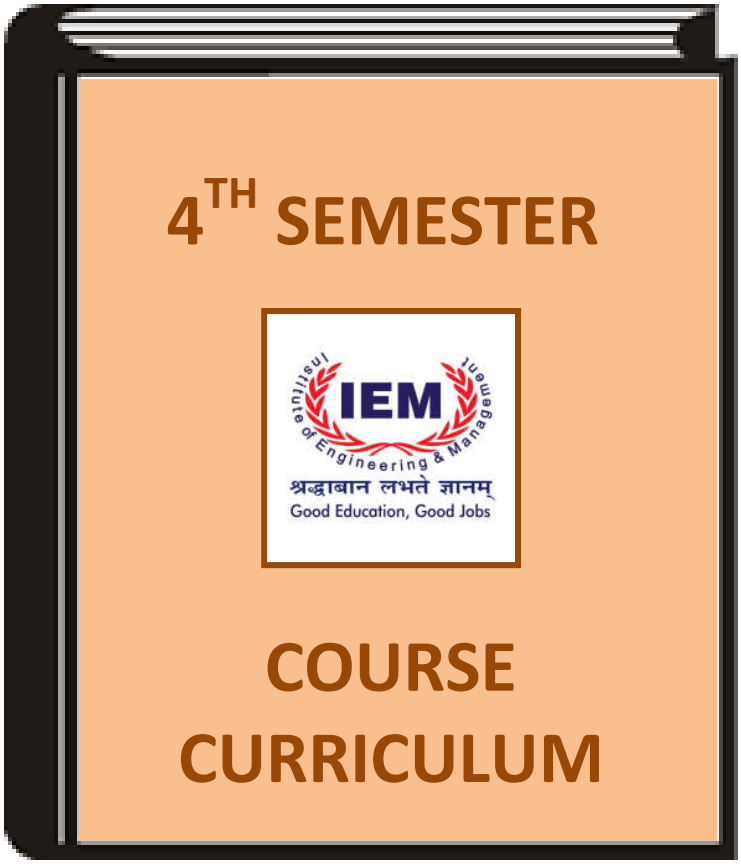
DEPARTMENT OF ELECTRICAL ENGINEERING



INSTITUTE OF ENGINEERING & MANAGEMENT

Course: HU 401- Values & Ethics in Profession

PROGRAMME: **Electrical Engineering**	DEGREE:**B. TECH**
COURSE: **Values and Ethics**	SEMESTER:4 CREDITS: **2**
COURSECODE: **HU 401**	COURSE TYPE: **THEORY**
COURSE AREA/DOMAIN **: Values and Ethics**	CONTACT HOURS: **2 (weekly)**
CORRESPONDING LAB COURSE CODE (IFANY):**N/A**	LAB COURSE NAME COURSE NAME: **N/A**

Course Objectives

1. Preparation for Profession: To inculcate professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach in the students.

2. Developing an ability to relate engineering issues to broader social context and equip them with strong knowledge, competence and soft skills that allows them to contribute to the needs of industry, consultancy, government and academia.

Course Outcomes

1. Students would be able to evaluate and analyze ethics and value policies and application of theories.
2. Students would be able to understand standard policies and procedures applicable to value principles.
3. Students would be able to pick and choose the best ethical standards and concepts for a given problem.

Programme Outcomes addressed in this course

1. An understanding of professional and ethical responsibility
2. A knowledge of contemporary issues
3. A recognition of the need for engaging in life long learning

Attainment of Program Outcomes through Course Work:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	√	√					√	√	
CO 2							√		√
CO3					√		√	√	√

Syllabus

Module I

Effects of Technological Growth:

1. Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development

2. Energy Crisis: Renewable Energy Resources

3. Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics

4. Appropriate Technology Movement of Schumacher; later developments

5. Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis.

6. Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology

Module II

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals.

2. Social and ethical responsibilities of Technologists.

3. Codes of professional ethics.

4. Whistle blowing and beyond,

5. Case studies

1. Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals.

2. Social and ethical responsibilities of Technologists.

3. Codes of professional ethics.

4. Whistle blowing and beyond,

5. Case studies

Module III

1. Values Crisis in contemporary society

2. Nature of values: Value Spectrum of a good life

3. Psychological values: Integrated personality; mental health

4. Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution.

5. Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity

6. Moral and ethical values: Nature of moral judgments; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Students should be taught regarding professional ethics	Case ex Studies	7

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	Applicability of ethics and values in changing business and financial scenarios.	1

Web Source References

S.NO.	URL
1	www.jstor.org/stable/40323926changingminds.org › Explanations › Values

Books References:

1.A N Tripathi, Human values in the Engineering Profession
2. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Power Point Presentation

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan

Science, Technology and Engineering as knowledge and as Social l Activities	Day 1
Science, Technology and Engineering as knowledge and as Professional Activities	Day 2
Factors of Production and Man-machine interaction	Day 3
Appropriate Technology Movement of Schumacher	Day 4
Human Operator in Engineering projects and industries	Day5
Safety aspects,product,human and design safety.	Day 6
Technology assessment ,movement and transfer	Day 7
Human centred technologies and Industrial safety	Day 8
Excessive use of Natural resources and effects on environment	Day 9
The concept of internalising costs of bad effects on environment	Day 10
Thalidomide drug,Germany(Chemie Grunenthal)	Day 11
Renewable Energy Resources Environmental degradation	Day12
Rapid Technological growth and depletion of resources	Day13
GDP (PPP and Nominal values) MRP, MRTP, RTI, scope of economics.	Day14
Definition of Whistle Blowing. Case studies of Whistle Blowing	Day15
Codes of Professional Ethics.Definition of Profession	Day16
Social and ethical responsibities of Technologists.	Day17
Conflicts between business demands and professional ideals.	Day18
Ethical issues in Engineering practice	Day19
Ethical issues in Engineering practice	Day20
Relevance of Ethics in Corporate life...A Presentation	Day21
Ethical codes for doctors and medical professionals.	Day22
Value crisis in a contemporary society- relevant concepts	Day23
Values crisis in Indian society	Day24
Pyschological values;integrated personality and mental health	Day25
Duties and responsibilities of engineers	Day26
Importance of values in student's life	Day27
Perception of students regarding the incorporation of values in the corporate life.	Day28
Nature of values: Value Spectrum of a good life	Day29
Societal values	Day30
Case studies where clashes between ethics and values can take place	Day31
Discussion of relevant case studies to elaborate the importance of values in our lives.	Day32
The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian	Day33
Constitution.	Day34
Aesthetic values	Day35
Perception and enjoyment of beauty,simplicity and clarity	Day36
Moral and ethical values	Day37

Course: PH(EE) 401-Physics II

PROGRAMME:**Electrical Engineering**	DEGREE:**B. TECH**
COURSE:**Physics-II**	SEMESTER: **4** CREDITS: **4**
COURSE CODE: PH(EE)401	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: **Advanced Theoretical Physics**	CONTACT HOURS: 4 **(weekly)**
CORRESPONDING LAB COURSE CODE (IFANY):**PH (EE)491**	LABCOURSE NAME: **Physics Lab-II**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION	SEM.
PH101	**Physics-I**	Basic idea of Quantum Physics	**1**
	Class XII knowledge of Physics	Basic idea of Classical Mechanics	
	Class XII knowledge of Mathematics	Basic idea of Vectors and Calculus	

Course Objectives

1. To develop an understanding in some advanced topics of science
2. To improve the logical ability of thinking to solve problems

Course Outcomes

1. To develop an understanding in some advanced topics of Physics and apply the knowledge of Mathematics and Physics in learning new technologies.
2. To improve the logical ability to analyze and solve problems.
3. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.
4. Develop students' understanding through laboratory activities to solve problems related to key concepts taught in the classroom.

Programme Outcomes addressed in this course

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO1	√								√
CO2	√	√							
CO3				√	√	√	√		
CO4			√	√	√				

Syllabus

UNIT	DETAILS	HOURS
I	**Quantum mechanics:** Generalized coordinates, Lagrange's equation of motion and Lagrangian, generalized force potential, moment and energy. Hamilton's Equation of motion and Hamiltonian. Properties of Hamilton and Hamilton's equation of motion. Concept of probability and probability density, operator, Commutator, Formulation of quantum mechanics and Basic postulates, Operator correspondence, Time dependent Time dependent Schrödinger's equation, formulation of time independent Schrödinger's equation by method of separation of variables, Physical interpretation of wave function Ψ(normalization and probability interpretation), Expectation values, Application of Schrödinger equationParticle in an infinite square well potential (1D and 3D potential well), Discussion on degenerate levels	10 6
II	**Statistical Mechanics**: Concept of energy levels and energy states. Microstates, Macrostates and thermodynamic probability, equilibrium macrostate. MB, FD, BE statistics (no deduction necessary), fermions, bosons (definitions in terms of spin, examples), physical significance and application, classical limits of quantum statistics . Fermi distribution at zero and non –zero temperature.	4
III	**Dielectric Properties:** Dielectric Material: Concept of Polarization, the relation between D, E and P, Polarizability, Electronic, Ionic, Orientation & Space charge polarization, behavior of Dielectric under alternating field, Dielectric losses. **Magnetic properties** Magnetization M, relation between B, H & M. Bohr magneton, DiamagnetismLarmor frequency & susceptibility, Curie law, Weiss molecular field theory & CurieWeiss law, Hysteresis loss, Antiferromagnetism, Ferromagnetism & Ferrites (analitative)	3 4

IV	**Crystal structure:** •Crystal structure Bravais lattice, Miller indices •Crystal diffraction (qualitative), Bragg's law and reciprocal lattice,Brillouin zone. (Qualitative description) •Free electron theory of metal – calculation of Fermi energy, density of states. •Band theory of solids Bloch theorem, Kronig Penny model. •Electronic conduction in solidsDrude's theory, Boltzmann equation, Wiedemann Frantz law. •SemiconductorBand structure, concept of electron and holes, Fermi level, density of states	14

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS
1 2	Electrical Images Semiconductor devices	Extra Class Extra class

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	**Electrical Images:** Solution of field problems in case of a point charge near a grounded conducting infinite plane. Boundary value problem : in uniform external field for (i) conducting spherical shell and (ii) dielectric sphere	2
2	**Semiconductor devices**: p-n junction diode, I-V characteristics, Zener diode and its applications, optoelectronic diodes: LED, photo diodes	2

Web Source References

S.NO.	URL
1	http://nptel.ac.in/courses/115101005/downloads/lectures-doc/Lecture-19.pdf
2	http://physics.usask.ca/~hirose/EP464/ch5-09.pdf
3	http://www2.pv.unsw.edu.au/nsite-files/pdfs/UNSW_Understanding_the_p-n_Junction.pdf
4	http://www.eie.polyu.edu.hk/~ymlai/ENG237/Diodes-Physics.pdf
5	http://www.mie.uth.gr/ekp_yliko/qm_engineers.pdf
6	http://www.people.fas.harvard.edu/~djmorin/waves/quantum.pdf

Text Books:

1. Engineering Physics by S. P. Kuila.
2. Engineering Physics by Pal and Bhattacharya

Reference Books:

1. Classical Mechanics: R.G. Takwal & P.S. Puranic
2. Quantum Mechanics: Eisberg & Resnic
3. Statistical Mechanics and Thermal Physics: Reif
4. Solid State Physics: 1) C. Kittel 2) Aschroft & Mermin 3) S.O. Pillai

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Power Point Presentation

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course plan

Day	Module No.	Module Name	Topic	Suggested References
Day – 1	1	Quantum Mechanics	Generalized co-ordinates, Lagrange's equation of motion and Lagrangian	1. A.K. Roychaudhuri 2. R.G. Takwal & P.S. Puranic 3. Goldstien
Day – 2			Concept of generalized force potential, moment and energy.	
Day – 3			Case studies and discussion of problems	
Day – 4			Hamilton's Equation of motion and Hamiltonian.	
Day – 5			Properties of Hamilton and Hamilton's equation of motion.	
Day – 6			Case studies and discussion of problems	
Day – 7			Concept of probability and probability density	1. Eisberg & Resnic 2. A.K. Ghatak & S. Lokanathan 3. S.N. Ghoshal
Day – 8			Operators in quantum mechanics and Commutator	
Day – 9			Formulation of quantum mechanics	
Day – 10			Basic postulates of quantum mechanics	
Day – 11			Operator correspondence, Time dependent Schrödinger's equation	
Day – 12			formulation of time independent Schrödinger's equation by method of separation of variables	

Day – 13			Physical interpretation of wave function Ψ(normalization and probability interpretation)	
Day – 14			Expectation values, Application of Schrödinger equation	
Day – 15			Particle in an infinite square well potential (1D)	
Day – 16			Particle in an infinite square well potential (3D)	
Day – 17	2	Statistical Mechanics	Concept of energy levels and energy states. Microstates, Macrostates	1. Frederick Reif 2.Sears and Salinger 3.Avijit Lahiri 4. Evelyn Guha
Day – 18			Thermodynamic, probability, equilibrium macrostate, MB, FD, BE statistics	
Day – 19			Fermions, bosons (definitions in terms of spin, examples), physical significance and application, classical limits of quantum statistics.	
Day – 20			Fermi distribution at zero and non –zero temperature.	
Day -21	3	Dielectric Properties	Dielectric Material, Concept of Polarization, The relation between D, E and P	1. Solid State Physics by A.J. Dekker 2. Introduction to Solid State Physics by C Kittel 3. Advanced Engineering Physics by S.P. Kuila 4. Solid State Physics by Ashcroft and Mermin
Day – 22			Electronic and Ionic Polarizability	
Day – 23			Orientation and Space charge polarization	
Day – 24			Behavior of Dielectric under alternating field, Dielectric losses, Discussion of problems	
Day – 25		Magnetic properties of solids	Magnetization M, relation between B, H and M, Origin of magnetic moment, Quantum numbers, Bohr magneton	
Day – 26			Diamagnetism, Larmor frequency and susceptibility	
Day – 27			Langevin Theory of Paramagnetism, Curie Law	
Day – 28			Ferromagnetism, Weiss molecular field theory and Curie-Weiss law,	

			Hysteresis loss, Antiferromagnetism, Ferrites	
Day – 29	4	Crystal structure	Crystal structure, Bravais lattice, unit cell, Coordination number, Miller indices	
Day – 30			Crystal diffraction, Braggs law	
Day – 31			Reciprocal lattice, Brillouin zone, Discussion of Problems	
Day – 32		Free electron theory of metal	Boltzmann Transport Equation	
Day – 33			Sommerfeld Theory, Thermal conductivity, Wiedmann Franz Law	
Day – 34			Quantum Theory of Free Electrons, Electrical Conductivity	
Day – 35			Calculation of Fermi energy and density of states, Discussion of Problems	
Day – 36		Band theory of solids	Formation of energy bands, Periodic potential in Crystalline Solid	
Day – 37			Bloch's Theorem, Kronig Penney Model	
Day – 38			Energy vs. Wave vector relationship, concept of effective mass, Distinction between metal, insulator and semiconductors	
Day – 39		Semiconductor	Semiconductor Band structure	
Day – 40			Concept of electron and hole	
Day – 41			Fermi level and density of states	

Course: ME(EE)411: Thermal Power Engineering

PROGRAMME: ELECTRICAL ENGINEERING	DEGREE:**B. TECH**
COURSE: Thermal Power Engineering	SEMESTER: **IV** CREDITS: **3**
COURSE CODE: **ME(EE)411**	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: **Mechanical Engineering**	CONTACT HOURS: 3 **(weekly)**
CORRESPONDING LAB COURSE CODE (IFANY): **ME(EE)481**	LABCOURSE NAME: **Thermal Power Engineering Lab**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION	SEM.
ME201	Engineering Thermodynamics & Fluid Mechanics	Basic thermodynamics Knowledge	**II**

Course Objectives

1. To impart Basic knowledge about Thermal Power, Boiler and IC Engines with effective thermodynamic analysis .

Course Outcomes

1. Communicate effectively with industry personnel by developing a Thermal Power centric vocabulary with sound fundamental knowledge of thermal power generation.
2. Ability to select and rate the different conventional boiler.
3. Ability to analyze and evaluate the performance of IC Engines..

Programme Outcomes addressed in this course

1. An ability to apply knowledge of mathematics, science, and engineering. (PO 1.)
2. An ability to identify, formulate and solve engineering problems (PO 2.)
3. An ability to design a system or process to meet the desired result within technical and socio-economic constraints (PO 4.)
4. An ability to communicate effectively (PO. 6)

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO1	√	√				√			
CO2		√	√						
CO3		√	√						

Syllabus

UNIT	DETAILS	HOURS
I	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
II	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
III	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
iv	Gas turbine Analysis – Regeneration - Reheating, Isentropic efficiency. Combustion efficiency.	6

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Vapour power cycle -Regeneration and Reheating	Extra Class	PO 2

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	Power station boilers, Fuel bed firing, PF firing and Fluidized bed boilers.	1

Web Source References

S.NO.	URL
1	http://www.em-ea.org/Guide%20Books/book-2/2.6%20FBC.pdf

Books References:

1. P.K.Nag- Engineering Thermodynamics – TMH ,2/e
2. P K Nag- Power Plant Engg. - TMH Pub
3. Domkundwar & Arora- Power Plant Engineering –.Dhanpat Rai & Co.
4.. Cengel --- Thermodynamics , 3/e ,TMH
5. Et-Wakil—Power Plant Engineering , MH
6. M W Zemansky & R.H.Dittman -Heat and Thermodynamics – McGraw Hill ,7/e
7. V Ganesan-I C Engines.
8. Mathur Sharma- I C Engine.
9. R K Rajput – Power plant Engineering, Laxmi Publications Ltd.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Power Point Presentation

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan

S. NO.	Day	Module	Topic
1	**Day-1**	Module- 1- Boiler	Thermal power plant introduction
2	**Day-2**	Module- 1- Boiler	Thermal power cycle- Vapour power cycles, Steam properties
3	**Day-3**	Module- 1- Boiler	Boilers: Definition, Boiler terms, classification,
4	**Day-4**	Module- 1- Boiler	Boiler- mountings and accessories
5	**Day-5**	Module- 1- Boiler	Water Tube & Fire Tube boilers
6	**Day-6**	Module- 1- Boiler	Circulating Principles, Forced Circulation, Critical pressure,
7	**Day-7**	Module- 1- Boiler	Superheaters, Reheaters, attemperators
8	**Day-8**	Module- 1- Boiler	induced draught, forced draught and secondary air Fans
9	**Day-9**	Module- 1- Boiler	Boiler performance analysis and heat balance.
10	**Day-10**	Module- 1- Boiler	Combustion Systems, Environmental Protection – ESP
11	**Day-11**	Module- 1- Boiler	Environmental Protection- Cyclone Separator, Dust Collector
12	**Day-12**	Module- 1- Boiler	Power station boilers, Fuel bed firing, PF firing and Fluidized bed boilers.
13	**Day-13**	Module- 2- IC Engines	IC Engines – classification. Term and terminology
14	**Day-14**	Module- 2- IC Engines	IC Engines -Analysis of a standard cycle
15	**Day-15**	Module- 2- IC Engines	IC Engines -Combustion, Engine performance
16	**Day-16**	Module- 2- IC	Fuel characteristic of SI & CI Engine,

		Engines	
17	**Day-17**	Module- 2- IC Engines	Automotive Engine exhaust emission and their control
18	**Day-18**	Module- 2- IC Engines	**Problems -** IC Engines
19	**Day-19**	Module- 2- IC Engines	**Problems -** IC Engines
20	**Day-20**	Module- 3- Gas turbine	Gas turbine, power plant, classification
21	**Day-21**	Module- 3- Gas turbine	Gas turbine Cycle Analysis
22	**Day-22**	Module- 3- Gas turbine	Regeneration - Reheating
23	**Day-23**	Module- 3- Gas turbine	Isentropic efficiency. Combustion efficiency
24	**Day-24**	Module- 3- Gas turbine	Problem- Gas turbine Cycle
25	**Day-25**	Module- 4- Steam turbines	Vapour power cycles & its modifications, Reheat cycle for steam.
26	**Day-26**	Module- 4- Steam turbines	Regenerative cycle for steam.
27	**Day- 27**	Module- 4- Steam turbines	Rotary Thermodynamic devices – Steam turbines & their classifications
28	**Day- 28**	Module- 4- Steam turbines	Impulse & Reaction type
29	**Day- 29**	Module- 4- Steam turbines	Thermodynamics of compressible fluid-flow
30	**Day- 30**	Module- 4- Steam turbines	Equation and continuity – Isentropic flow through
31	**Day- 31**	Module- 4- Steam turbines	Nozzles, velocity diagram
32	**Day- 32**	Module- 4- Steam turbines	Blade efficiency, optimum velocity ratio
33	**Day- 33**	Module- 4- Steam turbines	Multi-staging, velocity & pressure compounding, losses in turbines
34	**Day- 34**	Module- 4- Steam turbines	Erosion of turbine blades, turbine governing
35	**Day- 35**	Module- 4- Steam turbines	Performance analysis of turbine, Condensing system.
36	**Day- 36**	Module- 4- Steam turbines	Problems & Solutions- Steam turbines

Course: CH401- Basic Environmental Engineering & Elementary Biology

PROGRAMME:**ELECTRICAL ENGG**	DEGREE:**B. TECH**
COURSE:**Basic Environmental Engineering & Elementary Biology**	SEMESTER: **4** CREDITS: **3**
COURSECODE: **CH401**	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: **Basic idea about Environment,and Biology**	CONTACTHOURS: 3 **(weekly)**
CORRESPONDINGLABCOURSE CODE (IFANY):**NA**	LABCOURSE NAME:**NA**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION	SEM.
CH401	**Basic Environmental Engineering & Elementary Biology**	Basic idea on Environment, Pollution, Awareness & Biology	**4**

Course Objectives

2. To make students aware and to encourage them to think about environmental issues from an interdisciplinary perspectives
3. To improve their understanding about the present critical condition faced by the various ecological cycles, climate changes, sustainable development leading to probable solution and environmental management

Course Outcomes

4. Understand the importance of environment andthe environmental problems and issues on local, regional and global scale.
5. Identify problems due to human interactions with the environment andget encouragement to contribute solutions for the existing environmental issues
6. Understand the enforcement of environmental acts in our constitution

Programme Outcomes addressed in this course

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO1	√							√	
CO2	√	√						√	
CO3	√						√	√	√

Syllabus

UNIT	DETAILS	HOURS
I	**General:** Basic ideas of environment, basic concepts, man, society and environment, their interrelationship Mathematics of population growth and associated problems, Importance of population study in environmental engineering Definition and types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, sustainable development Steady of conservation system, steady state system with non-conservative pollutants, step function Natural environmental hazards like flood, earthwake, Landslide-causes, effects and control/management; anthropogenic degradation like acid rain-cause, effects and control. nature and scope of environmental science and engineering	6
II	**Ecology:** Elements of ecology: System, open and closed system, definition of ecology, species, population, community, definition of ecosystem-components types and function 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. Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur] Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity	6
III	**Air Pollution and Control:** Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems 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 Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion) Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model. 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. 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. 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).	12

IV	**Water Pollution and Control:** 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 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 Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) 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. Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic	10
V	**Land Pollution:** Lithosphere; Internal structure of earth, rock and soil Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).	3
VI	**Noise Pollution:** Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18hr Index), Ldn	2
VII	**Environmental Management:** Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol.	2

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Radiation Pollution in detail, Indoor pollution, Marine Pollution in detail	Extra Class	8

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	Classification of Pollution& Pollutants	1

Web Source References

S.NO.	URL
1	http://www2.hcmuaf.edu.vn/data/quoctuan/Basics_of_Environmental_Sci%20(Section%201).pdf

Books References:

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.
2. Basic Environmental Science, G. K. DasMahapatra, Vikas.
3. De, A. K., "Environmental Chemistry", New Age International.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Power Point Presentation

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan

S. NO.	Day	Module	Topic
1	Day 1	I	Basic ideas of environment, basic concepts, man, society and environment, their interrelationship
2	Day 2		Mathematics of population growth and associated problems, Importance of population study in environmental engineering
3	Day 3		Definition and types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, sustainable development
4	Day 4		Steady of conservation system, steady state system with non-conservative pollutants, step function
5	Day 5		Natural environmental hazards like flood, earthwake, Landslide-causes, effects and control/management;

6	Day 6		anthropogenic degradation like acid rain-cause, effects and control. nature and scope of environmental science and engineering
7	Day 7	II	Elements of ecology: System, open and closed system, definition of ecology, species, population, community, definition of ecosystem-components types and function
8	Day 8		Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems,
9	Day 9		Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web.
10	Day 10		Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]
11	Day 11		Biodiversity- types, importance, Endemic species,
12	Day 12		Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity
13	Day 13	III	Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause.
14	Day 14		Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems
15	Day 15		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
16	Day 16		Lapse rate: Ambient lapse rate Adiabatic lapse rate,
17	Day 17		Atmospheric stability, temperature inversion (radiation inversion)
18	Day 18		Atmospheric dispersion: Maximum mixing depth, ventilation coefficient,
19	Day 19		Effective stack height, smokestack plumes and Gaussian plume model.
20	Day 20		Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant.
21	Day 21		Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN.
22	Day 22		Smog, Photochemical smog and London smog
23	Day 23		Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification.
24	Day 24		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).
25	Day 25	IV	Hydrosphere, Hydrological cycle and Natural water.
26	Day 26		Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds
27	Day 27		River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants,
28	Day 28		Effect of oxygen demanding wastes on river[deoxygenation, reaeration], COD, Oil, Greases, pH
29	Day 29		Lake: Eutrophication [Definition, source and effect].
30	Day 30		Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)
31	Day 31		Standard and control: Waste water standard [BOD, COD, Oil, Grease]

32	Day 32		Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening]
33	Day 33		Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition.
34	Day 34		Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic
35	Day 35	V	Lithosphere; Internal structure of earth, rock and soil
36	Day 36		Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling.
37	Day 37		Solid waste management and control (hazardous and biomedical waste).
38	Day 38	VI	Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise]
39	Day 39		Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18hr Index), Ldn
40	Day 40	VII	Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India,
41	Day 41		Different international environmental treaty/ agreement/ protocol.

Course: EE401- ELECTRIC MACHINE I

PROGRAMME: **ELECTRICAL ENGG.**	DEGREE:**B. TECH**
COURSE: Electric Machine-I	SEMESTER: **4** CREDITS: **4**
COURSE CODE: **EE 401**	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: General theory of Electric Machine, DC generators and motors, Three phase transformers, Induction motors	CONTACT HOURS: 4 **(weekly)**
CORRESPONDING LAB COURSE CODE (IFANY): **EE 491**	LABCOURSE NAME: Electric Machine-I

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION	SEM.
ES101 & ES201	Basoc Electrical Engg I & II	**Basic knowledge of field theory, circuit theory, calculus, vector algebra and concept of electrical machines etc.**	**1 & 2**

Course Objectives

1. **To understand the fundamental principles of Electromagnetic energy conversion and operations and construction of DC Machine, Transformers and Induction Machines**
2. **To develop the understanding regarding the application of above machines in transmission, distribution and in different plants**
3. **To understand the different methods of testing of electrical machines**

Course Outcomes

1. **Students would be able to understand application of field theory and circuit theory in all Electrical machine.**
2. **Students would be able to troubleshoot the problems in the operation of Electrical machine and also learn to design suitable experiment to determine the operation parameters of machine.**
3. **Students would be able to identify the electrical machine required for specific application in a plant.**
4. **Students would be aware of modern trends in Electrical Machine and update their knowledge for the same.**

Programme Outcomes addressed in this course

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	√								
CO2		√	√						
CO3				√					
CO4							√		√

Syllabus

UNIT	DETAILS	HOURS
I	Electromechanical Energy Conversion Principle, Singly Excited Magnetic System and Doubly Excited Magnetic system. Physical concept of torque production; Electromagnetic torque and Reluctance torque. Concept of General terms pertaining to Rotating Machines: Electrical & Mechanical degree, Pole pitch, Coil, Generated EMF in full pitched coil, Generated EMF in a short pitched coil, EMF polygon. .Distribution factor, Pitch factor. MMF produced by Distributed Windings, MMF of a coil, MMF of single phase distributed Winding, MMF waveform of Commutator machines.	6
II	**DC Machines:** • EMF generated in the armature. Methods of Excitation, Armature reaction & its effect in the performance, Methods of decreasing the effects of Armature reaction, Effect of Brush shift. • Commutation process, Resistance commutation, Delayed commutation, Voltage commutation, Improvement of Commutation. • Operating Characteristics of DC Generators: Separately Excited generators, Shunt Generators, Series Generators and Compound Generators. • Torque equation of D.C motor, Operating Characteristics of Shunt, Series & Compound motors. • Losses and efficiency of DC machines, Hopkinson's and Swinburne's test. •D.C Machine application: Generator application, Motor application	12
III	**3-Phase Induction machine:** • Induction motor as a Transformer, Flux and MMF phasors in Induction motors • Equivalent circuit, Performance equations, Induction motor phasor diagram • Toque-slip characteristic, Power slip characteristic, Determination of equivalent circuit parameters. • Methods of starting of squirrel Cage and Wound rotor Motors. • Speed control of Induction motor • Polarity Test, Application of Polyphase Induction motor.	9
IV	**3-Phase Transformer:** • Determination of polarity and connections (star/star, star/delta, delta/star, star/zigzag, delta/ zigzag, open delta), Phasor groups. • Effect of unbalanced loading, Production of Harmonics in Transformer and its suppression, • 3 phase to 2 phase transformation, Scott connection, 3 phase to 6 phase connections, Double star and Double delta, • 3 winding transformer: Parameter estimation, application, • Parallel operation of Transformers, Introduction to Tap changing transformer and its function. • **Special Transformers:** Potential transformer, Current transformer, Pulse transformer, Audio frequency transformer, Grounding transformer, Pulse transformer.	13

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Breaking of DC motors-dynamic, plugging and regenerative methods	Extra Class	a.
2	Concept of operation of Transformer, Eqiv Circuit , regulation , efficiency Construction, windings, cooling and noise reduction	Extra Class	

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	Circle diagram and its application	1
2	Induction regulator	1

Web Source References

S.NO.	URL
1	http://nptel.ac.in/courses/108105017/
2	http://nptel.ac.in/courses/108106071/

Books References:

1. Electrical Machinery, P.S. Bhimra, 6th Edition, Khanna Publishers.
2. Electric machines, D.P. Kothari & I.J Nagrath, 3rd Edition, Tata Mc Graw-Hill Publishing Company Limited.
3. Electric Machinery & transformer, Irving L Koskow, 2nd Edition, Prentice Hall India
4. The performance and Design of Alternating Current Machines, M.G.Say, CBS Publishers & Distributors.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Power Point Presentation

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan

Sl. No.	Day	Module Name	Topics
1	Day 1		Overall discussion about the syllabus, Objective and importance of the subject
2	Day 2	3-phase Transformer	concept of operation of Transformer
3	Day 3		Eqiv Circuit , regulation , efficiency
4	Day 4		Construction, cooling , noise reduction
5	Day 5		Concept of 3 phase transformer, Fundamental principle
6	Day 6		Harmonics , its suppression
7	Day 7		Effect of unbalanced loading , its effect& supression
8	Day 8		Determination of polarity , connections
9	Day 9		Phasor Groups
10	Day 10		Parallel operation of Transformers
11	Day 11		3 phase to 2 phase transformation , Scott connection
12	Day 12		3 winding transformer and applications
13	Day 13		3-phase to 6-phase connection , Tap changing Transformer
14	Day 14		Special Transformer , Auto Transformer
15	Day 15		Special Transformers
16	Day 16	3-phase Induction motor	Concept of Rotating Field
17	Day 17		Induction motor as Transformer, MMF phasor
18	Day 18		Eqiv. Circuit , phasor diagram
19	Day 19		performance Equation
20	Day 20		Torque slip charteristics
21	Day 21		power slip characteritics , Equivalent circuit parameters
22	Day 22		method of starting of Induction Motor
23	Day 23		Speed control of Induction motor
24	Day 24		Speed control of Induction motor
25	Day 25		Polarity test , Application of Induction motor
26	Day 26	Electromechanical Energy conversion	Electromechanical Energy Conversion Principle, Singly Excited Magnetic System and Doubly Excited

			Magnetic system.
27	Day 27		Physical concept of torque production; Electromagnetic torque and Reluctance torque.
28	Day 28		Concept of General terms pertaining to Rotating Machines: Electrical & Mechanical degree, Pole pitch, Coil, Generated EMF in full pitched coil, Generated EMF in a short pitched coil,
29	Day 29		EMF polygon, Distribution factor, Pitch factor.
30	Day 30		MMF produced by Distributed Windings, MMF of a coil, MMF of single phase distributed Winding,
31	Day 31		MMF waveform of Commutator machines.
32	Day 32	DC Machines	EMF generated in the armature. Methods of Excitation,
33	Day 33		Armature reaction & its effect in the performance,
34	Day 34		Methods of decreasing the effects of Armature reaction, Effect of Brush shift.
35	Day 35		Commutation process, Resistance commutation, Delayed commutation, Voltage commutation,
36	Day 36		Improvement of Commutation.
37	Day 37		Operating Characteristics of DC Generators: Separately Excited generators, Shunt Generators,
38	Day 38		Operating Characteristics of Series Generators and Compound Generators.
39	Day 39		Torque equation of D.C motor, Operating Characteristics of Shunt motors
40	Day 40		Operating Characteristics of Series & Compound motors.
41	Day 41		Losses and efficiency of DC machines,
42	Day 42		Hopkinson's and Swinburne's test.
	Day 43		D.C Machine application: Generator application, Motor application

Course: EE-402- Electrical & Electronic Measurement

PROGRAMME: **Electrical Engineering**	DEGREE:**B. TECH**
COURSE: **Electrical & Electronic Measurement**	SEMESTER: **4** CREDITS: **3**
COURSE CODE: **EE-402**	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: **Basic idea about Electrical & Electronic Measurement**	CONTACT HOURS: 3 **(weekly)**
CORRESPONDING LAB COURSE CODE (IFANY): **EE-492**	LABCOURSE NAME: **Electrical & Electronic measurement**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION	SEM.
ES101	**Basic Elect. & Electronics Engg.-I**	Electromagnetism & ac fundamentals	1

Course Objectives

1. To produce Electrical Engineering graduates who have strong foundation in basic electrical & electronics engineering to prepare the students with strong measurement knowledge and technical competence.

Course Outcomes

1. Students would be able to understand characteristics of different electrical and electronics measurement elements.
2. Students would be able to understand the application of electrical and electronics measurement to modern technology.
3. Students would be able appreciate working various electrical and electronics measurement equipments

Programme Outcomes addressed in this course

1. An ability to apply the knowledge of mathematics, science and engineering. (PO 1.)
2. An ability to identify, formulate and solve engineering problems. (PO 2.)
3. An ability to design and conduct experiments as well as to interpret data. (PO 3)
4. An ability to design a system or proccss to meet the desired result within technical and socio-economic constraints. (PO 4.)

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO1	√								
CO2	√	√		√					
CO3		√	√						

Syllabus

UNIT	DETAILS	HOURS
I	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.	9
II	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 resistance: Measurement of medium, low and high resistances, Megger.	11
III	Measurement of Energy: Construction, theory and application of AC energy meter, testing of energy meters. Potentiometer: Principle of operation and application of Crompton's DC potentiometer, Polar and Co-ordinate type AC potentiometer. Application. AC Bridges: Measurement of Inductance, Capacitance and frequency by AC bridges	11
	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. Sensors & Transducers: Introduction to sensors & Transducers, Strain gauge, LVDT, Temperature transducers, Flow measurement using magnetic flow measurement.	11

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Latest functioning and measurement of tachometer	Extra Class	a.

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1		

Web Source References

S.NO.	URL
1	http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Bombay/Electrical%20and%20Electronic%20Measurements.htm

Books References:

1. Sensors & Transducers, D. Patranabis, PHI, 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.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Power Point Presentation

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan

S. NO.	Day	Module	Topic
1	Day 1	I	Measurements: Method of measurement, Measurement system,
2	Day 2		Classification of instruments
3	Day 3		Definition of accuracy, Precision, Resolution, Speed of response
4	Day 4		Error in measurement, Classification of errors
5	Day 5		loading effect due to shunt and series connected instruments
6	Day 6		Analog meters: General features, Construction, Principle of operation and torque equation of Moving coil
7	Day 7		Moving iron, Electrodynamometer
8	Day 8		Induction instruments: Principle of operation of the Electrostatic
9	Day 9		Thermoelectric, Rectifier type instruments,
10	Day 10		Extension of instrument ranges and multipliers

S. NO.	Day	Module	Topic
1	Day 1	II	Disadvantage of shunt and multipliers,
2	Day 2		Advantage of Instrument transformers
3	Day 3		Principle of operation of Current & Potential transformer
4	Day 4		Errors
5	Day 5		Principle of operation of Electrodynamic type wattmeter
6	Day 6		Induction type wattmeter
7	Day 7		Wattmeter errors
8	Day 8		Measurement of medium resistances
9	Day 9		Measurement of low and high resistances
10	Day 10		Megger

S. NO.	Day	Module	Topic
1	Day 1	III	Measurement of Energy:· Construction,
2	Day 2		theory of AC energy meter
3	Day 3		application of AC energy meter
4	Day 4		testing of energy meters
5	Day 5		Principle of operation and application of Crompton's DC potentiometer
6	Day 6		Principle of operation and application of Polar type AC potentiometer
7	Day 7		Principle of operation and application of Co-ordinate type AC potentiometer
8	Day 8		Application.AC Bridges: Measurement of Inductance
9	Day 9		Application.AC Bridges: Capacitance by AC bridges
10	Day 10		Application.AC Bridges: frequency by AC bridges.

S. NO.	Day	Module	Topic
1	Day 1	IV	Cathode ray oscilloscope (CRO): Measurement of voltage, current, frequency & phase by oscilloscope.
2	Day 2		Frequency limitation of CRO.
3	Day 3		Sampling and storage oscilloscope, Double beam CRO.
4	Day 4		Electronic Instruments: Advantages of digital meter over analog meters,
5	Day 5		Digital voltmeter, Resolution and sensitivity of digital meters
6	Day 6		Digital multimeter, Digital frequency meter
7	Day 7		Signal generator. Sensors & Transducers
8	Day 8		Introduction to sensors & Transducers
9	Day 9		Strain gauge, LVDT, Temperature
10	Day 10		transducers, Flow measurement using magnetic flow measurement

Course: PH491 ENGINEERING PHYSICS-II LABORATORY

PROGRAMME : ELECTRICAL ENGINEERING.	DEGREE:**B. TECH.**
COURSE: **Engineering Physics -II Laboratory**	SEMESTER: 4 CREDITS: **2**
COURSECODE: PH-**491**	COURSE TYPE: **Practical**
COURSE AREA/DOMAIN: Black Body Radiation, Solar Cell,Bohr's Theory, Dielectric behavior, CRO,Stephen's Law	CONTACT HOURS: **3 (weekly)**
CORRESPONDING THEORY COURSE CODE (IFANY): **PH-401**	THEORY COURSE NAME: **Engineering Physics -II**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION
PH-101/CH-101/M-101	B.Tech Ist Year Engineering Physics, Chemistry, Mathematics.	Knowledge of Ist Year Physics, Chemistry & Mathematics
PH-191/CH-191	B.Tech Ist Year) Physics & Chemistry Practical	Knowledge of practical's in Basic Physics & Chemistry.

Laboratory Educational Objectives (LEOs) :

1. **Conceptual Understanding:** Develop students' understanding through laboratory activities to solve problems related to key concepts taught in the classroom.

2. **Data Analysis and Verification Skills:** Develop capability to analyze and interpret data and design experiments to verify data.

Laboratory Outcomes (LOs) :

- **Instrumentation:** Apply appropriate instruments and handle them carefully and safely to make measurements of physical quantities or perform data analysis. **(LO – 1)**
- **Models:** Identify the strength and limitations of theoretical models and establish a relationship between measured data and underlying physical principles. **(LO – 2)**
- **Design:** Design experiments to interpret theoretical results. **(LO – 3)**

After completing this course, students will be able:

- To identify the use of the CRO, solar cell, photo cell, Tetrode, Diode valve, and filters.
- The students will understand the application of Rutherford Model, Quantum and Classical Physics. .
- To understand the operation of various electrical, electronic & Optical components.

Programme Outcomes addressed in this course

PO / LO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
LO1			√	√					
LO2	√	√	√						
LO3			√	√	√				

LIST OF EXPERIMENTS:

Engineering Physics laboratory-II

1. Determination of Stephan's Radiation constant.
2. To study the current voltage characteristics, load response, areal characteristic and spectral response of a photo voltaic Solar cell.
3. Determination of Planck's constant using photo cell.
4. Verification of Bohr's atomic orbital theory through Frank Hertz Experiment.
5. Determination of Band gap of Semiconductor.
6. Determination dielectric constant of a given dielectric material.
7. Determination of Rydberg constant by studying hydrogen Helium spectrum
8. Determination of specific charge (e/m) of electron by J J Thompson method.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Study Material

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

LESSON PLAN FOR 2ND YEAR B.TECH ENGINEERING PHYSICS LABORATORY

Name of the Experiments	Week 1	Week 2 job assigned	Week 3 job performed	Week 4 job performed	Week 5 job performed	Week 6 job performed	Week 7 job performed	Week 8 job performed	Week 9 job performed	Week 10	Week 11
Determination of Stephen's Radiation constant.	INTRODUCTORY CLASS	Gr.1	Gr.1	Gr.2	Gr.3	Gr.4	Gr.5	Gr.6	Gr.7	REVISION CLASS	DISCUSSION CLASS
To study the current voltage characteristics, load response, areal characteristic and spectral response of a photo voltaic Solar cell.		Gr.2	Gr.2	Gr.3	Gr.4	Gr.5	Gr.6	Gr.7	Gr.1		
Determination of Planck's constant using photo cell.		Gr.3	Gr.3	Gr.4	Gr.5	Gr.6	Gr.7	Gr.1	Gr.2		
Verification of Bohr's atomic orbital theory through Frank Hertz Experiment.		Gr.4	Gr.4	Gr.5	Gr.6	Gr.7	Gr.1	Gr.2	Gr.3		
Determination of Band gap of Semiconductor.		Gr.5	Gr.5	Gr.6	Gr.7	Gr.1	Gr.2	Gr.3	Gr.4		
Determination of dielectric constant of a given dielectric material.		Gr.6	Gr.6	Gr.7	Gr.1	Gr.2	Gr.3	Gr.4	Gr.5		
Determination of Rydberg constant by studying hydrogen Helium spectrum		Gr.7	Gr.7	Gr.1	Gr.2	Gr.3	Gr.4	Gr.5	Gr.6		

Course: ME(EE)481 Thermal Power Engineering Laboratory

PROGRAMME: ELECTRICAL ENGINEERING	DEGREE:**B. TECH.**
COURSE: Thermal Power Engineering Laboratory	SEMESTER: **IV** CREDITS: **3**
COURSECODE: **ME(EE)481**	COURSE TYPE: **Practical**
COURSE AREA/DOMAIN: **Mechanical Engineering**	CONTACT HOURS: **3 (weekly)**
CORRESPONDING THEORY COURSE CODE (IFANY): **ME(EE)411**	THEORY COURSE NAME: **Thermal Power Engineering**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION	SEM.
ME201	Engineering Thermodynamics & Fluid Mechanics	Basic thermodynamics Knowledge	**II**

Laboratory Educational Objectives (LEOs) :

1. To impart Basic knowledge about Thermal Power Plants layout, Boiler, IC Engines with effective thermodynamic analysis . **(LEO – 1)**
2. To impart Basic knowledge about IC Engines with effective thermodynamic performance analysis. **(LEO – 2)**
3. Steam generation exposure and steam Quality estimation. **(LEO –3)**

Laboratory Outcomes (Los):

1. Ability to select and rate the different conventional boiler. **(LO – 1)**
2. Ability to analyze and evaluate the performance of IC Engines. **(LO – 2)**
3. Ability to determine the calorific value of fuel and quality of steam. **(LO – 3)**
4. Communicate effectively with industry personnel by developing a Thermal Power -centric vocabulary. **(LO – 4)**

Programme Outcomes addressed in this course

1. An ability to identify, formulate and solve engineering problems. (PO – 2.)
2. An ability to design and conduct experiments, as well as to analyze and interpret data. (PO – 3.)
3. An ability to function as a member in a multidisciplinary team. (PO – 5.)
4. An ability to communicate effectively. (PO – 6.)

PO / LO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
LO1		√	√						
LO2		√	√						
LO3		√	√						
LO4					√	√			

LIST OF EXPERIMENTS AS PER SYLLABUS:

1. Study of Cut Models – Boilers IC Engines
_ Lanchashire Boiler
_ Bahcock & 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 Smokemeter and trace the BHP Vs. % Carbon Curve.

10. Measurement of the Quality of Steam – Enthalpy & Dryness fraction.

11. To find out the Boiler performance – Boiler efficiency & Steam evaporation rate.

12. To visit a Thermal Power Station & study of the followings :
a) Boiler b) Steam pipe c) Furnace d) Economizer e) Preheater f) Steam turbines
g) Alternator h) Water treatment plant i) E. S. P.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Power Point Presentation

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan:

S. NO.	Day	Experiment Performed	LO Mapping
1	Day-1	Thermal power Engineering Lab introduction, Group Formation and plant general layout introduction and virtual 3d walkthrough of thermal power plant.	**LO – 1 & LO - 4**
2	Day-2	Study of Cut Models – Boilers -Lanchashire Boiler, Vertical Tubular Boiler, Locomotive Boiler	**LO – 1 & LO - 4**
3	Day-3	Study of Cut Models – Boilers -Cochran Boiler, Bahcock & Willcox Boiler	**LO – 1 & LO - 4**
4	Day-4	To find the Calorific Value of Coal by Bomb Calorimeter	**LO – 3 & LO - 4**
5	Day-5	Measurement of the Quality of Steam – Enthalpy & Dryness fraction.	**LO – 3 & LO - 4**
6	Day-6	Measurement of the Quality of Steam – Enthalpy & Dryness fraction.	**LO – 3 & LO - 4**
7	Day-7	Study of Cut Models –IC Engines- 4S Diesel Engine, 4S Petrol Engine.	**LO –2 & LO - 4**
8	Day-8	Study of Cut Models –IC Engines-2S Petrol Engine	**LO –2 & LO - 4**
9	Day-9	Valve Timing Diagram on 4S Diesel Engine Model & 4S Petrol Engine Model.	**LO –2 & LO - 4**
10	Day-10	Load Test on 4 Stroke Diesel Engine by Electrical Load Box.	**LO –2 & LO - 4**
11	**Day-11**	Heat Balance on 4 Stroke Diesel Engine by Electrical Load Box.	**LO –2 & LO - 4**
12	**Day-12**	**Final Lab Report submission**	**LO - 4**

Course: ES 491 ELECTRIC MACHINE – I LABORATORY

PROGRAMME: **ELECTRICAL ENGINEERING**	DEGREE: **B. TECH.**
COURSE: **Electrical machine -I Laboratory.**	SEMESTER: 4th CREDITS: **2**
COURSECODE: **ES 491**	COURSE TYPE: **Practical**
COURSE AREA/DOMAIN: **DC- Machine, 1-Φ & 3- Φ Transformer, 3- Φ Induction Motor.**	CONTACT HOURS: **3 (weekly)**
CORRESPONDING THEORY COURSE CODE (IFANY): **ES 401**	THEORY COURSE NAME:**Electric machine -I.**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION
HS	Higher Secondary (Science)	Knowledge of Class XII level electrical and electronics
HS	Higher Secondary (Science)	Knowledge of Class XII level Physics & Mathematics.

Laboratory Educational Objectives (LEOs) :

1. **Conceptual Understanding:** Develop students' understanding through laboratory activities to solve problems related to key concepts taught in the classroom. **(L-I)**

2. **Debugging Skills:** Develop debugging capability in order to propose and apply effective engineering solutions. **(L-II)**

Laboratory Outcomes (Los) :

- **Instrumentation:** Apply appropriate instruments and handle them carefully and safely to make measurements of physical quantities or perform data analysis.**(LO – 1)**
- **Models:** Identify the strength and limitations of theoretical models and establish a relationship between measured data and underlying physical principles. **(LO – 2)**
- **Design:** Design and build a hardware part to meet desired specifications and tests it using appropriate testing strategy and/or equipments. **(LO – 3)**

After completing this course, students will be able:

- ❖ To identify the basic elements of the electrical and electronic engineering.
- ❖ The students will understand the basic operation of transformers and various electrical machines.
- ❖ To understand the basic operation of various electronic components.

Programme Outcomes addressed in this course

PO / LO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
LO1	√							√	
LO2	√	√			√				
LO3		√	√		√				

LIST OF EXPERIMENTS:

Electrical Machine Laboratory-I

1. Study of the characteristics of a separately excited DC generator.
2. Study of the characteristics of a DC motor.
3. Study of methods of speed control of DC motor
4. Study of the characteristics of a compound DC generator (short shunt).
5. Measurement of speed of DC series motor as a function of load torque.
6. Study of equivalent circuit of a single phase transformer.
7. Polarity test on a single phase transformer & study of different connections of three phase transformer.
8. Study of equivalent circuit of three phase Induction motor by no load and blocked rotor test.
9. Study of performance of wound rotor Induction motor under load.
10. Study of performance of three phase squirrel- cage Induction motor –determination of iron-loss, friction & windage loss.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Study Material

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan: EE491

Days	Experiment Performed
1	Study of the characteristics of a separately excited DC generator.
2	Study of the characteristics of a DC motor.
3	Study of methods of speed control of DC motor.
4	Study of the characteristics of a compound DC generator (short shunt).
5	Measurement of speed of DC series motor as a function of load torque.
6	**1st VIVA VOCE and Pending experiment clearing.**
7	Study of equivalent circuit of a single phase transformer.
8	Polarity test on a single phase transformer & study of different connections of three phase transformer**.**
9	Study of equivalent circuit of three phase Induction motor by no load and blocked rotortest**.**
10	Study of performance of wound rotor Induction motor under load.
11	Study of performance of three phase squirrel- cage Induction motor –determination of iron-loss, friction & windage loss.
12	**2nd VIVA VOCE and Pending experiment clearing.**

Course: EE 492 Electrical & Electronic Measurement LABORATORY

PROGRAMME: **ELECTRICAL ENGG.**	DEGREE:**B. TECH.**
COURSE: **Electrical & Electronics Measurement Laboratory**	SEMESTER: 4 CREDITS: **2**
COURSECODE: **EE 492**	COURSE TYPE: **Practical**
COURSE AREA/DOMAIN **: Bridges, Potentiometer**	CONTACT HOURS: **3 (weekly)**
CORRESPONDING THEORY COURSE CODE (IFANY): **EE 491**	THEORY COURSE NAME: **Electrical & Electronics Measurement**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION	SEM.
ES101	**Basic Elect. & Electronics Engg.-I**	Electromagnetism & ac fundamentals	1

Laboratory Educational Objectives (LEOs) :

1. **Conceptual Understanding:** Develop students' understanding through laboratory activities to solve problems related to key concepts taught in the classroom. **(L-I)**

2. **Debugging Skills:** Develop debugging capability in order to propose and apply effective engineering solutions. **(L-III)**

Laboratory Outcomes (Los) :

- **Instrumentation:** Apply appropriate instruments and handle them carefully and safely to make measurements of physical quantities or perform data analysis. **(LO – 1)**
- **Models:** Identify the strength and limitations of theoretical models and establish a relationship between measured data and underlying physical principles. **(LO – 2)**
- **Design:** Design and build a hardware part to meet desired specifications and tests it using appropriate testing strategy and/or equipments. **(LO – 4)**

After completing this course, students will be able:

- To identify the basic elements of the electrical and electronic engineering.
- The students will understand the basic operation of transformers and various electrical machines.
- To understand the basic operation of various electronic components.

Programme Outcomes addressed in this course

1. An ability to apply the knowledge of mathematics, science and engineering. **(PO-1)**
2. An ability to identify, formulate and solve engineering problems. **(PO-2)**
3. An ability to design and conduct experiments as well as to interprete data. **(PO-3)**

PO / LO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
LO1	√								
LO2	√	√							
LO4		√	√						

LIST OF EXPERIMENTS:

Electrical & Electronics Measurement Laboratory

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.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Study Material

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan: EE 492

Days	Experiment Performed
1	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	Measurement of power in a three phase circuit by two wattmeter method.
5	Measurement of resistance using Kelvin double bridge.
6	1st VIVA VOCE
7	Measurement of power using Instrument transformer.
8	Calibrate AC energy meter.
9	Measurement of frequency by Wien Bridge.
10	Measurement of Inductance by Anderson bridge
11	Measurement of capacitance by De Sauty Bridge & Measurement of capacitance by Schering Bridge.
12	2nd VIVA VOCE and Pending experiment clearing.