Course Booklet

2nd Year EE

श्रमम् विना न किमपि साध्यम्

Department of Electrical Engineering
RCC Institute of Information Technology

RCC Institute of Information Technology

Approved by AICTE, New Delhi and Affiliated to MAKAUT, W.B.

An ISO 9001 - 2008 & ISO 14001 - 2004 Certified Institute A Unit of RCC Institute of Technology an autonomous Society of Department of Higher Education, Govt. of West Bengal

Table of Content

About the Department

The Department of Electrical Engineering (which is now accredited by National Board of Accreditation (NBA), New Delhi) started its journey in the year 2009 under RCCIIT and the first batch of students graduated in the year 2013. It is situated in the ground floor of the new campus of the Institute. The department offers Electrical Engineering (EE) undergraduate program that augments the liberal education to undergraduates and imparts well understanding of the subject, Electrical Engineering and its different aspects built on a foundation of Science, Mathematics, Computation, Engineering and Technology. Admissions for UG program in this department require a valid rank of WBJEE/AIEEE which is monitored through the Institutional Admission Committee following the guidelines of the Maulana Abul Kalam Azad University of Technology, previously known as the West Bengal University of Technology. The department also take admission under lateral entry scheme from the merit list of JELET conducted by West Bengal Joint Entrance Examinations Board. The present intake of this department is 60. The department has highly qualified and experienced faculty and staff members. The Department has well modernized class rooms, Faculty rooms and possesses exclusive laboratories as per university course curriculum. Apart from the academics, students are also encouraged for different extra-curricular activities like quizzes, seminars, workshops etc.

Faculty Profile

Dr. Shilpi Bhattacharya (HoD)

Associate Professor

Power Electronics, Drives

Dr. Debasish Mondal

Professor

Control System, Field Theory

Dr. Alok Kole

Professor

AI ML, Control System

Dr. Dipankar Santra

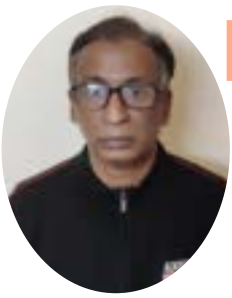
Associate Professor

Measurement, Machine

Mr. Budhaditya Biswas (PC)

Assistant Professor

Power System



Mr. Nijam Uddin Molla

Assistant Professor

Electric Machine

Mr. Sarbojit Mukherjee

Assistant Professor

Power Electronics, Drives

Mr. Subhasish Banerjee

Assistant Professor

Non-Conventional Energy

Dr. Shilpi Bhattacharya (HoD)

Assistant Professor

Microcontroller, FPGA

Non Teaching Staff Profile

Mr. Ashim Biswas

Lab Technician

Basic Electrical, Machine

Mr. Soumitra Dey

Lab Technician

Thermal Power, Power System

Mr. Rajesh Mahato

Lab Technician

Control System, Circuit Theory

Mr. Sumit Mukherjee

Technical Assistant

Power Electronics, Drives

Mr. Abir Sen

General Assistant

Vision of the Program (Electrical Engineering)

To create world class professionals who are globally competitive, capable of using and developing state-of-the-art technologies along with research and innovation in EE and allied fields.

Mission of the Program (Electrical Engineering)

M1: To provide education to the students that will enable them to meet the current and future needs of EE and possess diverse capabilities to pursue their careers successfully.

M2: To be research and innovation oriented so as to investigate and develop new technologies.

M3: To remain constantly agile to the needs of industry, environment and society so as catered to the needs of the nation and the global community.

Program Outcome (POs)

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
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.
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.
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.
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.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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, give and receive clear instructions.
11. **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.
12. **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 Educational Objectives (PEOs)

The graduate will posses:

- Basic understanding of core electrical engineering built on foundation of physical science, mathematics, computing, and technology so as to pursue successful career/higher studies in Electrical Engineering.
- Broad based knowledge of Electrical Engineering suitable for research, development and innovation to meet diverse and multidisciplinary needs of industry and society.
- Adequate professional skills, to be analytical and logical so that they can quickly adapt to new work environment, assimilate information and solve challenging problems.
- Self-learning capability, leadership qualities with strong communication skills and working in teams.
- Capacity to be productive with ethical values, conscious about social and environmental issues with lifelong learning attitude.

Program Specific Outcome (PSOs)

At the end of the program, the students

PSO1: Proficiency in use of software & hardware required to practice Electrical engineering profession.

PSO2: Proficiency in developing wind & solar hybrid power generating systems.

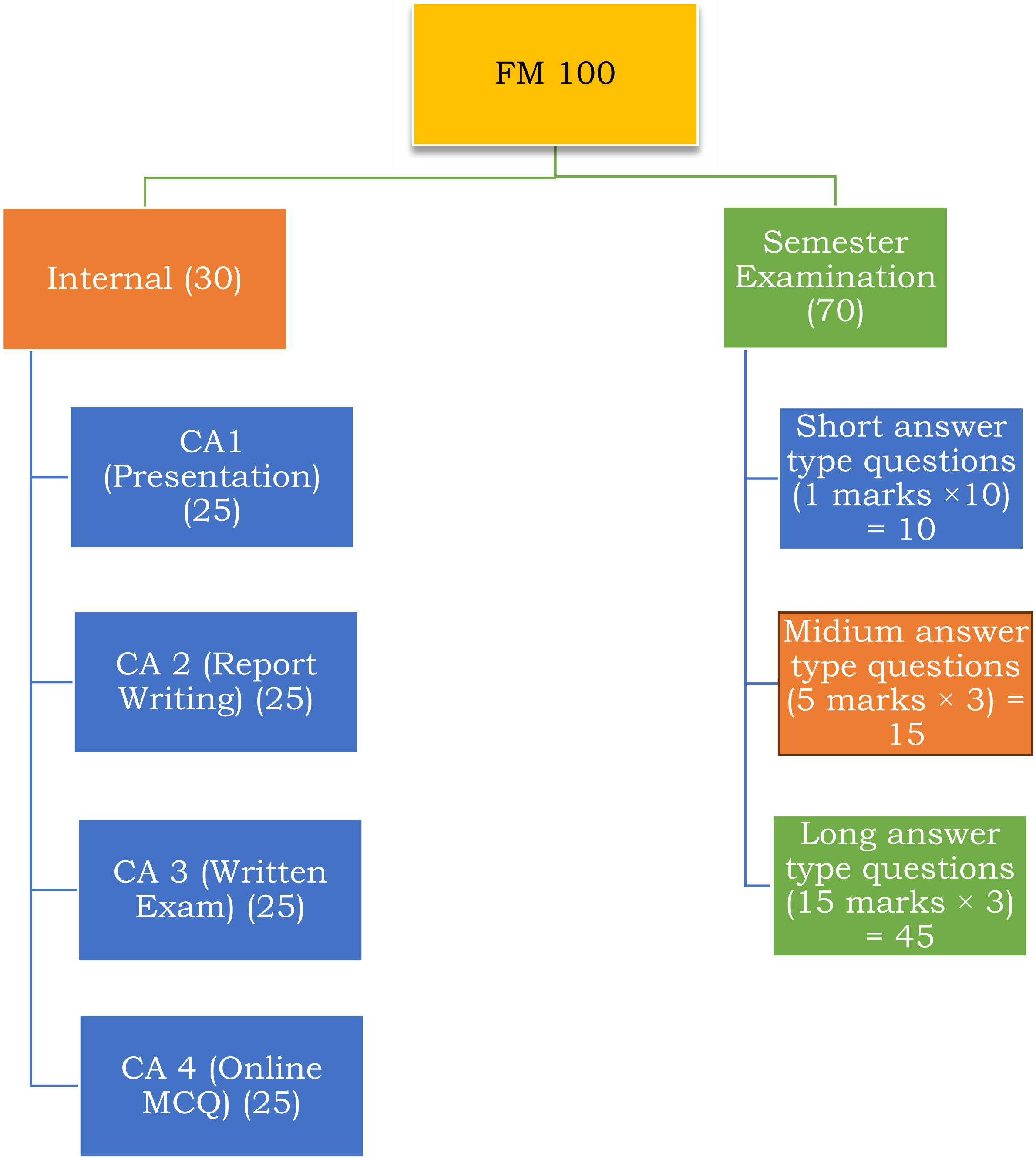
PSO3: Development of wireless control & automation and real time simulations for prototypes.

Correlation between Program Educational Objectives (PEOs) and Mission of the Department of Electrical Engineering, RCCIIT

PEO No.	Statement	M1	M2	M3
PEO 1	Basic understanding of core electrical engineering built on foundation of physical science, mathematics, computing, and technology so as to pursue successful career/higher studies in Electrical Engineering.	3	3	3
PEO 2	Broad based knowledge of Electrical Engineering suitable for research, development and innovation to meet diverse and multidisciplinary needs of industry and society.	3	3	3
PEO 3	Adequate professional skills, to be analytical and logical so that they can quickly adapt to new work environment, assimilate information and solve challenging problems.	2	3	3
PEO 4	Self-learning capability, leadership qualities with strong communication skills and working in teams.	3	3	2
PEO 5	Capacity to be productive with ethical values, conscious about social and environmental issues with lifelong learning attitude.	3	2	3

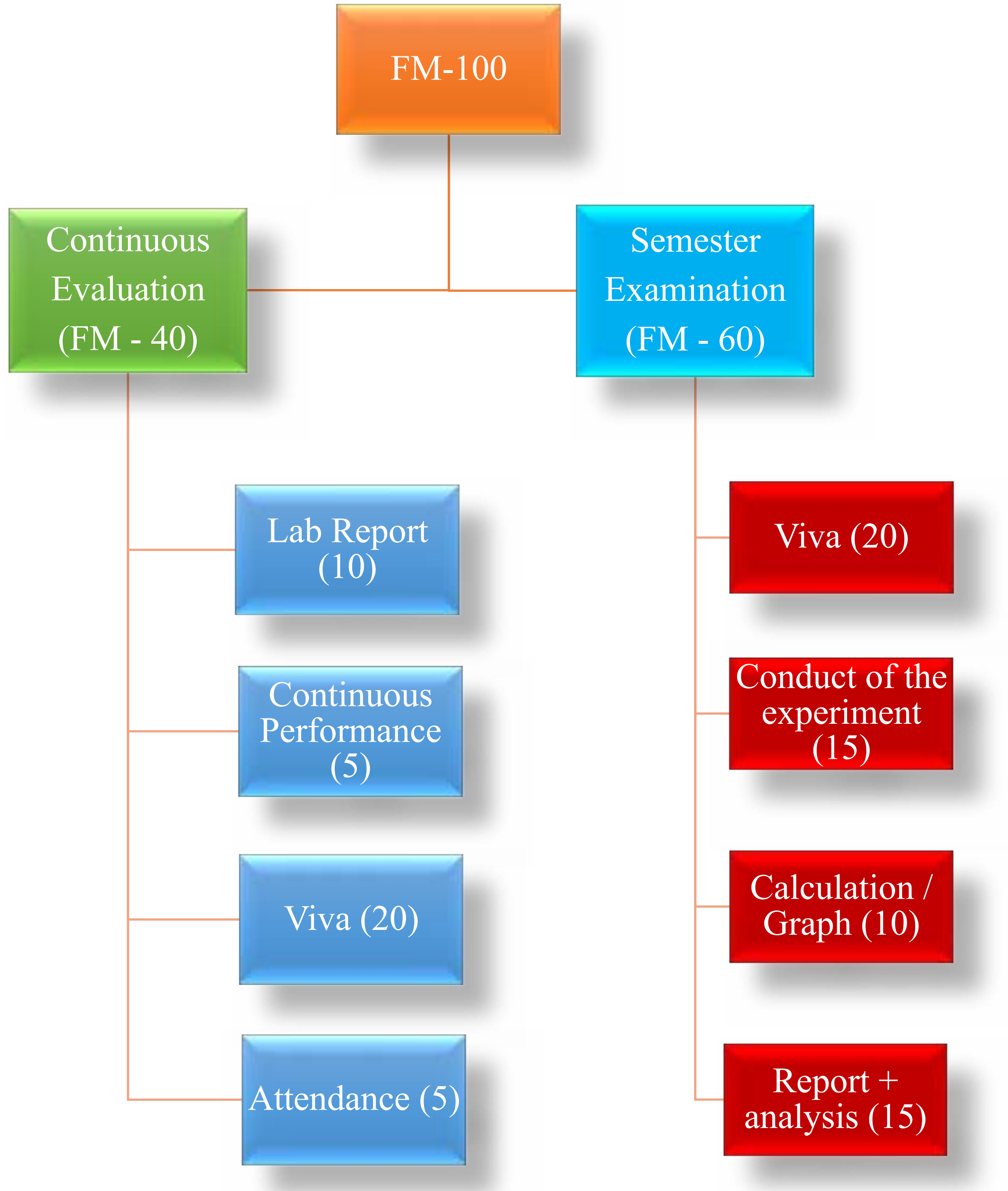
1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Marks Division for Theory Examination



University takes 4 **Continuous Assessments (CA)** out of 25 and they scale it within 30 marks in the final result.

Marks Division for Practical Examination



University takes 2 **Practical Continuous Assessment (PCA)** during the semester.

Course Structure

Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits

Range of credits:

A range of credits from 150 to 160 for a student to be eligible to get B.Tech Degree in Engineering. A student will be eligible to get B.Tech Degree with Honours, if he/she completes an additional 20 credits. These could be acquired through Massive Open Online Courses (MOOCs).

MOOCs for B. Tech Honours:

The additional 20 credits (for obtaining B. Tech with Honours) are to be gained through MOOCs. The complete description of the MOOCs relevant for the first year course are given in **Annexure-I**. The courses for subsequent years of study will be posted subsequently.

Guidelines regarding Mandatory Induction Program for the new students:

All concerned are requested to follow the guidelines given in **Annexure-II** concerning Mandatory Induction Program. The colleges/ Institute may also refer to the AICTE Model Curriculum for Undergraduate Degree Courses in Engineering & Technology

Mandatory Additional Requirement for earning B. Tech Degree:

All concerned are requested to follow the guidelines in **Annexure-III** concerning Mandatory Additional Requirements.

Group division:

Group-A:

Chemistry based subjects:

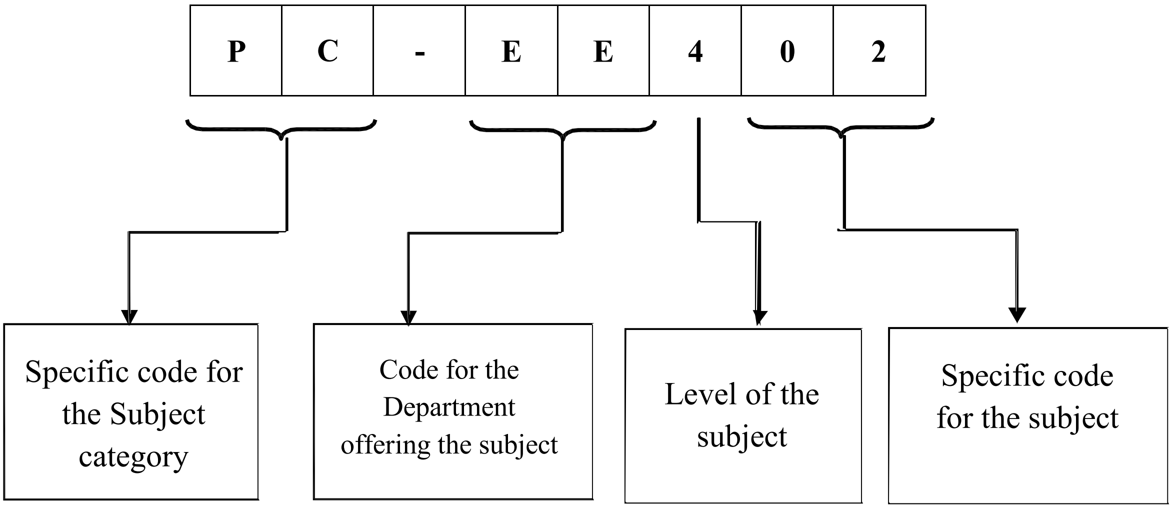
[Bio-Technology, Food Technology, Leather Technology, Textile Technology, Ceramic Technology, Chemical Engineering, and any other Engineering that chooses to be Chemistry based] + Physics based subjects: [Mechanical Engineering, Production Engineering, Civil Engineering, Automobile

Engineering, Marine Engineering, Apparel Production Engineering, Computer Science & Engineering, Information Technology.]

Group-B:

All Physics based subjects which are also Electrical & Electronics based [**Electrical Engineering**, Electronics & Communication Engineering, Applied Electronics & Instrumentation Engineering, Power Engineering, Electrical & Electronics Engineering, Bio- Medical Engineering, Instrumentation & Control Engineering]

Subject Numbering Scheme:



List of Codes for Subject Category	
Code	**Category Name**
BS	Basic Science Courses
E	Engineering Science Courses
HM	Humanities and Social Sciences including Management courses
PC	Professional core courses
PE	Professional Elective courses
OE	Open Elective courses
MC	Mandatory courses
PW	Project

2^{nd} Year First Semester

Theory

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 301	Electric Circuit Theory	3	1	0	4	4
2	PC-EE 302	Analog Electronics	3	0	0	3	3
3	PC-EE 303	Electromagnetic field theory	3	0	0	3	3
4	ES-ME 301	Engineering Mechanics	3	0	0	3	3
5	BS-M 301	Mathematics-III	3	0	0	3	3
6	BS-EE301	Biology for Engineers	3	0	0	3	3
7	MC-EE 301	Indian Constitution	3	0	0	3	0
		TOTAL OF SEMESTER:				**22**	**19**

Practical

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 391	Electric Circuit Theory Laboratory	0	0	2	2	1
2	PC-EE 392	Analog Electronics laboratory	0	0	2	2	1
3	PC-CS 391	Numerical Methods laboratory	0	0	2	2	1
		Total of Practical / Sessional				06	3
TOTAL OF SEMESTER:						**28**	**22**

2nd Year Second Semester

Theory

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 401	Electric machine-I	3	0	0	3	3
2	PC-EE 402	Digital Electronic	3	0	0	3	3
3	PC-EE 403	Electrical and Electronics Measurement	3	0	0	3	3
4	ES-EE 401	Thermal Power Engineering	3	0	0	3	3
5	HM-EE401	Values and Ethics in profession	3	0	0	3	3
6	MC- EE401	Environmental Science	3	0	0	3	0
		TOTAL OF SEMESTER:				**18**	**15**

Practical

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 491	Electric machine-I laboratory	0	0	2	2	1
2	PC-EE 492	Digital electronics laboratory	0	0	2	2	1
3	PC-EE 493	Electrical and electronic measurement laboratory	0	0	2	2	1
4	ES-ME 491	Thermal power engineering laboratory	0		2	2	1
		Total of Practical / Sessional				08	4
TOTAL OF SEMESTER:						26	19

Second Year First Semester Articulation Matrix

Sl. No.	NBA Code	Subject Code	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6	CO 7	CO 8	CO 9	CO 10	CO 11	CO 12	PSO 1	PSO 2	PSO 3
1	C201	PC-EE 301	3.0	2.5	1.7	1.5	2.2	1.5	1.0	1.0	3.0	1.8	2.0	1.3	2.8	1.0	1.3
2	C202	PC-EE 302	3.0	2.8	2.8	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	3.0	2.0	0.0	1.0
3	C203	PC-EE 303	3.0	2.8	2.0	1.2	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	1.8
4	C204	ES-ME 301	2.0	1.0	1.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	1.0	1.0	0.0	0.0
5	C205	BS- M 301	2.8	2.3	2.5	2.2	0.0	0.0	0.0	0.0	0.0	0.0	1.7	3.0	2.0	1.3	0.0
6	C206	BS- 301	0.0	1.0	2.3	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
7	C207	MC-EE 301	0.0	0.0	0.0	3.0	3.0	3.0	0.0	2.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0
8	C208	PC-EE 391	3.0	3.0	2.0	1.4	3.0	1.6	1.0	1.0	2.3	1.5	2.0	1.4	2.8	0.0	1.0
9	C209	PC-EE392	3.0	2.7	2.3	1.3	2.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0	2.0	0.0	1.0
10	C210	PC-CS 391	2.7	2.7	2.0	1.4	3.0	1.6	1.0	1.0	2.3	1.5	2.0	1.4	1.6	1.8	1.0

Second Year Second Semester Articulation Matrix

Sl. No.	NBA Code	Subject Code	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6	CO 7	CO 8	CO 9	CO 10	CO 11	CO 12	PSO 1	PSO 2	PSO 3
1	C211	PC-EE-401	2.0	2.3	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0
2	C212	PC-EE 402	2.3	1.8	2.2	2.2	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.4	1.7	2.4
3	C213	PC-EE 403	3.0	2.8	1.7	1.0	1.2	0.0	1.0	0.0	0.0	0.0	0.0	3.0	1.7	0.0	1.0
4	C214	ES-EE 401	3.0	2.8	1.7	1.5	1.0	0.0	1.0	0.0	0.0	0.0	0.0	1.0	1.0	1.5	0.0
5	C215	HM-EE 401	1.7	1.7	2.2	1.7	1.3	2.5	1.8	2.7	1.7	1.2	1.3	1.7	1.2	1.0	1.0
6	C216	PC-EE 491	2.5	2.2	1.7	1.5	2.2	1.5	1.0	1.0	2.8	1.8	2.0	1.3	2.3	2.3	1.2
7	C217	PC-EE 492	1.8	2.3	2.2	1.6	2.0	0.0	0.0	0.0	3.0	0.0	0.0	2.0	2.0	1.7	0.0
8	C218	PC-EE 493	2.7	2.7	2.0	1.4	3.0	1.6	1.0	1.0	2.3	1.5	2.0	1.4	1.6	1.8	1.0
9	C219	ES-ME 491	2.8	2.5	1.8	1.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0

Name of the course	**ELECTRIC CIRCUIT THEORY**
Course Code: PC-EE 301	Semester: 3^{rd}
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 1 hr/week	Assignment & Quiz: 10 Marks
Practical: 2 hrs/week	Attendance: 05 Marks
Credit Points: 4+1	End Semester Exam: 70 Marks

Course Objective:

1.	To understand the structure and properties of different type of electrical circuits, networks
2.	To apply different mathematical tools & techniques for analyzing electrical networks.
3.	To apply circuit analysis techniques to simplify electrical networks.
4.	To solve problems of electrical circuits.

Pre-Requisite:

Basic Electrical Engineering (ES-EE-101)
Mathematics (BS-M-102, Bs-M202)

Course Outcomes:

CO1	Describe different type of networks, sources and signals with examples.
CO2	Apply network theorems and different tools to solve network problems.
CO3	Select suitable techniques of network analysis for efficient solution.
CO4	Estimate parameters of two-port networks.
CO5	Solve coupled circuit and tools for solution of networks.
CO6	Design filters circuits.

Mapping with CO – PO – PSO

	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	PSO 3
CO1	3	3	1	0	0	0	1	0	0	0	0	1	0	1	1
CO2	3	3	1	1	2	1	0	0	3	2	0	1	3	0	1
CO3	3	3	1	0	2	0	0	0	3	1	0	1	3	0	2
CO4	3	2	2	1	2	0	0	0	3	0	0	0	3	0	1
CO5	3	2	2	1	2	0	0	0	3	1	0	0	2	0	1
CO6	3	2	3	3	3	2	1	1	3	3	2	2	3	0	2
Avg	3.00	2.50	1.67	1.50	2.20	1.50	1.00	1.00	3.00	1.75	2.00	1.25	2.80	1.00	1.33

Detail Syllabus:

Unit	Content	Hrs
1	Introduction: Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems. Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth signals	3
2	Graph theory and Networks equations: Concept of Tree, Branch, Tree link, Incidence matrix, Tie-set matrix and loop currents, Cut set matrix and node pair potentials. Duality, Solution of Problems	4
3	Coupled circuits: Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modeling of coupled circuits, Solution of problems.	3
4	Laplace transforms: Impulse, Step & Sinusoidal response of RL, RC, and RLC circuits. Transient analysis of different electrical circuits with and without initial conditions. Concept of Convolution theorem and its application. Solution of Problems with DC & AC sources.	8
5	Fourier method of waveform analysis: Fourier series and Fourier Transform (in continuous domain only). Application in circuit analysis, Solution of Problems	6
6	Network Theorems: Formulation of network equations, Source transformation, Loop variable analysis, Node variable analysis. Network theorem: Superposition, Thevenin's, Norton's & Maximum power transfer theorem. Millman's theorem and its application in three phase unbalanced circuit analysis. Solution of Problems with DC & AC sources.	8

7	Two port networks analysis: Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and their inter relations. Driving point impedance & Admittance. Solution of Problems	4
8	Filter Circuits: Analysis and synthesis of Low pass, High pass, Band pass, Band reject, All pass filters (first and second order only) using operational amplifier. Solution of Problems	4

Text books:

1. Networks & Systems, Ashfaq Husain, Khanna Book Publishing, New Delhi
2. Networks and Systems, D. Roy Chowdhury, New Age International Publishers
3. Network Analysis and Synthesis, C.L. Wadhwa, New Age International Publishers
4. Circuit and Networks: Analysis and synthesis, A. Sudhakar & S.S. Palli4th edition. Tata Mc Graw Hill Education Pvt. Ltd.
5. Circuit theory, Dr. Abhijit Chakrabarty, Dhanpat Rai & Co Pvt. Ltd.

Reference books

1. Network Analysis, M.E. Valkenburg, Pearson Education.
2. Fundamental of Electric circuit theory, D. Chattopadhay & P.C. Rakshit, S. Chand
3. Engineering Circuit Analysis, W.H. Hyat, J.E. Kemmerly & S.M. Durbin, The Mc Graw Hill Company.
4. Problems and Solutions of Electric Circuit Analysis, R.K. Mehta & A.K. Mal, CBS, New Delhi

Name of the course	**ANALOG ELECTRONICS**
Course Code: PC-EE 302	Semester: 3rd
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks
Practical: 2 hrs/week	Attendance: 05 Marks
Credit Points: 3+1	End Semester Exam: 70 Marks

Course Objective:

1.	To understand the structure and properties of different components of analog electronics.
2.	To explain principle of operation of analog electronics components and circuits.
3.	To understand the application of operational amplifier
4.	To solve problems of analog electronic components and circuits
5.	To analyze amplifiers, oscillators and other analog electronic circuits.

Pre-Requisite:

Physics (10+2)

Course Outcomes:

CO1	Understand the use of diodes in different analog electronic rectifiers, Filters and regulators and wave shaping applications
CO2	Apply fundamentals of BJT and MOSFET characteristics, biasing and modeling of transistor to obtain the voltage and current gain and other parameters in common amplifiers
CO3	Analyze the effect of feedback in transistor amplifiers and oscillator circuits to obtain the frequency response characteristics and conditions for sustained oscillations in practical oscillators.
CO4	Compare different classes of power amplifiers and evaluate their conversion efficiency
CO5	Understand the principle of Operational amplifiers and its use in various analog signal processing applications
CO6	Explain the use of Voltage Controlled Oscillators and PLL in the domain of signal processing and communication

Mapping with CO – PO – PSO

	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	PSO 3
CO1	3	3	3	1			1					3	2		1
CO2	3	3	3	1			1					3	2		1
CO3	3	3	3	1			1					3	2		1
CO4	3	2	2	1			1					3	2		1
CO5	3	3	3	1			1					3	2		1
CO6	3	3	3	1			1					3	2		1
Avg	3.00	2.83	2.83	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	3.00	**2.00**	**0.00**	**1.00**

Detail Syllabus:

1 Filters & Regulators: Review of half wave and full wave rectifier, Capacitor filters, □-section filter, ripple factor, series and shunt voltage regulator, percentage regulation. 4

2 BJT circuits: Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits 8

3. MOSFET circuits: MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common- source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit. 8

4. Feed back amplifier & Oscillators: Concept of Feed back, Negative & Positive feedback, Voltage/Current, Series/Shunt feedback, Berkhausen criterion, Colpit , Hartley's, Phase shift, Wien bridge, & Crystal oscillators. 5

5. Operational amplifier: Ideal OPAMP, Differential amplifier, Constant current source (Current mirror etc), Level shifter, CMRR, Open & closed loop circuits, importance of feedback loop (positive & negative), inverting & non-inverting amplifiers, Voltage follower/Buffer circuits. 5

6. Application of Operational amplifiers: Adder, Integrator & Differentiator, Comparator, Schmitt Trigger, Instrumentation Amplifier, Log & Antilog amplifier, Trans-conductance multiplier, Precision rectifier, Voltage to current &Current to voltage converter.

7. ower amplifier: Class A, B, AB, C, Conversion efficiency 2

8. Multivibrator: Monostable, Bistable multivibrator, Monostable & Astable operation using 555 timer. 2
9. Special function circuits: VCO & PLL 2

Text books:

1. Malvino—Electronic Principles , 6/e ,TMH
2. Nagrath, Electronics: Analog and Digital, PHI, 2004
3. Mottershed, Electronics Devices & Circuits, Wiley Eastern
4. Millman & Halkias – Integrated Electronics, Tata McGraw Hill.
5. Gayakwad R.A -- OpAmps and Linear IC's, 4/e, Pearson-PHI
6. Franco—Design with Operational Amplifiers & Analog Integrated Circuits, 3/e,TMH
7. Coughlin and Drisscol – Operational Amplifier and Linear Integrated Circuits – Pearson Education Asia.
8. A.K. Maini, Analog Electronics, Khanna Publishing House, 2019
9. L.K. Maheswari, Analog Electronics, Laxmi Publications

Reference books

1. Nagchoudhuri , Microelectronic Devices, 1/e, Pearson Education, 2001
2. Natarajan, Microelectronics: Analysis & Design, 1/e 2005, TMH
3. Maheshwari and Anand , Analog Electronics, PHI
4. Boyle'stead , Nashelsky: & Kishore, Electronic Devices & Circuit theory, 1/e, PHI/Pearson.
5. Millman & Halkias: Basic Electronic Principles; TMH.
6. Tobey & Grame – Operational Amplifier: Design and Applications, Mc Graw Hill

Name of the course	**ELECTRO MAGNETIC FIELD THEORY**
Course Code: PC-EE 303	Semester: 3rd
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks
Practical: 0 hrs/week	Attendance: 05 Marks
Credit Points: 3	End Semester Exam: 70 Marks

Course Objective:

1.	To understand the basic mathematical tools to deal with Electromagnetic field Problem.
2.	To understand properties and application of Electric and magnetic field.
3.	To analyze electromagnetic wave propagation
4.	To solve problem related to Electromagnetic field.

Pre-Requisite:

1.	Basic Electrical Engineering (ES-EE-101)
2.	Mathematics (BS-M-102, Bs-M202)
3.	Physics (BS-PH 101)

Course Outcomes:

CO1	To learn the basic mathematical tools to deal with Electromagnetic field
CO2	To understand properties and application of Electrostatic field in solving various problems related to static electric field
CO3	Able to understand properties and application of Magneto static fields in solving various problems related to static magnetic field
CO4	Able to apply the laws of Electromagnetic induction for time-varying Electromagnetic field.
CO5	To analyze characteristics of electromagnetic wave and wave equations
CO6	Able to deduce the parameters of the transmission line and its modeling for propagation of Electromagnetic wave.

Mapping with CO – PO – PSO

	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	PSO 3
CO1	3	2	1	1	1	0	0	0	0	0	0	0	0	0	0
CO2	3	3	2	1	1	0	0	0	0	0	0	0	0	0	0
CO3	3	3	2	1	1	0	0	0	0	0	0	0	1	1	1
CO4	3	3	2	1	0	0	0	0	0	0	0	0	1	1	2
CO5	3	3	2	1	1	0	0	0	0	0	0	0	1	3	2
CO6	3	3	3	2	1	0	0	0	0	0	0	0	1	3	2
Avg	3.00	2.83	2.00	1.17	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2.00	1.75

Detail Syllabus:

Unit	Content	Hrs
1	Introduction: Co-ordinate systems and transformation, Cartesian coordinates, Circular cylindrical coordinates, Spherical coordinates & their transformation. Differential length, area and volume in different coordinate systems. Solution of problems	4
2	Introduction to Vector calculus: DEL operator, Gradient of a scalar, Divergence of a vector & Divergence theorem, Curl of a vector & Strokes theorem, Laplacian of a scalar, Classification of vector fields, Helmholtz's theorem. Solution of problems	4
3	Electrostatic field: Coulomb's law, field intensity, Gauss's law, Electric potential and Potential gradient, Relation between E and V, an Electric dipole and flux lines. Energy density in electrostatic field. Boundary conditions: Dielectric-dielectric, Conductor –dielectric, Conductor-free space. Poisson's and Laplace's equation, General procedure for solving Poisson's and Laplace's equation. Solution of problems	8
4	Magneto static fields: Biot- savart law, Ampere's circuit law, Magnetic flux density, Magnetic static and Vector potential, Forces due to magnetic field, Magnetic torque and moments, Magnetisation in material,Magnetic boundary condition, Inductor and Inductances, Magnetic energy, Force on magnetic material. Solution of problems	8

5	Electromagnetic fields: Faraday's law, Transformer and motional emf, Displacement current, Maxwell's equations, Time varying Potential, Time harmonic fields. Solution of problems	6
6	Electromagnetic wave propagation: Wave equation, Wave propagation in lossy dielectric, Plane waves in loss less dielectric, Plane wave in free space, Plane wave in good conductor, Skin effect, Skin depth, Power & Poynting vector, Reflection of a plane wave at normal incidence, reflection of a plane wave at oblique incidence, Polarisation. Solution of problems	6
7	Transmission line: Concept of lump & distributed parameters, Line parameters, Transmission line equation & solutions, Physical significance of solutions, Propagation constants, Characteristic impedance, Wavelength, Velocity of propagation. Solution of problems	4

Text books:

1. Elements of Electromagnetic, Mathew N.O. Sadiku, 4th edition, Oxford university press.
2. Engineering Electromagnetic, W.H. Hyat & J.A. Buck, 7th Edition, TMH
3. Theory and problems of Electromagnetic, Edminister, 2nd Edition, TMH
4. Electromagnetic field theory fundamentals, Guru & Hizroglu, 2nd edition, Cambridge University

Name of the course	**MATHEMATICS-III**
Course Code: BS- M 301	Semester: 3rd
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks
Practical: 0 hrs/week	Attendance: 05 Marks
Credit Points: 3	End Semester Exam: 70 Marks

Objective:

1.	To understand Probability theory required an Electrical Engineer to
2.	To understand numerical methods to solve engineering problem
3.	To understand basics of Z transform to solve engineering problems.

Pre-Requisite

1.	Mathematics (10+2)

Course Outcomes:

CO1	To understand basic Probability theory and different properties
CO2	To apply probability theory in real life problem and in profession as Electrical Engineer
CO3	To understand the basics of numerical methods
CO4	To solve engineering problem using different numerical methods
CO5	To understand basics of Z transform
CO6	To solve engineering problems using Z transform.

Mapping with CO – PO – PSO

	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**	**PSO 3**
CO1	3	3	3	3								3		3	2	
CO2	3	3	3	3								3		2	1	
CO3	3	3	3	2								3		2	1	
CO4	3	1	2	1							1	3		2	2	
CO5	2	2	2	2							2	3		1	1	
CO6	3	2	2	2							2	3		2	1	
Avg	**2.83**	**2.33**	**2.50**	**2.17**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.67**	**3.00**		**2.00**	**1.33**	**0.00**

Detail Syllabus:

Unit	Content	Hrs
1	Probability: Basic Probability Theory: Classical definition and its limitations. Axiomatic definition. Some elementary deduction: i) P(O)=0, ii) 0≤P(A)≤1, iii) P(A')=1-P(A) etc. where the symbols have their usual meanings. Frequency interpretation of probability.	1
	Addition rule for 2 events (proof) & its extension to more than 2 events (statement only). Related problems. Conditional probability & Independent events. Extension to more than 2 events (pair wise & mutual independence). Multiplication Rule. Examples. Baye's theorem (statement only) and related problems.	3
	Random Variable & Probability Distributions. Expectation: Definition of random variable. Continuous and discrete random variables. Probability density function & probability mass function for single variable only. Distribution function and its properties (without proof). Examples. Definitions of Expectation & Variance, properties & examples.	2
	Some important discrete distributions: Binomial & Poisson distributions and related problems. Some important continuous distributions: Uniform, Exponential, Normal distributions and related problems. Determination of Mean & Variance for Binomial, Poisson & Uniform distributions only.	2

2	Numerical Methods: Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors. Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation. Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms. Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method. Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method. Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method.	4 5 3 6 4 6
3	Z transform: Sequence, Representation of sequence, Basic operations on sequences, Z-transforms, Properties of Z-transforms, Change of scale, Shifting property, Inverse Z-transform, Solution of difference equation, Region of convergence.	4

Text books:

1. Lipschutz S., and Lipson M.L.: Probability (Schaum's Outline Series), TMH.
2. C.Xavier: C Language and Numerical Methods.
3. Dutta & Jana: Introductory Numerical Analysis.
4. J.B.Scarborough: Numerical Mathematical Analysis.
5. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).
6. Hwei P Hsu, " Signal and system", (Schaum's Outline Series), Mc Graw Hill education.

Reference books

1. Balagurusamy: Numerical Methods, Scitech.
2. R.S. Salaria: Numerical Methods, Khanna Publishing House.
3. S.S. Sashtry: Numerical Methods, PHI
4. Baburam: Numerical Methods, Pearson Education.
5. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
6. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
7. Srimanta Pal: Numerical Methods, OUP.

Name of the course	**ENGINEERING MECHANICS**
Course Code: ES-ME 301	Semester: 3rd
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks
Practical: 0 hrs/week	Attendance: 05 Marks
Credit Points: 3	End Semester Exam: 70 Marks

Course Objectives:

1.	To understand the basic mathematical tools to deal with the physical
2.	To learn different mathematical techniques to analyze physical bodies.
2.	To learn analysis techniques of rigid bodies.
2.	To solve problem of general motion.

Pre Requisite:

1.	Physics (BS-PH-101)
2.	Mathematics (BS-M102, BS-M202)

Course Outcomes:

CO1	Explain the co-ordinate system, principle of three dimensional rotation, kinematics and kinetics of rigid bodies.
CO2	Elaborate the theory of general motion, bending moment, torsional motion and friction.
CO3	Develop free body diagram of different arrangements.
CO4	Solve problems with the application of theories and principle of motion , friction and rigid bodies.
CO5	Analyze torsional equation and bending moment.
CO6	To solve problem of general motion.

Mapping with CO – PO – PSO

	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	PSO 3
CO1	2	0	0	0	0	0	0	0	0	0	0	1			
CO2	2	0	0	0	0	0	0	0	0	0	0	1			
CO3	2	0	0	0	0	0	0	0	0	0	0	1			
CO4	2	1	1	0	0	0	0	1	0	1	0	1	1		
CO5	2	0	1	0	0	0	0	1	0	1	0	1	1		
CO6	2	1	1	0	0	0	0	1	0	1	0	1	1		
Avg	**2.00**	**1.00**	**1.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.00**	**0.00**	**1.00**	**0.00**	**1.00**	**1.00**	**0.00**	**0.00**

Detail Syllabus:

Unit	Content	Hr
1	Introduction to vectors and tensors and co ordinate systems Introduction to vectors and tensors and coordinate systems; Vector and tensor algebra; Indical notation; Symmetric and anti-symmetric tensors; Eigenvalues and Principal axes.	5
2	Three-dimensional Rotation Three-dimensional rotation: Euler's theorem, Axis-angle formulation and Euler angles; Coordinate transformation of vectors and tensors.	4
3	Kinematics of Rigid Body Kinematics of rigid bodies: Dentition and motion of a rigid body; Rigid bodies as coordinate systems; Angular velocity of a rigid body, and its rate of change; Distinction between two- and three dimensional rotational motion; Integration of angular velocity to find orientation; Motion relative to a rotating rigid body: Five term acceleration formula.	6
4	Kinetics of Rigid Bodies Kinetics of rigid bodies: Angular momentum about a point; Inertia tensor: Dentition and computation, Principal moments and axes of inertia, Parallel and perpendicular axes theorems;	5
	Mass moment of inertia of symmetrical bodies, cylinder, sphere, cone etc., Area moment of inertia and Polar moment of inertia, Forces and moments; Newton-Euler's laws of rigid body motion.	
5	Free Body Diagram (1 hour) Free body diagrams; Examples on modelling of typical supports and joints and discussion on the kinematic and kinetic constraints that they impose.	1
6	General Motion Examples and problems. General planar motions. General 3-D motions. Free precession, Gyroscopes, Rolling coin.	9

7	Bending Moment Transverse loading on beams, shear force and bending moment in beams, analysis of cantilevers, simply supported beams and overhanging beams, relationships between loading, shear force and bending moment, shear force and bending moment diagrams.	5
8	Torsional Motion Torsion of circular shafts, derivation of torsion equation, stress and deformation in circular and hollow shafts.	2
9	Friction Concept of Friction; Laws of Coulomb friction; Angle of Repose; Coefficient of friction.	3

Text books:

1. J. L. Meriam and L. G. Kraige, "Engineering Mechanics: Dynamics", Wiley, 2011.
2. M. F. Beatty, "Principles of Engineering Mechanics", Springer Science & Business Media, 1986.
3. Manoj K. Harbola, " Engineering Mechanics", Cengage Learning India Pvt. Ltd, 2018
4. D.S. Bedi & M.P. Poonia, "Engineering Mechanics", Khanna Publishing House, 2019
5. R.S. Khurmi, "Engineering Mechanics", S.Chand Publications
6. R.K. Bansal, "Engineering Mechanics", Laxmi Publications

Name of the course	**BIOLOGY FOR ENGINEERS**
Course Code:BS- 301	Semester: 3rd
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks
Practical: 0 hrs/week	Attendance: 05 Marks
Credit Points: 3	End Semester Exam: 70 Marks

Objective:

1.	To introduce modern biology with an emphasis on evolution of biology as a multi-
2.	To make students aware of application of engineering principles in biology and

Pre-Requisite

1.	NIL

Course Outcomes:

CO1	To describe with examples the biological observations lead to major discoveries, to convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry
CO2	To explain the classification of kingdom and building blocks of life (biomolecules), classification at cellular, energy and excretory level, habitat, study of model organisms
CO3	To identify DNA as genetic material in the molecular basis of information transfer
CO4	To analyze biological processes at the reductionistic level, understanding proteins and their structure -function, explores the cells and molecules of the immune system, basic understanding of cancer biology and treatment, stem cell
CO5	To apply thermodynamic principles to biological systems, breakdown and synthesis of glucose
CO6	Identify microorganisms and microscopes, techniques in bio physics

Mapping with CO – PO – PSO

	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	PSO 3
CO1			2			1							1		
CO2			2			1							1		
CO3			2			1							1		
CO4		1	3			2						1	1		
CO5			2			1							1		
CO6		1	3			2						1	1		
Avg	0.00	1.00	2.33	0.00	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00

Detail Syllabus:

Unit	Content	Hrs
1	Introduction Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry. Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry	2
2	Classification: Purpose: To convey that classification per se is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity-Unicellular or multicellular (b) ultrastructure prokaryotes or eucaryotes. (c) energy and Carbon utilization - Autotrophs, heterotrophs, lithotrophs (d) Ammonia excretion – amino telic, uricotelic, ureotelic (e) Habitat- aquatic or terrestrial (e) Molecular	3

	taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus.	
3	Biomolecules Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine. Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.	4
4	Macromolecular analysis: Purpose: To analyze biological processes at the reductionistic level. Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	5
5	Metabolism Purpose: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge.	4
6	Microbiology Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.	3

7	Immunology Purpose: How does the immune system work? What are the molecular and cellular components and pathways that protect an organism from infectious agents or cancer? This comprehensive course answers these questions as it explores the cells and molecules of the immune system. Immunology- Self vs Non-self, pathogens, human immune system, antigen-antibody reactions.	5
8	Information Transfer Purpose: The molecular basis of coding and decoding genetic information is universal. Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic	4

Text / References:

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, “Biology: A global approach”, Pearson Education Ltd, 2014.
2. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, “Outlines of Biochemistry”, John Wiley and Sons, 2009.
3. D. L. Nelson and M. M. Cox, “Principles of Biochemistry”, W.H. Freeman and Company, 2012.
4. G. S. Stent and R. Calendar, “Molecular Genetics”, Freeman and company, 1978.
5. L. M. Prescott, J. P. Harley and C. A. Klein, “Microbiology”, McGraw Hill Higher Education, 2005.
6. Lewis J. Kleinsmith. “Principles of cancer biology”, Pearson, 2016

Name of the course	**INDIAN CONSTOTUTION**
Course Code: MC-EE 301	Semester: 3rd
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks
Practical: 0 hrs/week	Attendance: 05 Marks
Credit Points: 0	End Semester Exam: 70 Marks

Objective:

1.	To have basic knowledge about Indian Constitution.
2.	To understand the structure and functioning of union, state and local self-government.
3.	To understand the structure, jurisdiction and function of Indian judiciary.

Pre-Requisite

1.	NIL

Course Outcomes:

CO1	Understand the Basic Structure and Applied Doctrines of the Indian Constitution
CO2	Apply the Central Executive and Legislative of the Indian Constitution
CO3	Apply the understanding of State Executive and Legislative of the Indian Constitution
CO4	Evaluate the understanding of Central & State Executive and Legislative of the Indian Constitution
CO5	Evaluate the performance of Central, State & Subordinate Judiciary of India
CO6	Complete Research Project for Central State and Local Self Government

Mapping with CO – PO – PSO

	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	PSO 3
CO1	0	0	0	0	0	3	0	2	2	2	1	2	0	1	1
CO2	0	0	0	0	0	3	0	2	2	2	1	2	0	0	1
CO3	0	0	0	0	0	3	0	2	2	2	1	2	0	0	0
CO4	0	0	0	0	0	3	0	2	2	2	1	2	1	1	0
CO5	0	0	0	0	0	3	0	2	2	2	1	2	1	1	1
CO6	0	0	0	3	3	3	0	2	2	2	1	2	1	1	1
Avg	0.00	0.00	0.00	3.00	3.00	3.00	0.00	2.00	2.00	2.00	1.00	2.00	1.00	1.00	1.00

Detail Syllabus:

Unit	Content	Hr
1	Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive	5
2	Union government and its administration: Structure of the Indian Union: Federalism, Centre-State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha. State government and its administration: Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions	10
3	Supreme court: Organization of supreme court, procedure of the court, independence of the court, jurisdiction and power of supreme court. High court: Organization of high court, procedure of the court, independence of the court, jurisdiction and power of supreme court. Subordinate courts: constitutional provision, structure and jurisdiction. National legal services authority, Lok adalats, family courts, gram nyayalays. Public interest litigation (PIL): meaning of PIL, features of PIL, scope of PIL, principle of PIL, guidelines for admitting PIL	10

4	Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.	10

Text books:

1. Indian polity, M, Laxmikanth, MC Graw Hill education, 5th Edition.

Reference books

1. DD Basu, " Introduction to the constitution of India", 21st Edition, Lexis Nexis Books Publication ltd, India

Name of the course	**Electric circuit theory Lab**
Course Code: PC-EE391	Semester: 3rd
Duration: 6 months	Maximum marks:100
Teaching Scheme	Examination scheme:
Theory: Nil	Continuous Internal Assessment:40
Tutorial: Nil	External Assessment: 60
Practical: 2 hrs/week	
Credit Points:1	

Course Outcomes:

CO1	Analyse transient response of R-L/R-C/R-L-C circuits.
CO2	Evaluate and analyse two-port networks.
CO3	Design and evaluate performance of different active filters.
CO4	Simulate and synthesize different functions using software.
CO5	Design, analyze and solve electrical circuit using network theorems.
CO6	Design, Simulate an electric circuit and use modern tools to obtain parameters.

Mapping with CO – PO – PSO

	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	PSO 3
CO1	3	3	1	0	3	0	0	0	2	1	0	1	2	0	0
CO2	3	3	2	1	3	1	0	0	2	1	0	1	3	0	0
CO3	3	3	3	1	3	2	1	0	2	2	0	2	3	0	1
CO4	3	3	1	1	3	2	0	0	2	1	0	0	3	0	0
CO5	3	3	2	1	3	1	0	1	3	1	0	1	3	0	1
CO6	3	3	3	3	3	2	1	1	3	3	2	2	3	0	1
Avg	**3.00**	**3.00**	**2.00**	**1.40**	**3.00**	**1.60**	**1.00**	**1.00**	**2.33**	**1.50**	**2.00**	**1.40**	**2.83**	**0.00**	**1.00**

Detail Syllabus:

1.	Transient response of R-L and R-C network: simulation with software & hardware
2.	Transient response of R-L-C series and parallel circuit: simulation with software & hardware

3.	Determination of Impedance (Z) and Admittance (Y) parameter of two-port network: simulation & hardware.
4.	Frequency response of LP and HP filters: simulation & hardware.
5.	Frequency response of BP and BR filters: simulation & hardware.
6.	Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signal using MATLAB in both discrete and analog form.
7.	Determination of Laplace transform and Inverse Laplace transform using MATLAB.
8.	Amplitude and Phase spectrum analysis of different signals using MATLAB.
9.	Verification of Network theorems using software & hardware

Name of the course	**Analog Electronic Laboratory**
Course Code:PC-EE392	Semester: 3rd
Duration: 6 months	Maximum marks:100
Teaching Scheme	Examination scheme:
Theory: Nil	Continuous Internal Assessment:
Tutorial: Nil	External Assessment: 60
Practical: 2 hrs/week	Credit Points:1

Course Outcomes:

CO1	Able to build different forms of rectifier and Voltage regulating circuits
CO2	Able to study electrical characteristics of discrete BJT and FET components
CO3	Able to design single stage and two-stage BJT based RC coupled amplifier and find different amplifier characteristics.
CO4	Able to compare the different forms of Multi vibrating circuits using 555 timer IC
CO5	Able to construct different OP-AMP based source converter circuits and function generators
CO6	Able to study different DAC and ADC converting unit using suitable IC and find the applications of signal conversions in practical Data Acquisition System

Mapping with CO – PO – PSO

	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	PSO 3
CO1	3	3	3	1	2						2	1	2		1
CO2	3	3	2	1	2						2	1	2		1
CO3	3	3	2	2	2						2	1	2		1
CO4	3	2	2	1	2						2	1	2		1
CO5	3	3	2	2	2						2	1	2		1
CO6	3	2	3	1	2						2	1	2		1
Avg	3.00	2.67	2.33	1.33	2.00	0.00	0.00	0.00	0.00	0.00	2.00	1.00	2.00	0.00	1.00

Detail Syllabus:

1.	Study of ripple and regulation characteristics of full wave rectifier with and without capacitor filter.
2.	Study of Zener diode as voltage regulator.
3.	Study of characteristics curves of B.J.T & F.E.T .
4.	Construction of a two-stage R-C coupled amplifier & study of it's gain & Bandwidth.
5.	Study of class A, C & Push-Pull amplifiers.

6.	Study of timer circuit using NE555 & configuration for monostable & astable and bistable multivibrator
7.	Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip
8.	Construction of a simple function generator using IC.
9.	Realization of a V-to-I & I-to-V converter using Op-Amps.
10.	Realization of a Phase Locked Loop using Voltage Controlled Oscillator (VCO).
11.	Study of D.A.C & A.D.C.

Name of the course	**Numerical Methods laboratory**
Course Code: PC-CS 391	Semester: 3rd
Duration: 6 months	Maximum marks:100
Teaching Scheme	Examination scheme:
Theory: Nil	Continuous Internal
Tutorial: Nil	External Assessment: 60
Practical: 2 hrs/week	
Credit Points:1	

Course Outcomes:

CO1	Solve problems with Newton forward /backward, Lagrange's interpolation
CO2	Solve problems of numerical integration using Trapezoidal rule, Simpson's 1/3 ule, Weddle's rule
CO3	Solve problems to find numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.
CO4	Solve problems to find numerical solution of Algebraic Equation by Regularfalsi and Newton Raphson methods
CO5	Solve ordinary differential equation by Euler's and Runga-Kutta methods
CO6	Use software package to solve numerical problems

Mapping with CO – PO – PSO

	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	PSO 3
CO1	3	3	1	0	3	0	0	0	2	1	0	1	2	0	0
CO2	3	3	2	1	3	1	0	0	2	1	0	1	3	0	0
CO3	3	3	3	1	3	2	1	0	2	2	0	2	3	0	1
CO4	3	3	1	1	3	2	0	0	2	1	0	0	3	0	0
CO5	3	3	2	1	3	1	0	1	3	1	0	1	3	0	1
CO6	3	3	3	3	3	2	1	1	3	3	2	2	3	0	1
Avg	**3.00**	**3.00**	**2.00**	**1.40**	**3.00**	**1.60**	**1.00**	**1.00**	**2.33**	**1.50**	**2.00**	**1.40**	**2.83**	**0.00**	**1.00**

Detail Syllabus:

1.	Assignments on Newton forward /backward, Lagrange's interpolation.
2.	Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
3.	Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations
4.	Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
5.	Assignments on ordinary differential equation: Euler's and Runga-Kutta methods.
6.	Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.

Name of the course	**ELECTRIC MACHINE-I**
Course Code: PC-EE-401	Semester: 4th
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks
Practical: hrs/week	Attendance: 05 Marks
Credit Points: 3	End Semester Exam: 70 Marks

Objective:

1.	To review the concept of magnetic fields and magnetic circuits
2.	To learn the principle of production of electromagnetic force and torque.
3.	To learn the basic principle of operation of DC machine
4.	To learn the principle of operation and characteristics of DC motor and generator
5.	To learn the principle of operation, connections and different tests on Transformers
6.	To acquire problem solving skills to solve problems of DC machines and Transformers

Pre-Requisite:

1.	Basic Electrical Engineering (ES-EE-101)
2.	Electric Circuit Theory (PC-EE-301)
3.	Electromagnetic Field Theory (PC-EE-303)

Course Outcomes:

CO1	Describe the function of different components of magnetic circuit, DC machines and transformers.
CO2	Explain the principle of operation of different types of DC machines and transformers.
CO3	Solve numerical problems of DC machines and transformers.
CO4	Estimate the parameters and efficiency of transformer.
CO5	Determine the characteristics of DC machines.
CO6	Recommend methods to control output of DC machines.

Mapping with CO – PO – PSO

	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	PSO 3
CO1	2	2	1									1	1		
CO2	2	3	1				1					1	1		
CO3	2	3	1									1	1		
CO4	2	2	1									1	1		
CO5	2	2	1										1		
CO6	2	2	1										1		
Avg	2.00	2.33	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00

Detail Syllabus:

Unit	Content	Hrs
1	Magnetic fields and magnetic circuits: Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines.	3
2	Electromagnetic force and torque: B-H curve of magnetic materials; flux-linkage vs current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element; torque as a partial derivative of stored energy with respect to angular position of a rotating element. Examples - galvanometer coil, relay contact, lifting magnet, rotating element with eccentricity or saliency	5
3	DC machines: Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Armature winding and commutation – Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.	8

4	DC machine - motoring and generation: Armature circuit equation for motoring and generation, Types of field excitations – separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines	7
5	Transformers: Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers. Cooling of transformers.	12

Text books:

1. Electrical Machines-I, P.S. Bimbhra, Khanna Publishing House (AICTE)
2. Electrical Machinery, P.S. Bimbhra, 7th Edition, Khanna Publishers
3. Electric machines, D.P. Kothari & I.J Nagrath, 3rd Edition, Tata Mc Graw-Hill Publishing Company Limited
4. Electrical Machines, P.K. Mukherjee & S. Chakrabarty, 2nd edition, Dhanpat Rai Publication.

Reference books:

1. Electric Machinery & Transformers, Bhag S. Guru and H.R. Hiziroglu, 3rd Edition, Oxford University press.
2. Electrical Machines, R.K. Srivastava, Cengage Learning
3. Theory of Alternating Current Machinery, Alexander S Langsdorf, Tata Mc Graw Hill Edition.
4. The performance and Design of Alternating Current Machines, M.G.Say, CBS Publishers & Distributors.
5. Electric Machinery & transformer, Irving L Koskow, 2nd Edition, Prentice Hall India

Name of the course	**DIGITAL ELECTRONICS**
Course Code: PC-EE-402	Semester: 4th
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks
Practical: hrs/week	Attendance: 05 Marks
Credit Points: 3	End Semester Exam: 70 Marks

Objective:

1.	To learn the fundamentals of Digital systems and principle of operation of Logic families.
2.	To learn the principle of operation of Combinational digital circuits.
3.	To learn the principle of operation of sequential circuit and systems.
4.	To learn the principle of operation of A/D and D/A converter
5.	To learn the principle of operation of semiconductor memories and Programmable logic devices.
6.	To acquire problem solving skills to solve problems of Digital circuits

Pre-Requisite:

1.	Analog Electronics (PC-EE-302)

Course Outcomes:

CO1	To understand and examine the structure of various number systems and its application in digital design
CO2	The ability to understand, analyze and design various combinational and sequential circuits using basic gates
CO3	Ability to identify basic requirements for a design application and propose a cost effective solution.
CO4	The ability to apply memory elements in designing various digital electronics circuits.
CO5	To develop skill to build, and troubleshoot digital circuits
CO6	Ability to design various analog to digital and digital to analog converters

Mapping with CO – PO – PSO

	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	PSO 3
CO1	2	-	2	3	-	-	-	-	-	-	-	-	2	-	2
CO2	3	2	3	1	2	-	-	-	-	-	-	-	1	-	2
CO3	2	2	2	3	2	-	-	-	-	-	-	-	2	-	3
CO4	-	1	2	2	3	-	-	-	-	-	-	2	-	2	-
CO5	2	2		2	2	-	-	-	-	-	-	1	1	1	3
CO6	-	-	2	-	1	-	-	-	-	-	-	-	1	2	2
Avg	2.25	1.75	2.20	2.20	2.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	**1.40**	**1.67**	**2.40**

Detail Syllabus:

Unit	Content	Hrs
1	Fundamentals of Digital Systems and logic families: Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.	7
2	Combinational Digital Circuits: Standard representation for logic functions, K-map representation, simplification of Logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.	7
3	Sequential circuits and systems: A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D types flipflops, applications of flipflops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of Counters	7

4	A/D and D/A Converters: Digital to analog converters: weighted resistor/converter, R-2R Ladder, D/A converter, specifications for D/A converters, examples of D/A converter, lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs.	7
5	Semiconductor memories and Programmable logic devices: Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).	7

Text books:

1. Digital Principles & Application, 5th Edition, Leach & Malvino, Mc Graw Hill Company.
2. Modern Digital Electronics, 4th Edition, R.P. Jain. Tata Mc Graw Hill Company Limited
3. Fundamental of Digital Circuits, A. Anand Kumar, 4th Edition, PHI.
4. Digital Electronics, R. Anand, Khanna Publishing House (2018).

Reference books:

1. Digital Logic Design, Morries Mano, PHI.
2. Digital Integrated Electronics, H. Taub & D. Shilling, Mc Graw Hill Company.
3. Digital Electronics, James W. Bignell & Robert Donovan, Thomson Delman Learning.
4. Fundamental of logic Design, Charles H. Roth, Thomson Delman Learning.

Name of the course	**ELECTRICAL & ELECTRONICS MEASUREMENTS**
Course Code: PC-EE-403	Semester: 4th
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0hr/week	Assignment & Quiz: 10 Marks
Practical: hrs/week	Attendance: 05 Marks
Credit Points: 3	End Semester Exam: 70 Marks

Objective:

1.	To learn methods of measurement, errors in measurement and its classification.
2.	To learn the principle of operation of analog and digital meters.
3.	To learn the basic principle of operation of instrument transformers.
4.	To learn the principle of operation of cathode ray oscilloscope and different sensors and transducers.
5.	To learn the principle of measurement of power, energy and different electrical parameters
6.	To acquire problem solving skills to solve problems on the topics studied.

Pre-Requisite:

1.	Basic Electrical Engineering (ES-EE-101)
2.	Electric Circuit Theory (PC-EE-301)

Course Outcomes:

CO1	To identify different methods of measurement, errors and types of errors and its classification in order to quantify possible errors in actual measurements.
CO2	To understand the principles of operation of analog and digital meters in order to summarize their application in different forms of measurement.
CO3	To understand the basic principle of operation of instrument transformers and its types in order to appraise its use in AC measurement system.
CO4	To make use of cathode ray oscilloscope and different sensors and transducers and find the applicability of different sensors and conditioning circuits.
CO5	To analyze different instruments required for measurement of power, energy and different electrical parameters in order to learn how various electrical parameters are measured.
CO6	To acquire problem solving skills to solve problems on the topics of electrical and electronics measurements.

Mapping with CO – PO – PSO

	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	PSO 3
CO1	3	3	1	1	1	-	1	-	-	-	-	3	2		1
CO2	3	2	2	1	1	-	1	-	-	-	-	3	1		1
CO3	3	3	2	1	1	-	1	-	-	-	-	3	2		1
CO4	3	3	2	1	2	-	1	-	-	-	-	3	2		1
CO5	3	3	2	1	1	-	1	-	-	-	-	3	2		1
CO6	3	3	1	1	1	-	-	-	-	-	-	3	1		1
Avg	3.00	2.83	1.67	1.00	1.17	0.00	1.00	0.00	0.00	0.00	0.00	3.00	**1.67**	**0.00**	**1.00**

Detail Syllabus:

Unit	Content	Hrs
1	Measurements: Method of measurement, Measurement system, Classification of instruments, Definition of accuracy, Precision, Resolution, Speed of response, Error in measurement, Classification of errors, loading effect due to shunt and series connected instruments. Analog meters: General features, Construction, Principle of operation and torque equation of Moving coil, Moving iron, Electrodynamometer, Induction instruments Principle of operation of the Electrostatic, Thermoelectric, Rectifier type instruments, Extension of instrument ranges and multipliers.	7
2	Instrument transformer: Disadvantage of shunt and multipliers, Advantage of Instrument transformers, Principle of operation of Current & Potential transformer, errors. Measurement of Power: Principle of operation of Electrodynamic & Induction type wattmeter, Wattmeter errors Measurement of Energy: Construction, theory and application of AC energy meter, testing of energy meters.	9

3	Measurement of resistance: Measurement of medium, low and high resistances, Megger Potentiometer: Principle of operation and application of Crompton's DC potentiometer, Polar and Co-ordinate type AC potentiometer, applications AC Bridges: Measurement of Inductance, Capacitance and frequency by AC bridges	8
4	Cathode ray oscilloscope (CRO): Measurement of voltage, current, frequency & phase by oscilloscope. Frequency limitation of CRO. Sampling and storage oscilloscope, Double beam CRO. Electronic Instruments: Advantages of digital meter over analog meters, Digital voltmeter, Resolution and sensitivity of digital meters, Digital multimeter, Digital frequency meter, Signal generator, Digital Storage oscilloscope.	7
5	Sensors & Transducers: Introduction to sensors & Transducers, Strain gauge, LVDT, Temperature transducers, Flow measurement using magnetic flow measurement.	4

Text books:

1. A course in Electrical & Electronic Measurements & Instrumentation, A.K. Sawhney, Dhanpat Rai & sons.
2. Electrical Measurement & Measuring Instruments, E.W. Golding & F.C. Wides, Wheeler Publishing
1. Sensors & Transducers, D. Patranabis, PHI, 2nd edition.

Reference books:

1. Electronic Instruments, H.S. Kalsi, Tata Mc-Graw hill, 2nd Edition.
2. Digital Instrumentation, A.J. Bouwens, Tata Mc-Graw hill.
3. Modern Electronic instrumentation & Measuring instruments, A.D. Heltric & W.C. Copper, Wheeler Publication
4. Instrument transducers, H.K.P. Neubert, Oxford University press.
5. All-in One Electronics Simplified, A.K. Maini, Khanna Book Publishing Co. (2018)

Name of the course	**THERMAL POWER ENGINEERING**
Course Code:ES-EE-401	Semester: 4th
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks
Practical: hrs/week	Attendance: 05 Marks
Credit Points: 3	End Semester Exam: 70 Marks

Objective:

1.	To learn the principle of operation of different types of boilers and Turbines
2.	To learn the principle of operation of IC engines and Gas turbines
3.	To acquire problem solving skills to solve problems of boilers, turbines, IC engines and Gas turbines

Pre-Requisite:

1.	Mathematics (BS M102 & BS M201)

Course Outcomes:

CO1	Recall the thermodynamic processes, working and analyses of combustion, vapor power cycles for electrical and mechanical power
CO2	Analyze the various internal combustion engine cycles and performance parameters.
CO3	Interpret various concepts, principles of operation, theories and phenomena related to the boilers and nozzles.
CO4	Develop the performance parameters of the steam turbine and reaction turbine for maximum efficiency, thermodynamic analysis of a stage, degree of reaction, velocity diagram.
CO5	Demonstrate the principles of operation, classification, working, accessories and mountings of various steam generators and condensers.
CO6	Identify the working principles and analyses of combustion, gas power cycles for producing electrical and mechanical power

Mapping with CO – PO – PSO

	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	PSO 3
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	-	-
CO2	3	3	2	2	1	-	1	-	-	-	-	1	1	1	-
CO3	3	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO5	3	3	1	-	-	-	-	-	-	-	-	-	1	-	-
CO6	3	3	2	1	-	-	1	-	-	-	-	-	1	-	-
Avg	3.00	2.83	1.67	1.50	1.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.00	1.50	0.00

Detail Syllabus:

Unit	Conte	Hrs
1	Boilers: Water Tube & Fire Tube boilers, Circulating Principles, Forced Circulation, Critical pressure, Superheaters, Reheaters, attemperators, induced draught, forced draught and secondary air Fans, Boiler performance analysis and heat balance. Combustion Systems, Environmental Protection – ESP, Cyclone Separator, Dust Collector etc.	12
2	Turbines: Rotary Thermodynamic devices – Steam turbines & their classifications – Impulse & Reaction type Turbines, Thermodynamics of compressible fluid-flow, equation and continuity – Isentropic flow through nozzles, velocity diagram, Blade efficiency, optimum velocity ratio, multi-staging, velocity & pressure compounding, losses in turbines, erosion of turbine blades, turbine governing, performance analysis of turbine, Condensing system.	12
3	IC Engines: IC Engines – classification, Analysis of a standard cycle, fuel characteristic of SI & CI Engine, Combustion, Engine performance Automotive Engine exhaust emission and their control	6

4	Gas Turbines: Gas turbine Analysis – Regeneration - Reheating, Isentropic efficiency Combustion efficiency	5

Text books:

1. Engineering Thermodynamics, P.K. Nag, 6th Edition , Mc Graw Hill Education Pvt. Ltd
2. Power Plant Engineering, P K Nag, 4th Edition, Mc Graw Hill Education Pvt. Ltd
3. Thermal Engineering , P.S. Ballaney, 25th Edition, , Khanna publishers
4. Power Plant Engineering, Domkundwar, Arora, Dhanpat Rai & Co.

Reference books:

1. Thermodynamics , Cengel , 6th Edition, Tata Mc Graw- Hill Education.
2. Power Plant Technology ,M M Ei-Wakil 1st Edition, Tata McGraw Hill
3. Heat and Thermodynamics, M W Zemansky & R.H.Dittman , 8th Edition, McGraw Hill

Name of the course	**VALUES AND ETHICS IN PROFESSION**
Course Code: HM-EE-401	Semester: 4th
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks
Practical: 0 hrs/week	Attendance: 05 Marks
Credit Points: 3	End Semester Exam: 70 Marks

Objective:

1.	To inculcate Human values to grow as a responsible human beings with a proper personality.
2.	To instill Professional Ethics to maintain ethical conduct and discharge professional duties.

Course Outcomes:

CO1	Illustrate different aspects of human values, ethics, engineers' responsibility and duties
CO2	Explain different principles, different theories and laws of engineering ethics and social experimentation
CO3	Identify different factors in the light of Engineers' responsibility towards safety and risk
CO4	Correlate ethics of different work environment
CO5	Explain the need for intellectual property rights
CO6	Design appropriate technologies and management patterns to create harmony in professional and personal life

Mapping with CO – PO – PSO

	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**	**PSO 3**
CO1	1	2	2	1	1	3	2	3	2	1	1	2	1	0	0
CO2	2	2	2	2	1	3	2	3	1	1	1	2	1	0	0
CO3	2	2	2	2	1	3	1	2	1	1	1	1	1	1	1
CO4	1	1	2	1	1	3	3	3	3	1	1	1	1	0	0
CO5	1	2	2	2	1	1	1	3	1	2	2	2	1	0	0
CO6	3	1	3	2	3	2	2	2	2	1	2	2	2	1	1
Avg	**1.67**	**1.67**	**2.17**	**1.67**	**1.33**	**2.50**	**1.83**	**2.67**	**1.67**	**1.17**	**1.33**	**1.67**	**1.17**	**1.00**	**1.00**

Detail Syllabus:

Unit	Content	Hrs
1	Human values: Morals, Values, and Ethics – Integrity –Trustworthiness – Work Ethics – Service-Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty – Courage – Value Time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality- Character.	5
2	Principles for harmony: Truthfulness – Customs and Traditions -Value Education – Human Dignity – Human Rights – Fundamental Duties Aspirations and Harmony (I, We & Nature) – Gender Bias – Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness	5
3	Engineering ethics and social experimentation: History of Ethics – Need of Engineering Ethics – Senses of Engineering Ethics- Profession and Professionalism —Self Interest – Moral Autonomy – Utilitarianism – Virtue Theory – Uses of Ethical Theories – Deontology- Types of Inquiry – Kohlberg's Theory – Gilligan's Argument – Heinz's Dilemma – Comparison with Standard Experiments — Learning from the Past – Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law – Role of Codes – Codes and Experimental Nature of Engineering.	8
4	Engineers' responsibility towards safety and risk for sustainable development: The concept of Safety – Safety and Risk – Types of Risks – Voluntary v/s Involuntary Risk – Consequences – Risk Assessment –Accountability – Liability – Reversible Effects – Threshold Levels of Risk – Delayed v/s Immediate Risk – Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.	5
5	Engineers' duties and rights: Concept of Duty – Professional Duties – Collegiality – Techniques for Achieving Collegiality – Senses of Loyalty – Consensus and Controversy – Professional and Individual Rights – Confidential and Proprietary Information – Conflict of Interest-Ethical egoism – Collective Bargaining – Confidentiality – Gifts and Bribes – Problem solving-Occupational Crimes- Industrial Espionage- Price Fixing-Whistle Blowing.	7

6	Global issues: Globalization and MNCs –Cross Culture Issues – Business Ethics – Media Ethics – Environmental Ethics – Endangering Lives – Bio Ethics – Computer Ethics – War Ethics – Research Ethics - Intellectual Property Rights.	5

Text books:

1. Professional Ethics & Human Values, Premvir Kapoor, Khanna Publishing House, Delhi (AICTE Recommended Textbook).
2. A text book on professional Ethics & Human values, R.S. Naagarazan, New Age international Publishing.
3. Engineering Ethics, M. Govindarajan, S. Natarajan , V.S. Senthilkumar, Prentice Hall India.
4. Human value and professional Ethics, Jayshree Suresh, B.S. Raghvan, S. Chand Publishing

Reference books:

1. Ethics in Science and Engineering, James G. Speight & Russel Foote, Wiley.

Name of the course	**ENVIRONMEMTAL SCIENCE**
Course Code: MC-EE-401	Semester: 4th
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks
Practical: 0 hrs/week	Attendance: 05 Marks
Credit Points: 0	End Semester Exam: 70 Marks

Objective:

1.	To understand the environment and its relationships with human activities
2.	To be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk
3.	To understand environmental laws and regulations to develop guidelines and procedures for health and safety issues
4.	To acquire the skill to solve problem related to environment and pollution

Pre-Requisite:

1.	Basic knowledge of science

Course Outcomes:

CO1	To describe with examples the biological observations lead to major discoveries, to convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry
CO2	To explain the classification of kingdom and building blocks of life (biomolecules), classification at cellular, energy and excretory level, habitat, study of model organisms
CO3	To identify DNA as genetic material in the molecular basis of information transfer
CO4	To analyze biological processes at the reductionistic level, understanding proteins and their structure -function, explores the cells and molecules of the immune system, basic understanding of cancer biology and treatment, stem cell
CO5	To apply thermodynamic principles to biological systems, breakdown and synthesis of glucose
CO6	Identify microorganisms and microscopes, techniques in bio physics

Mapping with CO – PO – PSO

	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	PSO 3
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	-	-
CO2	3	3	2	2	1	-	1	-	-	-	-	1	1	1	-
CO3	3	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO5	3	3	1	-	-	-	-	-	-	-	-	-	1	-	-
CO6	3	3	2	1	-	-	1	-	-	-	-	-	1	-	-
Avg	3.00	2.83	1.67	1.50	1.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.00	1.50	0.00

Detail Syllabus:

Unit	Content	Hrs
1	Basic ideas of environment, basic concepts, man, society & environment, their interrelationship (1L) Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non- renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development (2L). Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function (1L). Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide- causes, effects and control/management; Anthropogenic degradation like Acid rain- cause, effects and control. Nature and scope of Environmental Science and Engineering (2L)	6
2	Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function (1L). Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web (2L) Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur] (1L) Biodiversity- types, importance, Endemic species, Biodiversity Hot- spot, Threats to biodiversity, Conservation of biodiversity.(2L)	6

3	Atmospheric Composition: Troposphere, Mesosphere, Thermosphere, Tropopause and Mesopause (1L) Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.(1L) Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget.(1L) Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(2L) Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.(2L) Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN (2L) Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification. (1L) Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). (1L)	11
4	Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. (2L) River/Lake/ground water pollution: River: DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH. (2L) Lake: Eutrophication [Definition, source and effect]. (1L) Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)(1L) Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. (2L) Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic (1L)	9
5	Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. (3L)	3

Text books:

1. Environmental Studies, M.P. Poonia & S.C. Sharma, Khanna Publishing House
2. Introduction to Environmental Engineering and Science, G.M. Masters, Prentice-Hall of India Pvt. Ltd.,1991.

Reference books:

1. Environmental Chemistry, A. De, New Age International
2. Text Book for Environmental Studies, Erach Bharucha, UGC
3. Elements of Environmental Pollution Control, O.P. Gupta, Khanna Publishing House (AICTE Recommended Book).

Name of the course	**ELECTRIC MACHINE-I LABORATORY**
Course Code:PC-EE491	Semester: 4th
Duration: 6 months	Maximum marks:100
Teaching Scheme	Examination scheme:
Theory: 0 hr/week	Continuous Internal Assessment:40
Tutorial: 0 hr/week	External Assessment: 60
Practical: 2 hrs/week	
Credit Points:1	

Course Outcomes:

CO1	Identify appropriate equipment and instruments for the experiments
CO2	Test the the instruments application to the experiment
CO3	construct circuit with appropriate instruments and safety precautions
CO4	Validate different characteristics of DC Machine, methods of speed control of DC motor.
CO5	Determine the equivalent cicuit and study of different connection of three phase transformer.
CO6	Work effectively in a team

Mapping with CO – PO – PSO

	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	PSO 3
CO1	3	2	1	0	0	0	1	0	0	0	0	1	0	1	1
CO2	2	2	1	1	2	1	0	0	2	2	0	1	0	0	1
CO3	3	3	1	0	2	0	0	0	3	1	0	1	2	3	2
CO4	3	2	2	1	2	0	0	0	3	0	0	0	3	3	1
CO5	3	2	2	1	2	0	0	0	3	1	0	0	3	0	1
CO6	1	2	3	3	3	2	1	1	3	3	2	2	1	0	0
Avg	**2.50**	**2.17**	**1.67**	**1.50**	**2.20**	**1.50**	**1.00**	**1.00**	**2.80**	**1.75**	**2.00**	**1.25**	**2.25**	**2.33**	**1.20**

Detail Syllabus:

1.	Determination of the characteristics of a separately excited DC generator.
2.	Determination of the characteristics of a DC motor
3.	Study of methods of speed control of DC motor
4.	Determination of the characteristics of a compound DC generator (short shunt)

5.	Determination of speed of DC series motor as a function of load torque.
6.	Polarity test on a single phase transformer
7.	Determination of equivalent circuit of a single phase transformer and efficiency.
8.	Study of different connections of three phase transformer.
9.	Study of Parallel operation of a single phase transformers.
10.	Determination of temperature rise and efficiency of the transformer. (Back to back test)

Name of the course	**DIGITAL ELECTRONICS LABORATORY**
Course Code:PC-EE492	Semester: 4^{th}
Duration: 6 months	Maximum marks:100
Teaching Scheme	Examination scheme:
Theory: 0 hr/week	Continuous Internal Assessment:40
Tutorial: 0 hr/week	External Assessment: 60
Practical: 2 hrs/week	
Credit Points:1	

Course Outcomes:

CO1	Identify appropriate equipment and instruments for the experiment
CO2	Test the instruments for application to the experiment
CO3	Construct decoder, multiplexer, adder and subtractor circuits with appropriate instruments and precaution
CO4	Realize RS-JK and D flip flop, universal register with gates, multiplexer and flip-flops and asynchronous and synchronous up down counters
CO5	Validate the operation of code conversion circuit –BCD to Excess 3 & vice versa, 4 bit parity generator & comparator circuits
CO6	Construct the different types of AD/DA converter

Mapping with CO – PO – PSO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	1	-	2	1	-	2	-	-	-	-	-	2
CO2	2	1	3	1	2	-	-	-	-	2	-	-
CO3	1	3	3	3	3	1	3	-	2	-	-	-
CO4	-	3	2	2	2	-	-	-	-	-	2	3
CO5	3	2		1	2	-	-	3	-	-	-	1
CO6	-	-	1	-	1	-	-	-	3	2	-	2
Avg	**1.75**	**2.25**	**2.20**	**1.60**	**2.00**	**0.00**	**0.00**	**0.00**	**2.50**	**0.00**	**0.00**	**2.00**

PSO 1	**PSO 2**	**PSO 3**
2	-	2
3	-	2
2	-	3
-	2	-
2	1	3
1	2	2
2.00	**1.67**	**0.00**

Detail Syllabus:

1. Realization of basic gates using Universal logic gates.
2. Code conversion circuits- BCD to Excess-3 & vice-versa.
3. .4-bit parity generator & comparator circuits.
4. Construction of simple Decoder & Multiplexer circuits using logic gates.
5. Design of combinational circuit for BCD to decimal conversion to drive 7-segment display using multiplexer.
6. Construction of simple arithmetic circuits-Adder, Subtractor.
7. Realization of RS-JK & D flip-flops using Universal logic gates.
8. Realization of Universal Register using JK flip-flops & logic gates.
9. Realization of Universal Register using multiplexer & flip-flops.
10. Construction of Adder circuit using Shift Register & full Adder.
11. Realization of Asynchronous Up/Down counter
12. Realization of Synchronous Up/Down counter
13. Design of Sequential Counter with irregular sequences.
14. Realization of Ring counter & Johnson's counter.
15. Familiarization with A/D and D/A circuits

Name of the course	**ELECTRICAL & ELECTRONICS MEASUREMENT LABORATORY**
Course Code:PC-EE493	Semester: 4th
Duration: 6 months	Maximum marks:100
Teaching Scheme	Examination scheme:
Theory: 0 hr/week	Continuous Internal Assessment:40
Tutorial: 0 hr/week	External Assessment: 60
Practical: 2 hrs/week	
Credit Points:1	

Course Outcomes:

CO1	Identify appropriate equipment and instrument
CO2	Test the instrument application to the experiment.
CO3	Construct circuit with appropriate instrument and safety precautions
CO4	Evaluate and adjust the precision and accuracy of AC energy meter, moving iron and dynamometer type voltmeter , ammeter, wattmeter.
CO5	Measure voltage, current, active and reactive power.
CO6	Measure Resistance, inductance, capacitance, frequency using different bridge

Mapping with CO – PO – PSO

	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	PSO 3
CO1	2	3	1	0	3	0	0	0	2	1	0	1	0	0	0
CO2	2	2	2	1	3	1	0	0	2	1	0	1	1	0	0
CO3	3	3	3	1	3	2	1	0	2	2	0	2	1	2	1
CO4	3	3	1	1	3	2	0	0	2	1	0	0	2	2	1
CO5	3	2	2	1	3	1	0	1	3	1	0	1	2	1	1
CO6	3	3	3	3	3	2	1	1	3	3	2	2	2	2	0
Avg	2.67	2.67	2.00	1.40	3.00	1.60	1.00	1.00	2.33	1.50	2.00	1.40	1.60	1.75	1.00

Detail Syllabus:

1.	Instrument workshop- Observe the construction of PMMC, Dynamometer, Electrothermal and Rectifier type of instruments, Oscilloscope and Digital multimeter.
2.	Calibrate moving iron and electrodynamometer type ammeter/voltmeter by potentiometer.
3.	Calibrate dynamometer type wattmeter by potentiometer.
4.	Calibrate AC energy meter.
5.	Measurement of resistance using Kelvin double bridge.
6.	Measurement of power using Instrument transformer.
7.	Measurement of power in Polyphase circuits.
8.	Measurement of frequency by Wien Bridge.
9.	Measurement of Inductance by Anderson bridge
10.	Measurement of capacitance by De Sauty Bridge.
11.	Measurement of capacitance by Schering Bridge.

Name of the course	**THERMAL POWER ENGINEEING LABORATORY**
Course Code: ES-ME-491	Semester: 4th
Duration: 6 months	Maximum marks:100
Teaching Scheme	Examination scheme:
Theory: 0 hr/week	Continuous Internal Assessment:40
Tutorial: 0 hr/week	External Assessment: 60
Practical: 2 hrs/week	
Credit Points:1	

Course Outcomes:

CO1	Demonstrate the basic working principle of boilers and IC engine through cut model.
CO2	Analyze the 4 Stroke Petrol Engine & Diesel Engine and their performance parameters by Rope Brake Dynamometer & Electrical Load Box
CO3	Compare the heat balance at 4 stroke diesel engine for load applied by Rope Brake Dynamometer or Electrical Load Box.
CO4	Construct Valve Timing Diagram through the cut model of 4S Diesel Engine Model & 4S Petrol Engine.
CO5	Distinguish various characteristics of Petrol and Diesel fuel.
CO6	Determine the quality of steam like enthalpy, dryness fraction through experiment.

Mapping with CO – PO – PSO

	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	PSO 3
CO1	2	1	1	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	3	2	1	1	-	1	-	-	-	-	-	1	-	-
CO3	3	3	2	1	1	-	-	-	-	-	-	-	1	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	1	-	-	1	-	-	-	-	-	-	-	-
CO6	3	3	2	1	-	-	-	-	-	-	-	-	1	-	-
Avg	2.83	2.50	1.83	1.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00

Detail Syllabus:

1.	Study of Cut Models – Boilers IC Engines: Lancashire Boiler, Babcock & Willcox Boiler, Cochran Boiler, Vertical Tubular Boiler, Locomotive Boiler, 4S Diesel Engine, 4S Petrol Engine, 2S Petrol Engine
2.	Load Test on 4 Stroke Petrol Engine & Diesel Engine by Electrical Load Box.
3.	Load Test on 4 Stroke Diesel Engine by Rope Brake Dynamometer.
4.	Heat Balance on 4 Stroke Diesel Engine by Rope Brake Dynamometer & by Electrical Load Box.
5.	Valve Timing Diagram on 4S Diesel Engine Model & 4S Petrol Engine Model
6.	To find the Calorific Value of Diesel Fuel & Coal by Bomb Calorimeter
7.	To find the Flash Point & Fire Point of Petrol & Diesel Fuel
8.	To find the Cloud Point & Pour Point of Petrol & Diesel Fuel
9.	To find Carbon Particle Percentage in Diesel Engine Exhaust Smoke by Smoke meter and trace the BHP Vs. % Carbon Curve
10.	Measurement of the Quality of Steam – Enthalpy & Dryness fraction