Measure of performance and analysis of search algorithms.	9
II	REPRESENTATION OF KNOWLEDGE Game playing - Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic- Structured representation of knowledge.	9
III	KNOWLEDGE INFERENCE Knowledge representation -Production based system, Frame based system. Inference – Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning - Certainty factors, Bayesian Theory-Bayesian Network-Dempster - Shafer theory.	9
IV	INTRODUCTION TO MACHINE LEARNING Machine Learning–Types –Machine learning process- preliminaries, testing Machine Learning algorithms, turning data into Probabilities, and Statistics for Machine Learning- Probability theory – Probability Distributions – Supervised and Unsupervised learning - Decision Tree Learning – Bayesian Learning - Clustering- K-means - Components Analysis.	9
V	APPLICATIONS OF AI AND ML AI applications: Language models – natural language processing – information retrieval – Speech Translation – Robot path planning and moving. ML Applications: Speech recognition – Product recommendations - Virtual Assistants – Self driving cars.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Identify problems that are amenable to solution by AI methods
CO2: Identify appropriate AI methods to solve a given problem.
CO3 :Formalize a given problem in the language/framework of different AI methods.
CO4 :Familiarize on machine learning methods.
CO5 :Apply the AI & ML algorithms to a real-world problems.

TEXT BOOKS:

- T1 - Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, Mc Graw Hill- 2008.
T2 - Ethem Alpaydin, “Introduction to Machine Learning”, PHI learning Second Edition 2010.

REFERENCE BOOKS:

- R1 - Stuart Russel and Peter Norvig “AI – A Modern Approach”, 2nd Edition, Pearson Education 2007.
R2 - Deepak Khemani “Artificial Intelligence”, Tata Mc Graw Hill Education 2013.
R3- Christopher M. Bishop, “Pattern Recognition and Machine Learning”. Springer 2006.
R4 - Mitchell Tom, “Machine Learning”, McGraw Hill, 1997.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI8305	INSTRUMENTATION AND CONTROL IN PAPER INDUSTRY	3	0	0	3

- Course Objective
1. Categorize the process parameters involved in paper making.
 2. Differentiate the properties of paper and its measurement methods.
 3. Analyse methods for measurement of consistency.
 4. Infer about the working and quality parameters of paper making machine.
 5. Analyse various control aspects involved in paper production.

Unit	Description	Instructional Hours
	OVERVIEW OF PAPER MAKING PROCESS	
I	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.	9
	PAPER PROPERTIES AND ITS MEASUREMENT	
II	Physical, electrical, optical and chemical properties of paper - compressive test method-quality measurement method - optical testing-ultrasonic measurement - standards in testing.	9
	CONSISTENCY MEASUREMENT	
III	Definition of consistency, Techniques for head box consistency measurement, Stock consistency measurement and control. Paper Making Machine: Functioning of Paper making machine- Quality parameters, Moisture, Basic weight, Caliper, Brightness, Color, Ash content, Strength, Gloss and tensile strength, Parameters monitoring Instrumentation.	9
	WET END INSTRUMENTATION	
IV	Conventional measurements at wet end- Pressure, Vacuum, Temperature, Liquid density, Specific gravity, Level-flow consistency measurement – pH – ORP measurement, Freeness measurement. Dry End Instrumentation Conventional measurements: Moisture, Basis weight, Caliper, coat thickness, Optical variables, Measurement of length, Speed, Digester, Rotary, Batch type.	9
	PUMPS AND CONTROL VALVES	
V	Flow box, Wet end variables, Evaporator feedback, Feed forward control, Lime mud density control, Stock proportioning system, Refiner control instrumentation, Basic pulper instrumentation, Head box, Rush/drag control, Instrumentation for size preparation, Coating preparation, Coating weight control, Batch digester, K/Kappa number control, Bleach plant chlorine stage control. Control Aspects: Machine and cross direction control technique, Consistency, Moisture and basic weight control, Dryer control, Computer based control systems, Mill wide control.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Apply the process learnt in real time application.
CO2: Summarise various properties of paper and it's testing methods.
CO3 : Demonstrate the consistency of paper through the learnt methodologies.
CO4 : Appraise about the quality parameters associated in production of paper.
CO5 : Point out the appropriate control technique involved in production of paper.

TEXT BOOKS:

- T1 - B.G Liptak, "Instrumentation in Process Industries", Chilton Book Company, 2003
T2 - P.E.Sankaranarayanan, "Pulp and Paper Industries- Technology and Instrumentation", Kotharis Desk book Series, 1995.

REFERENCE BOOKS:

- R1 - Britt K.W, "Handbook of Pulp and Paper Technology", Reinbold Company Second Edition, 2004.
R2 - James P.Casey , "Pulp and Paper Chemistry and Chemical Technology", John Wiley and sons, 1981.
R3- Randolph Norris Shreve and George, "Shreve's Chemical Process Industries", McGraw Hill, Singapore,1985.


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PROFESSIONAL ELECTIVE V

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI8181	DISASTER MANAGEMENT	3	0	0	3

- Course Objective
1. Interpret the basic knowledge of disaster management.
 2. Discuss about the exposure of environmental disaster.
 3. Create awareness about earthquake and Tsunami.
 4. Express the cyclone management techniques.
 5. Apply the technologies in disaster management..

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Disaster - Disaster management - Disaster prevention and preparedness measures - Types of Disaster Causal factor of Disaster - Natural, Manmade and creeping disaster - Disaster in the Indian context-various measures - Disaster related policy goals - United Nations Development Program (UNDP) - United Nations Disaster Relief Organization (UNDRO) - Govt. of India.	9
	ENVIRONMENTAL DISASTER	
II	Environmental hazards - Typology - Assessment and response - the strategies - the scale of disaster - Vulnerability - Disaster trends - Paradigms towards a balanced view - Chemical hazards and Toxicology - Biological hazards - Hazard caused by world climate change - Risk analysis - other technological disasters.	9
	EARTHQUAKE AND TSUNAMI	
III	Earthquake - Causes of earthquake - Earthquake scales - Measures of earth quake - Magnitude and Intensity - Seismic zone - Earthquake disaster mitigation - Forecasting techniques and Risk analysis – Tsunami - Causes of Tsunami - Effects of Tsunami - Tsunami warning system in India - International status of Tsunami warning and communication system - Tsunami warning centers - Pacific Tsunami Warning Center (PTWC) - Institutional arrangements and design criteria for Tsunami mitigation.	9
	CYCLONE	
IV	Tropical cyclone - Warning system - Protection of buildings from cyclones - Precaution before and during cyclones - Tropical cyclone warning strategy in India - Cyclone related problems - Aerial survey - Management strategy - risk reduction by public awareness and education.	9
	APPLICATION OF TECHNOLOGY IN DIASTER MANAGEMENT	
V	Hazard map - Multi hazard mapping - Application of satellites in Disaster Management - Application of remote sensing in forecasting and disaster relief - Use of digital image processing in disaster management - GIS in disaster management - Spatial data - GIS data base design - Convention mapping concepts and Coordinate system - Methods of spatial Interpolation in GIS.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Associate the basic concepts of disaster management in real life
 CO2: Summarize the vulnerability of environmental disaster
 CO3: Determine the measures to be taken during environmental disaster
 CO4: Predict the consequences of cyclones
 CO5: Innovate the technology in disaster management

TEXT BOOKS:

- T1 - Pardeep Sahni, Madhavi malalgoda and Ariyabandu, "Disaster Risk Reduction in South Asia", Prentice Hall of India 2003.
 T2 - Amita Sinhal, "Understanding Earthquake Disasters", Tata McGraw-Hill, 2010.

REFERENCE BOOKS:

- R1 -Pardeep Sahni, Alka Dhameja and Uma medury, "Disaster Mitigation: Experiences and Reflections", Prentice Hall of India ,2004.
 R2 - Jeff Groman, "The Atlas of Natural Disasters", Michael Friedman Publication, 2002.
 R3 -Jaikrishna & Chandrasekar, "Elements of Earthquake Engineering", South Asian Publishers Pvt ltd, 2000.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI8182	TOTAL QUALITY MANAGEMENT	3	0	0	3

Course Objective	Description
1.	Infer the basic concepts of quality management.
2.	Interpret the concepts of TQM principles.
3.	Interpret the various statistical process control charts
4.	Categorize various tools for quality improvement.
5.	Interpret the concept of Quality Management Systems and recognize the need for ISO 9000 and ISO 14000 Quality Systems

Unit	Description	Instructional Hours
	INTRODUCTION TO QUALITY MANAGEMENT	
I	Definitions - TOM Framework, Benefits, Awareness and Obstacles. Quality - Vision, Mission and Policy Statements. Customer Focus - Customer Perception of Quality, Translating needs into requirements, Customer Retention. Dimensions of Product and Service Quality. Cost of Quality.	9
	TQM PRINCIPLES	
II	Leadership - Strategic quality planning, Quality Councils -Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles, Recognition and Reward, Performance Appraisal - Continuous Process Improvement – PDCA cycle, 5S, Kaizen - Supplier Partnership - Partnering, Supplier Selection, Supplier Rating.	9
	TQM TOOLS AND TECHNIQUES I	
III	Seven Traditional Tools of Quality - New Management Tools - Six Sigma: Concepts, Methodology, Applications to Manufacturing, Service Sector including IT - Bench Marking - Reason to Bench Mark, Bench Marking Process - FMEA - Stages, Types.	9
	TQM TOOLS AND TECHNIQUES II	
IV	Control Charts- Process Capability- Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi Quality Loss Function – TPM - Concepts, Improvement Needs - Performance Measures.	9
	QUALITY SYSTEMS ORGANIZING AND IMPLEMENTATION	
V	Introduction to IS/ISO 9004:2000 – Quality Management Systems – Guidelines for Performance Improvements. Quality Audits. TQM Culture, Leadership – Quality Council, Employee Involvement, Motivation, Empowerment, Recognition and Reward- Introduction to Software Quality.	9
Total Instructional Hours		45

Course Outcome	Description
CO1:	Conceptualize and imbibe the different TQM principles.
CO2:	Recall various quality concepts like employee involvement and performance measurements
CO3:	Apply the various statistical process control charts to improve the quality of the product.
CO4:	Apply various tools like QFD and FMEA for quality improvement.
CO5:	Apply the concept of Quality Management Systems

TEXT BOOKS:

- T1 - Dale H. Besterfield, et al., “Total Quality Management”, Pearson Education Asia, 3rd Edition, Reprint 2006.
T2 - Shridhara Bhat K, “Total Quality Management – Text and Cases”, Himalaya Publishing, 2002.

REFERENCE BOOKS:

- R1 - James R. Evans and William M. Lindsay, “The Management and Control of Quality”, 8th Edition, First Indian Edition, Cengage Learning, 2012.
R2 - Sughanti.L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006.
R3 -Janakiraman. B and Gopal .R.K., “Total Quality Management – Text and Cases”, PHI Ltd., 2006.

WEB REFERENCES:

- <https://nptel.ac.in/courses/110/104/110104085/>
- <https://nptel.ac.in/courses/110/104/110104080/>


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI8183	PROFESSIONAL ETHICS FOR ENGINEERS	3	0	0	3

- Course Objective
1. Infer the essentials of engineering ethics.
 2. Interpret the rudiments of engineers as social experimentation.
 3. Speculate the responsibilities of engineers for safety.
 4. Create awareness on social responsibilities and rights.
 5. Outline the global issues in environment.

Unit	Description	Instructional Hours
I	ENGINEERING ETHICS Senses of Engineering Ethics - Variety of moral issues - Types of inquiry - Moral dilemmas - Moral Autonomy - Kohlberg's theory - Gilligan's theory - Consensus and Controversy - Professions and Professionalism - Professional ideals and virtues - Use of ethical theories.	9
II	ENGINEERING AS SOCIAL EXPERIMENTATION Engineering as experimentation - Engineers as responsible experimenters - Research ethics - Codes of ethics - Industrial Standards - Case Study of Space Shuttle Challenger Disaster.	9
III	ENGINEERS' RESPONSIBILITY FOR SAFETY Safety and risk - Assessment of safety and risk - Risk Benefit Analysis - Reducing risk - Case Studies: Chernobyl and Bhopal Disaster.	9
IV	RESPONSIBILITIES AND RIGHTS Collegiality and Loyalty - Respect for Authority –Collective Bargaining- Confidentiality - Conflicts of Interest - Occupational Crime - Professional Rights - Employee Rights - Intellectual Property Rights (IPR) - Discrimination.	9
V	GLOBAL ISSUES Multinational Corporations - Business Ethics - Environmental Ethics -Computer Ethics -Weapons Development- Engineers as Managers - Consulting Engineers - Engineers as Expert Witnesses and Advisors - Honesty - Moral Leadership - Sample code of conduct.	9
Total Instructional Hours		45

- Course Outcome
- CO1: Practice engineering ethics and human values for a moral life.
CO2: Develop the codes of conduct for engineers in the society.
CO3: Experiment the safety measures as a responsible engineer.
CO4: Interpret the responsibilities, professional rights and moralities for enhancement of an organization.
CO5: Validate the broad range of contemporary global issues.

TEXT BOOKS:

- T1 - Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York, 2013.
T2 - Charles D Fledderman, "Engineering Ethics", Prentice Hall of India, 2004.

REFERENCE BOOKS:

- R1 - Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
R2 - John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
R3 - Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
R4 - Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI8184	PRINCIPLES OF MANAGEMENT	3	0	0	3

- Course Objective
1. Learn the basic functions of management in an organization
 2. Study the importance of planning and also the different types of plans.
 3. Understand the different types of organization structure in management
 4. Know the basis and importance of directing and controlling in management
 5. Understand to the importance of corporate governance and social issues.

Unit	Description	Instructional Hours
	INTRODUCTION TO MANAGEMENT CONTEXT Management definition – Science or Art – Manager versus Entrepreneur – types of managers – managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization – Sole proprietorship, partnership, company-public and private sector enterprises – Organization culture and Environment – Current trends and issues in Management.	9
I		
	PLANNING Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making - steps and process.	9
II		
	ORGANISING Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design – Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.	9
III		
	DIRECTING Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.	9
IV		
	CONTROLLING AND ISSUES IN MANAGEMENT System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – Direct And Preventive Control – Reporting. Contemporary Issues In Management: Corporate Governance Social responsibilities – Ethics in business – Recent issues.	9
V		
Total Instructional Hours		45

- Course Outcome
- CO1: Describe the concepts of management, administration and the evolution of management thoughts.
CO2: Understand and apply the planning concepts.
CO3: Explain the different organizational structures and understand the staffing process.
CO4: Analyze the various motivational and leadership theories and controlling processes.
CO5: Understand and analyze the various Contemporary Issues in Management.

TEXT BOOKS:

T1-Stephen P. Robbins and Mary Coulter, "Management", Prentice Hall of India, 8th edition. 2012

T2-Harold Koontz & Heinz Wehrich "Essentials of management" Tata Mc Graw Hill, 1998.

REFERENCE BOOKS:

R1 - Charles W L Hill, Steven L McShane, "Principles of Management", Mcgraw Hill Education, Special Indian Edition, 2007

R2 - Tripathy PC & Reddy PN, "Principles of Management", Tata McGraw Hill, 1999.

R3 - JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.

R4 -Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.


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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI8185	PATENT, COPYRIGHT AND COMPETITION LAW	3	0	0	3

Course Objectives	Objectives
	<ol style="list-style-type: none"> Outline the basic concepts of Intellectual Property Rights and Laws Illustrate the Patent registration aspects Classify the agreements and legislations and copyrights Illustrate the innovations in Intellectual Property Rights Interpret various competition Law

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Introduction to IPRs, Basic concepts and need for Intellectual Property – Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.	9
	PATENTS AND REGISTRATION	
II	Elements of Patents, Research exemption Introduction to Patents - Concepts, Novelty, Utility - Patent Act 1970 - Patentable subject matter, Patentability criteria, non-patentable inventions - Software Patents - Rights of patentee - Working of Patents, Compulsory License Acquisition, Surrender, Revocation, restoration Transfer of patent rights.	9
	AGREEMENTS, LEGISLATIONS AND COPYRIGHT	
III	International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Design Act, Trademark Act, Geographical Indication Act. Copyright and Neighboring - Rights Concept and Principle - Berne Convention, Universal Copyright Convention, Copyright Act 1957 - Copyright Registrar -Procedure Copyright Societies, Ownership, Assignment, License, Translation of Copyright.	9
	DIGITAL PRODUCTS AND LAW	
IV	Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.	9
	COMPETITION LAW	
V	Introduction to competition Law- Indian Competition Act and IPR protection - Anticompetitive agreement and abuse of dominance in IPR protection- relationship and Interaction between IPR and competition law - IPR issues in merger and acquisition; Harmonization of IP protection and competition Law in India.	9

Total Instructional Hours 45

Course Outcome	Outcomes
	CO1: Explain basic concepts of Intellectual Property Rights.
	CO2: Apply the patent registration aspects.
	CO3: Summarize the agreements and legislations and Copyrights.
	CO4: Understand the innovations in Intellectual Property Rights
	CO5: Infer the various competition enforcement laws and its issues

TEXT BOOKS:

T1 - V. Scople Vinod, “Managing Intellectual Property”, Prentice Hall of India, Second edition, 2012.
T2 - S. V. Satakar, “Intellectual Property Rights and Copy Rights”, Ess Ess Publications, 2nd edition, 2014

REFERENCE BOOKS:

R1 -Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, Third Edition, 2012.
R2 - H. K. Saharay , “Competition Law” Universal law publishinh, second edition 2016.
R3 - K.Bansal& P.Bansal , “Fundamentals of IP for Engineers” - Cengage learning 2012.

WEB REFERENCES:

1. <https://nptel.ac.in/courses/110/105/110105139/>
2. <https://nptel.ac.in/courses/109/106/109106137/>


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OPEN ELECTIVE

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	19EI7401	INTRODUCTION TO PROGRAMMABLE LOGIC CONTROLLERS	3	0	0	3

- Course Objective
1. Understand the basics of PLC and its components.
 2. Impart knowledge on developing PLC logical programs for various conditions.
 3. Gain knowledge on various PLC instruction sets.
 4. Establish the communication protocols used in PLC's.
 5. Outline the importance on PLC and SCADA for industrial automation

Unit	Description	Instructional Hours
I	<p>INTRODUCTION TO PLC History of Programmable Logic controller – need for PLC – PLC sizes - modular and fixed PLC – PLC architecture – Hardware components : input and output modules(Analog and digital I/O) – power supply – PLC memory - PLC wiring diagram – Latching relays.</p>	9
II	<p>PROGRAMMING OF PLC Basics of PLC programming – types: Ladder logics(LD),Functional block diagram(FBD),Sequential function chart(SFC),Structured Text(ST) and Instruction List(IL) . PLC Timers: ON Delay, OFF Delay and Retentive Timers- Counters: UP Counter, DOWN Counter and UP DOWN Counters - ladder examples.</p>	9
III	<p>PLC INSTRUCTIONS Program control instructions – Data handling and Data manipulation instructions - Math instructions - Sequencer and shift register – program subroutines - motor controls - programming examples</p>	9
IV	<p>COMMUNICATION AND NETWORKING PLC communication ports – serial communications – RS232 – standard requirements – communication between several PLCs – PLC field bus – Profibus – PLC troubleshooting - Introduction to Supervisory control and data acquisition systems (SCADA) and DCS. (Qualitative treatment only).</p>	9
V	<p>PLC APPLICATIONS AND AUTOMATION PLC traffic light control – stepper motor control – Elevator control – Bottle filling system – Pneumatic Stamping system – PLC in process control systems. Need for automation in industries – FMS – Role of PLC and SCADA in industrial automation.</p>	9
Total Instructional Hours		45

- Course Outcome
- CO1: Describe the architecture of PLCs with the analogy of relay logic components.
 CO2: Develop the ladder logic program for any applications.
 CO3: Characterize the different instructions available in PLC and implement them.
 CO4: Classify the communication protocols used in PLC and to establish network with other systems.
 CO5: Summarize the impact on PLC and SCADA for various industrial automation processes.

TEXT BOOKS:

- T1 - Frank D. Petruzella, "Programmable Logic Controllers", McGraw-Hill Companies, 3rd Edition, 2013.
 T2 - John W. Webb and Ronald A.Reis, "Programmable Logic Controllers – Principles and Applications", Prentice Hall Inc., New Jersey, 3rdEdition, 1995.

REFERENCE BOOKS:

- R1 – John R. Hackworth and Frederick D. Hackworth Jr, "Programmable Logic Controllers", Pearson Education, New Delhi, 2004.
 R2 - David Bailey, Edwin Wright, "Practical SCADA for Industry", Elsevier, 2003.
 R3 - W. Bolton, "Programmable logic controllers", Elsevier Ltd, 2015
 R4- R KRajput, "Robotics and Industrial Automation", S Chand Publishers, Revised edition 2014.


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LIFE SKILL COURSES – OPEN ELECTIVE

Programme	Course Code	Name of the Course	L	T	P	C
B.E./B.TECH.	19LS6401	GENERAL STUDIES FOR COMPETITIVE EXAMINATIONS	2	1	0	3

- Course Objectives**
1. To provide awareness to the students about higher education entrance exams and various types of jobs offered both in the Central and State Government.(CAT, GMAT, GRE, IBPS, IELTS, UPSC, SSC, RRB, TNPSC, GATE, IES, TNEB, AFCAT, DRDO, ISRO, INCOME TAX,LIC...)
 2. To help the students to choose the area where they are interested.
 3. To develop competitive skills through various types of objective tests.
 4. To train them by conducting aptitude test based on verbal and quantitative skills.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	NUMERICAL ABILITY Simplification and Approximation – Algebra – Number System- Averages – Ratio and Proportion – Partnership – Allegation or Mixture – Problem on Ages - Percentages - Profit and Loss – Time and Work – Pipes and Cisterns – Time, Speed and Distance – Problems on Trains ,Boats and Streams - Permutation and Combination- Probability- Data Interpretation- Simple Interest and Compound Interest – Geometry , Trigonometry and Mensuration – Progressions.	18
II	REASONING ABILITY Alphanumeric series - Reasoning Analogies – Coding-Decoding – Blood Relations -Directions – Calendars –Clocks – Data Sufficiency – Deductive Reasoning - Input-Output – Order & Ranking – Seating Arrangements –Visual Reasoning – Cubes and cuboids -Critical Reasoning – Syllogism – Venn Diagram – Puzzles.	10
III	LANGUAGE COMPETENCY Reading Comprehensions – Cloze Test – Sentence Completion – Match the Columns –Error Detection – Jumbled word/Paragraphs – Vocabulary& Grammar – One Word Substitution – Idioms and Phrases – Antonyms and Synonyms – Sentence Correction –Misfit/Out of Context sentence.	10
IV	COMPUTER ACQUAINTANCESHIP Internet – Memory – Keyboard Shortcuts – Computer Abbreviation – Microsoft Office –Computer Hardware – Computer Software – Operating System – Networking – Computer Fundamentals /Terminologies.	3
V	GENERAL AWARENESS Geography – Culture – History – Economic Science – Scientific Research – General Policy– Awards and Honours – Books and Authors – Static GK - Current Affairs	4
Total Instructional Hours		45

- Upon completion of the course, students can be able to**
- Course Outcomes**
- CO1: Thinking critically and applying basic mathematics skills to interpret data, draw conclusions, and solve problems; developing proficiency in numerical reasoning; Application of quantitative reasoning in aptitude tests.
- CO2: The ability to identify and define problems/issues, recognizing their complexity, and considering alternative viewpoints and solutions to use the critical skills of observation, analysis, evaluation.
- CO3: Understanding and reasoning using concepts framed in words; Critical verbal reasoning; Reading Comprehension; Application of verbal reasoning in aptitude tests.
- CO4: Students will possess the basic understanding of computer hardware and software, utilizing web technologies, basic understanding of network principles, Keyboard Shortcuts and various Operating System.
- CO5: Students will be updated with awareness and knowledge regarding the occurrences around the world.


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REFERENCES BOOKS:

- R1: Quantitative Aptitude for Competitive Examinations – Abhijith Guptha
R2: The Pearson Guide to Quantitative Aptitude - Dinesh Khattar
R3: Analytical Reasoning and Logical Reasoning- Peeyush Bharadwaj R4: A New Approach to Reasoning - B.S. Sijwali& S. SijwaliArihant R5: Word Power made easy - Norman Lewis
R6: Verbal Ability & Reading Comprehension for the CAT – Arun Sharma, Meenakshi Upadhyay - Mcgraw-hill Education
R7: Computer Awareness - Arihant Publication
R8: General Knowledge and General Awareness - ArihantManhar Pandey


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Programme B.E./B.TECH.	Course Code 19LS6402	Name of the Course HUMAN RIGHTS, WOMEN RIGHTS AND GENDER EQUALITY	L 3	T 0	P 0	C 3
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Course Objectives	<ol style="list-style-type: none"> To sensitize the Engineering students to various aspects of Human Rights To make them understand the world level perspective related to Human Rights To identify the constitutional rights of women To understand the various political rights and laws related to women To understand the gender equality concepts
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UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	Introduction Human Rights – Evolution of the concept of Human Rights - Meaning, origin and Development. Notion and Classification of Rights – Natural, Moral and Legal Rights, Civil and Political rights. Economic, Social and Cultural Rights - Theories of Human Rights - Philosophical foundations of Human Rights	9
II	Human Rights national and international perspective Human Rights in India – Constitutional Provisions / Guarantees – Redressal Mechanisms at National and International levels – Constitutional Remedies and Directions of state policy - Geneva Convention of 1864. Universal declaration of Human Rights, 1948. UN agencies to monitor and compliance – UNHRC (United Nations Human Rights Commission)	9
III	CONSTITUTIONAL RIGHTS OF WOMEN IN INDIA Indian constitution relating to women - Fundamental rights - Directive principles of state policy - right to equality - rights against exploitation, the right to constitutional remedy - University Declaration of Human Rights - Enforcement of Human Rights for Women and Children - Role of Cells and Counseling Centers - Legal AID cells, Help line, State and National level Commission	9
IV	POLITICAL RIGHTS OF WOMEN IN INDIA AND LAWS Political Rights of Women in India - Electoral process - women as voters - candidates and leader - pressure group, Representation of women in local self government – women in Rural and urban local bodies – Reservation of women – Laws against violence & Sexual crimes: eve teasing – rape - indecent representation of women - immoral trafficking	9
V	GENDER EQUALITY Gender roles: Biological vs cultural determinism – Private vs public dichotomy – Gender division of labour and asymmetric role structure Gender role socialization and formation of identity –Occupational segregation and wage discrimination – Gender stereotyping in work place – Human development indicators and gender disparity	9
Total Instructional Hours		45

Course Outcomes	<p>Upon completion of the course, students can be able to</p> <p>CO1: Engineering students will have the basic knowledge of human rights</p> <p>CO2: Initiates the students to know the various national and international perspectives of human rights</p> <p>CO3: Gives an orientation on the various rights of women</p> <p>CO4: Makes them to understand the role of women in politics</p> <p>CO5: Provides a direction on gender equalities</p>
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TEXT BOOKS

- Kapoor S.K, “Human Rights under International Law and Indian Laws”, Central Agency, 2014
- ArunaGoel. (2004). “Violence and Protective Measures for Women Development and Empowerment”. Deep & Deep, New Delhi.

REFERENCES BOOKS:

- Chandra U “Human Rights” Allahabad Law Agency, Allahabad 2014
- UpandraBaxi “The Future of Human Rights, Oxford Univeristy Press, New Delhi
- Menonivedita (2004). “Recovering Subversion: Feminist Politics beyond the Law”. Permanent Black, Delhi.


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Programme B.E./B.TECH.	Course Code 19LS6403	Name of the Course INDIAN ETHOS AND HUMAN VALUES	L 3	T 0	P 0	C 3
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- Course objectives**
1. To learn about Indian ethos and its importance today
 2. To know about business concepts and philosophies from various perspectives.
 3. To know the Indian philosophical system of knowing oneself.
 4. To understand values and its significance.
 5. To know ethics from western and Indian perspective.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	INDIAN ETHOS Indian Ethos – Models of management in Indian socio-political environment. Indian work ethos and principles of Indian Management – Goals of Life- Teachings of important Indian Spiritual leaders..	9
II	BUSINESS CONCEPTS AND PHILOSOPHIES Economics of giving - Western economic system. Developing and implementing gross national happiness - Sabbath economics - Islamic economics and Banking	9
III	CONSTITUTIONAL RIGHTS OF WOMEN IN INDIA Indian constitution relating to women - Fundamental rights - Directive principles of state policy - right to equality - rights against exploitation, the right to constitutional remedy - University Declaration of Human Rights - Enforcement of Human Rights for Women and Children - Role of Cells and Counseling Centers - Legal AID cells, Help line, State and National level Commission	9
IV	POLITICAL RIGHTS OF WOMEN IN INDIA AND LAWS Political Rights of Women in India - Electoral process - women as voters - candidates and leader - pressure group, Representation of women in local self government – women in Rural and urban local bodies – Reservation of women – Laws against violence & Sexual crimes: eve teasing – rape - indecent representation of women - immoral trafficking	9
V	GENDER EQUALITY Gender roles: Biological vs cultural determinism – Private vs public dichotomy – Gender division of labour and asymmetric role structure Gender role socialization and formation of identity –Occupational segregation and wage discrimination – Gender stereotyping in work place – Human development indicators and gender disparity	9
Total Instructional Hours		45

- Course Outcomes**
- Upon completion of the course, students can be able to**
- CO1: To impart knowledge on Indian Ethos for inspirational life
- CO2: To apply Business concepts and philosophies for broader perspective in society
- CO3: To familiarize students about Indian philosophy system to handle life efficiently
- CO4: To apply values in day to day functioning for better standard of life.
- CO5: To conceptualize ethics from western and Indian perspective

TEXT BOOKS

- T1- Nandagopal.R and Ajith Sankar R.N. Indian Ethos and Values in Management, ISBN – 978-0-07-106779-9. Tata McGraw Hill Education Private Ltd, 2011.
- T2-Khandelwal.N.M, Indian Ethos and Values for Managers, ISBN 978-93-5024-452-4, 3rd Edition, Himalaya Publishing House, 2011.

REFERENCES BOOKS:

- R1-Management Thoughts in Thirukkural by K. Nagarajan – ANMOL Publications PVT Ltd 4374/4B Ansari Road, New Delhi 110 002. 2010
- R2-Dr. Radhakrishnan Pillai, Corporate Chanakya, ISBN 978-81-8495-133-2, Jaico Publishing House, 2016
- R3-Soham, LEEP (Life Empowerment and Enrichment Program), ISBN 9788175977259 Central Chinmaya Mission Trust, 2017. .


Chairman - Bos
EIE - HiCET




Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E./B.TECH.	19LS6404	INDIAN CONSTITUTION AND POLITICAL SYSTEM	3	0	0	3

Course Objectives
1. Teach history and philosophy of Political Science.
2. Describe the Indian Constitution and fundamental rights.
3. Summarize powers and functions and Emergency rule of Indian government.
4. Explain Local Governance.
5. Converse the challenges to Indian Democracy

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	INTRODUCTION Meaning, Nature and Scope of Political Science – Significance of Political Science as a Discipline - Approaches to the study of Political Science – Key Concepts: State, Nation and Sovereignty - Political Science as a Science or an Art .	9
II	CONSTITUTION OF INDIA & FUNDAMENTAL RIGHTS Meaning of the constitution law and constitutionalism – Historical perspective of the constitution of India – salient features and characteristics of the constitution of India. Scheme of the fundamental rights – fundamental duties and its legislative status – The directive principles of state policy –Rights of women and Children - Constitutional Remedies for citizens	9
III	PARLIAMENTARY FORM OF GOVERNMENT AND EMERGENCY PROVISIONS The constitution powers and the status of the president in India. – Amendment of the constitutional powers and procedures – Emergency provisions: National emergency, President rule, Financial emergency.	9
IV	LOCAL GOVERNANCE Panchayati Raj and Municipal Government; Structure, Power & Functions; Significance of 73rd and 74th Amendments; Changes in Rural Power structure and empowerment of the marginalized groups such as SCs/STs and Women	9
V	CHALLENGES TO INDIAN DEMOCRACY Caste, class, ethnicity and gender in Indian politics; Criminalization and corruption, politics of regionalism, communalism, backward class and Dalit movements, Tribal people movements, struggle for gender justice	9
Total Instructional Hours		45

Upon completion of the course, students can be able to

Course Outcomes
CO1: Understand the history of Indian Constitution
CO2: Understand fundamental rights and fundamental duties.
CO3: Understand the Parliamentary form of Government and Challenges to Indian Democracy

TEXT BOOKS

- T1 - Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi, 1997.
T2 - Agarwal R C., "Indian Political System", S.Chand and Company, New Delhi, 1997.
T3 - Johari, J.C. Principles of Modern Political Science. New Delhi: Sterling, 1989.
T4 - Sharma K L., "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi, 1997.

REFERENCES BOOKS:

- R1 - Sharma, Brij Kishore, "Introduction to the Constitution of India.", Prentice Hall of India, New Delhi.
R2 - Gahai U R., "Indian Political System", New Academic Publishing House, Jalaendhar.
R3 - Sharma R N., "Indian Social Problems", Media Promoters and Publishers Pvt. Ltd.


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Dean (Academics)
HiCET

Programme B.E./B.TECH.	Course Code 19LS6405	Name of the Course YOGA FOR HUMAN EXCELLENCE	L 2	T 0	P 2	C 3
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Course Objectives

Understanding of

- (1) Structure and functions of Human Body,
- (2) Importance of Physical Exercises and various Medical systems
- (3) Life force and Philosophy of Kaya Kalpa
- (4) Mind and its functions and Meditation Practices.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	PHYSICAL STRUCTURE <ul style="list-style-type: none"> • Purpose of life - life - yoga - modern life style - importance of physical health • Physical structure - combination of five elements - three forms of body. • Blood circulation system - Respiratory system. • Nervous system - Digesting system. 	9
II	FUNCTIONS OF PHYSICAL BODY Three circulations - disease, pain and death - causes for disease. <ul style="list-style-type: none"> • Limit and method in five aspects - food, work, sleep, sensual pleasure and thought. • Importance of physical exercises - Simplified Physical Exercises - Rules and regulations. • Food and Medicine - yogic food habits - natural food - naturopathy - Medical systems: Allopathy, Siddha, Ayurvedha, Unani and Homeopathy. 	9
III	REJUVENATION OF LIFE-FORCE Philosophy of Kaya kalpa - Physical body - Sexual vital fluid - Life force - Bio-Magnetism - Mind. <ul style="list-style-type: none"> • Anti-ageing and postponing death - Kayakalpa Practical - benefits. • Sex and spirituality - value of sexual vital fluid - married life - chastity. • Functional Relationships of body, life force and mind. 	9
IV	MIND Bio-magnetic wave - Mind - imprinting and magnifying - Eight essential factors of living beings. <ul style="list-style-type: none"> • Mental Frequency - functions of mind - five layers. • Ten stages of mind Benefits of meditation - habitual imprints - understandable imprints. • Importance of meditation - benefits of meditation. 	9
V	MEDITATION Simplified Kundalini Yoga - greatness of guru - types of meditation <ul style="list-style-type: none"> • Agna meditation - explanation - benefits. • Santhi meditation - explanation - benefits - clearance of spinal cord - benefits. • Thuriam meditation - explanation - benefits - Thuriyatheetam meditation - explanation - benefits. 	9
Total Instructional Hours		45

TEXT BOOKS

T1 - Yogic Life - VISION, Vethathiri Publications.

REFERENCES BOOKS:

- R1 - Vethathiri Maharishi, Yoga for Modern age, 2017, Vethathiri Publications, Erode.
- R2. Vethathiri Maharishi, Mind, 2017, Vethathiri Publications, Erode.
- R3. Dr.MathuramSekar, Medicine and Health, Narmadha Publications.
- R4. Vethathiri Maharishi, Simplified Physical Exercises, 2013, Vethathiri Publications, Erode.
- R5. WCSC-VISION for Wisdom, Yogasanas, 2012, Vethathiri Publications, Erode.


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Hindusthan College of Engineering And Technology
Approved by AICTE, New Delhi, Accredited with 'A' Grade by NAAC
(An Autonomous Institution, Affiliated to Anna University, Chennai)
Coimbatore - 641032

REGULATIONS 2022 &

REGULATIONS 2019

B.E ELECTRONICS AND INSTRUMENTATION ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates of the programme B E Electronics and Instrumentation Engineering will

- PEO 1. Graduates would have strong foundation in basic science and mathematics to formulate, analyze and solve electronics and instrumentation problems.
- PEO 2. Graduates shall have good knowledge of instrumentation systems and their applications to design control and safety systems for industrial process.
- PEO 3. Graduates exhibit professionalism with ethics, communication and team work to satisfy the needs of the society.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

- PO 1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

- PO 2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- PO 3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO 4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO 5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- PO 6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.



DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING
REGULATIONS 2022 & REGULATIONS 2019

Mapping of Course Outcome and Programme Outcome:

Year	Sem	Course code & Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
I	I	22MA1101- Matrices and Calculus	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2
		22HE1151- English for Engineers	2	1	-	-	1	1	1.6	2.2	2.4	3	1	1.2	1	2
		22CY1151- Chemistry for Circuit Engineering	2	2.6	2.6	1.4	1.4	1	1	-	1	-	1.2	2	-	1
		22CS1151- Problem Solving using C Programming	2	3	3	-	2	-	-	-	2	-	-	2	2	2
		22EI1201- Fundamentals of Electrical, Electronics and Instrumentation Engineering	2.8	2.6	2.2	1	-	0.4	-	-	0.4	0.4	-	1.4	1.8	2.6
		22HE1071- Universal Human Values	-	-	-	-	-	1	2	1	1	-	2	-	-	2.2

		22HE1072- Entrepreneurship & Innovation														
		22MC1091-தமிழரும் தொழில்நுட்பமும்														
		22MC1092- Indian Constitution														
	II	22HE2151- Effective Technical Communication	1.4	1.5	1.5	2	-	1.4	2		3	-	1.6	-	1.2	1
		22MA2102- Differential Equations and Laplace Transform	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	1.8
		22PH2101- Basics of Material Science	3	2.4	1.2	1.8	1.8	1	2	-	-	-	-	1	2	2.2
		22CY2101-Environmental Studies	3	2	2	2	2	1	1	-	-	-	-	1	1	1
		22EI2251- Electronic Devices and Circuits	2.8	2.8	2.2	1	-	0.4	-	-	0.8	0.6	-	1.8	2.2	2.6
		21ME2001 - Engineering Practices	3	-	3	-	3	-	-	-	1	-	-	-	1	2
		22MC2091- தமிழர் மரபு														
		22MC2092-Heritage of Tamil														
II	III	21MA3102 - Fourier Analysis and Transforms	3	3	3	3	2.6	-	-	-	-	-	-	2	2	1.2
		21EI3201 - Electronic Devices and Circuits	2.6	2	1.6	1.2	-	0.2	0.4	-	0.4	0.2	-	0.8	3	2.6
		21EI3202 - Sensors and Transducers	2	1.2	2.2	1	0.4	0.4	1	-	-	0.4	-	1.4	2.8	2.6

		21ME3231 - Fluid Mechanics and Thermal Engineering	2.2	2.8	1.8	1.2	1.2	1.4	-	-	0.4	-	0.4	1	2	2.8
		21EI3251- Electrical and Electronic Measurements	2.8	2.6	2.4	0.4	0.6	-	0.2	-	0.4	-	0.2	1.4	2.2	3
		21EI3001 - Electronic Devices and Circuits Laboratory	2.8	0.4	1	-	-	1	-	-	3	-	0.5	-	1.4	2.8
		21EI3002 - Sensors and Transducers Laboratory	1.8	1.6	3	0.4	0.5	-	0.4	-	3	-	-	0.5	2.6	2.6
		21MC3191-Indian Constitution														
	IV	21MA4101 - Numerical Methods	3	3	3	3	2.6	-	-	-	-	-	-	2	2	1.2
		21EI4201 - Electrical Machines	2.2	2.6	2.6	2.16	1	0.4	0.6	-	0.4	-	-	1.4	3	2.6
		21EI4202 - Integrated Circuits and Its Applications	2.5	2	2.2	2.5	-	2	-	-	-	-	-	2	3	2.6
		21EI4203- Industrial Instrumentation-I	2	1.2	2.2	1	-	0.4	-	-	-	-	-	0.8	1.2	2.6
		21EI4251 - Digital Logic Circuits	2	1.2	2.2	0.5	0.4	0.4	1	-	-	0.2	-	0.5	1.8	2.6
		21EI4001 - Electrical Machines Laboratory	2.8	0.8	-	0.8	-	-	-	-	3	-	-	1.2	0.6	2.8
		21EI4002 - Integrated Circuits Laboratory	2.8	0.4	2.5	0.8	0.4	-	-	-	3	-	-	1	0.6	2.8
		21MC4191-Essence of Indian tradition knowledge/ Value Education														
III	V	19EI5201 -Industrial Instrumentation – II	3	1.6	2	2	1	-	-	-	-	0.4	-	0.6	3	3
		19EI5202 – Control Systems	2	1.2	2.2	1	0.4	0.4	-	-	-	-	-	0.8	2.8	3

		19EI5203 - Microprocessors and Microcontrollers	2.4	1.2	2.2	1	0.4	0.4	1	-	-	-	-	1.4	2.4	2.6
		19EI5204 - Analytical Instrumentation	2	1.2	2.2	1	-	0.4	-	-	-	-	-	0.8	2.6	3
		19EI53XX -Professional Elective -I														
		19EI5251 - Programmable Logic Controllers and SCADA	2.2	1.2	2.2	1	-	0.4	-	-	0.4	-	-	0.6	2	2.6
		19EI5001 - Industrial Instrumentation Laboratory	2.8	0.8	0.6	0.8	0.4	-	3	-	3	-	-	1.8	1	2.8
		19EI5002-Microprocessors and Microcontrollers Laboratory	1.8	1.6	3	1	0.6	-	3	-	3	-	-	1	2.6	2.6
		19HE5071-Soft Skills - I														
		19HE5072-Design Thinking														
	VI	19EI6181 – Industrial Safety Management	2	1.2	2.2	1	-	0.4	-	-	-	-	-	0.8	1.8	2.6
		19EI6201 – Process Control	2	1.2	2.2	1	0.4	0.8	-	-	-	-	-	0.8	1.2	2.6
		19EI6202- Discrete Time and Signal Processing	3	2	2	2	1	-	-	0.2	-	0.4	-	-	2	2.6
		19EI63XX -Professional Elective - II														
		19XX64XX -Open Elective– I														
		19EI6251 -Embedded System	2	1.8	2.2	1	-	0.4	-	-	0.4	0.2	-	0.8	1.2	2.6
		19EI6001 – Process Control laboratory	2.4	2.2	3	1.4	1.8	-	3	-	3	-	-	2	2.8	2.8
		19EI6002 - Virtual Instrumentation Laboratory	2.8	0.4	1	0.8	0.4	-	2	-	3	-	-	1.2	0.6	2.8

		19EI6701-Internship Training															
		19HE6071-Soft Skills - II															
		19HE6072-Intellectual Property Rights (IPR)															
IV	VII	19EI7201 – Computer Control of Process	2	1.2	2.2	1	0.4	0.8	-	-	-	-	-	0.8	1.2	2.6	
		19EI7202 – Industrial Electronics	2	1.8	2.2		1.4	-	-	-	0.4	-	0.2	-	1.8	1.4	
		19EI73XX -Professional Elective-III															
		19XX74XX -Open Elective – II															
		19EI7251-Biomedical Instrumentation	2.6	1	2	0.4	0.6	-	0.2	-	-	-	-	1.4	2.2	2.8	
		19EI7001 - Computer Control of Process Laboratory	2.8	0.8	1	0.8	0.6	-	-	-	3	-		1.2	1	2.8	
		19EI7002- Instrumentation System Design Laboratory	2.8	0.4	1	0.8	0.4	-	-	-	3	-	-	1.2	0.6	2.8	
		19EI7901 - Project Work – Phase I	3	2.8	0.6	1	0.6	0.8	1	0.6	1.6	-	-	0.6	2.8	2.6	
	VIII	19EI83XX -Professional Elective –IV															
		19EI81XX -Professional Elective- V															
		19EI8901-Project Work – Phase II	3	2.8	1	1.2	-	0.8	-	0.6	1.4	0.6	0.8	1	2.6	2.8	

PROFESSIONAL ELECTIVE COURSES

Elective	Sem	Course code & Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
I	V	19EI5301 - Power Plant Instrumentation	1.2	1.4	1.8	0.6	1	1	1	0.2	0.4	0.2	0.4	0.2	2	2
		19EI5302 - Communication Theory	3	2.4	2.4	2.4	0.8	0.8	1	3	1	1.8	0.4	0.6	2	2
		19IT5331 - Fundamentals of Java Programming	2.4	2.2	2	2	0.4	0.8	1	0.4	0.4	0.4	0.6	0.2	1	2
		19EI5303 - Industrial Chemical Process	3	0.2	1.6	-	0.6	0.4	0.2	-	0.4	-	0.4	0.6	2	1.8
		19EI5304 - Operating Systems	3	2.6	2.6	2	1.8	-	0.4	-	0.6	3	-	2.2	3	3
II	VI	19EI6301 - VLSI Design	3	2	3	2.8	2	-	-	0.6	-	0.2	0.6	-	3	2.8
		19EI6302 - Micro Electro Mechanical Systems	3	3	2	2	3	-	-	-	-	3	-	3	3	3
		19EI6303 - Industrial Data Communication	3	1.2	3	-	0.4	-	3	-	-	0.4	0.6	-	3	2
		19EI6304 - Digital Image Processing	3	3	2.8	2.8	2	-	2	-	0.2	0.4	-	2.8	3	2.8
		19EI6305 - Introduction to Soft Computing	2.6	2.2	2.2	2	-	0.2	0.2	1	-	1	-	2.6	2.8	3
III	VII	19EI7301 - Non-Linear Control System	2.8	3	2.8	2.8	2.8	-	0.2	0.4	2.2	1.8	2.6	2	2.2	2.8
		19EI7302 - Industrial IoT	1.6	1	1	1.5	1.5	1	1	1	2	3	1	1	2.8	3
		19EI7303 - Robotics and Automation	3	2.6	2.8	3	-	-	1.5	1	0.2	-	1.8	2.6	3	3

		19EI7304- Microcontroller Based System Design	2.6	1	1.6	0.4	0.6		0.2		0.4	-	-	1.4	2.2	3
		19EI7305 - Neural Networks and Fuzzy Systems	2	1.6	0.6	0.6	-	0.4	-	1.6	-	1.6	0.2	2	3	2.2
IV	VIII	19EI8301- Fiber Optics and Laser Instruments	2.2	1.2	2	1	-	-	-	0.4	-	0.4		0.6	2	3
		19EI8302 - Instrumentation in Petrochemical Industries	2	2	1.8	1	-	0.6	-	0.2	0.4	-	0.8	2	3	2
		19EI8303 - Instrumentation System Design	3	2.6	2.2	0.6	0.6	0.4	-	1	-	0.2	0.4	2	3	2.6
		19EI8304 - Artificial Intelligence and Machine Learning	3	2	0.6	3	0.2	0.4	2	1	-	3	2	0.4	3	2.6
		19EI8305 - Instrumentation and Control in Paper Industry	2.8	2.4	2.6	1.8	1	2.6	1.4	1.4	1.4	-	-	2.6	3	2.8
V		19EI8181 - Disaster Management	3	2.6	0.4	1.2	0.6	-	0.4	1	1.2	-	0.6	2	3	2.6
		19EI8182 - Total Quality Management	1.8	1.6	0.4	0.6	0.6	0.4	0.2	0.2	0.8	0.6	0.2	0.4	2.2	2.6
		19EI8183 - Professional Ethics for Engineers	3	1.6	0.6	-	-	2.4	2.2	3	1.8	2.4	-	2.2	3	2.8
		19EI8184 - Principles of Management	2.2	2.8	1.6	-	0.8	-	0.4	-	0.6	0.6	0.2	-	2	2.6
		19EI8185 - Patent, Copyright and Competition Law	2.8	2.8	1.8	2.6	2.6	0.2	0.8	-	2.4	0.2	1.4	1	2.6	13

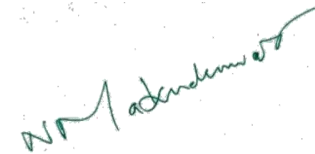
OPEN ELECTIVE COURSES

Elective	Sem	Course code & Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
I	VI	19EI6401- Smart Sensors for Engineering Applications	3	2.8	3	2.8	3	0.4	-	1.8	-	0.2	-	3	2.6	3
		19EI6402- Electrical Energy Management and Audit	1.8	2	1.4	1	-	0.4	-	0.6	0.4	-	2	1.2	3	2.6
II	VII	19EI7401- Introduction to Programmable Logic Controllers	3	2.4	2.2	0.6	1	0.4	-	1.4	-	1	1.2	2	3	2.6

1-Low, 2-Medium, 3-High, - No Correlation



Chairman Board of Studies



Dean - Academics