Criteria Number: 1 **Criteria Name: Curricular Aspects**

Sub criteria Number: 1.3 **Sub-criteria Name: Curriculum Enrichment**

1.3.1. Institution integrates cross-cutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability in transacting the Curriculum

Sr No	Documents	Digital Page No
1	Curriculum Enrichment	2
2	List of Subjects reflecting subjects and courses integrates crosscutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability	4
3	University Curriculum of all mentioned subjects	4-50
4	Report on Nirbhay Kanya Abhiyan	51-54

TSSM's Bhivrabai Sawant College of Engineering & Research Narhe, Pune - 411 041

Principal,
BSCOER,Pune.
PRINCIPAL
TSSM's Bhivrabai Sawant College of Engineering & Research
Narhe, Pune - 411 041

Curriculum Enrichment

In order to integrate the cross-cutting issues relevant to gender, environment and sustainability, human values and professional ethics, the Institute has included various courses in the SPPU syllabus . Some courses improve professional aptitude while others aim to inculcate general competencies like social ethical values, human values, environment sensitivity etc., which leads to the overall development of students. The curriculum includes courses related to renewable energy, waste management and water conservation technologies. Furthermore, institute makes efforts to attract students toward green culture by organizing curriculum based awareness programs

1.Gender Sensitivity

Gender sensitivity and gender sensitization is accomplished through acclamation of theory and practice. The cultural stereotypical perceptions of having different abilities among gender are overcome by the institute through adaptation of assignments irrespective of gender. While imparting the training, no gender discrimination is observed. Women Grievance and anti-sexual harassment Cell is committed to create social, physical and psychological environment that will raise awareness about and acts of sexual harassment of students, staff and other employees at the Institute. As per the SPPU guidelines, Social Welfare Cell conducted a Self Defence Training Programme for women students and staff under Nirbhay Kanya Abhiyan to create the awareness about about the necessity of self-defence for women. Experts also mentioned that we should take care of ourselves and the society

2.Human Values and Professional Ethics

As per the National Educational Policy 2020, to fulfil the aim of holistic education, course like Humanity and Social Science (HSS) is offered as a core subject to all the second year students of compute engineering during the programme of study. Objectives of this course are to produce well-rounded engineers not only having good technological skills but also with the ability to interact with different organs of an organization. HSS is concerned with society and the relationships among individuals within a society. It in turn has many subtopics, related to social science which includes topics like social development, Environment and Ecology.

Course Objectives are - Human and social development; Contemporary national and international affairs, Emergence of Indian society and Economics.

3. Energy and Environment

In order to fulfil sustainable development Goals (SDGs), A course on Environmental studies I is included as Audit course in first year engineering curriculum. Course Objectives are to explain the concepts and strategies related to sustainable development and various components of environment which satisfy NEP 2020 policy The course aims to examine biotic and abiotic factors within an ecosystem, to identify food chains, webs, as well as energy flow and relationships ,to identify and analyse various conservation methods and their effectiveness in relation to renewable and non-renewable natural resources Outcome of the course is to understand the integrative approach to environmental issues with a focus on sustainability, the role of the organism in energy transfers in different ecosystems, difference between renewable and non-renewable resources and key threats to biodiversity.

1.3.1 List of Subjects reflecting subjects and courses integrates crosscutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability

Sr. No	Course	Course Code	Name Of the Course	Description
1	S.E Computer Engineering	210259	Code Of Conduct	Integrates Environment and Sustainability, Professional Ethics
2	S.E Computer Engineering	210250	Humanity And Social Sciences	Integrates Environment and Sustainability, Human Values
3	T.E Computer Engineering	310259B	Sustainable Energy System	Integrates Environment and Sustainability, Professional Ethics
4	B.E Computer Engineering	410253C	Business Intelligence	Integrates Human Values and Professional Ethics
5	B.E Computer Engineering	410248	Project Stage I	Integrates Environment and Sustainability, Professional Ethics and Human Values
6	B.E Computer Engineering	410256	Project Stage II	Integrates Environment and Sustainability, Professional Ethics and Human Values
7	BE. Mechanical Engineering	402051E	Electric and Hybrid Vehicle	Integrates Environment and Sustainability
8	BE. Mechanical Engineering	402050B	Energy Audit and Management	Integrates Environment and Sustainability
9	BE. Mechanical Engineering	402049	Energy Engineering	Integrates Environment and Sustainability
10	BE. Mechanical Engineering	402041	Heating, Ventilation, Air Conditioning and Refrigeration	Integrates Environment and Sustainability
11	TE. Mechanical Engineering	302055	Internship	Integrates Environment and Sustainability, Professional Ethics and Human Values
12	TE. Mechanical Engineering	302042	Heat and Mass Transfer	Integrates Environment and Sustainability
13	SE. Mechanical Engineering	202043	Thermodynamics	Integrates Environment and Sustainability
14	S.E Civil Engineering	201007	Awareness to Civil Engineering Practices	Integrates Environment and Sustainability, Professional Ethics

15	S.E Civil Engineering	Audit Course	Road Safety Management	Integrates Environment and Sustainability, Human Values
16	T.E Civil Engineering	301011	Professional Ethics and Etiquettes	Integrates Environment and Sustainability, Professional Ethics
17	S.E Civil Engineering	301012	Waste Water Engineering	Integrates Environment and sustainability
18	S.E Electrical Engineering	203151	Soft Skill	Integrates Environment and Sustainability, Professional Ethics
19	S.E Electrical Engineering	203152	Project Based Learning	Integrates Environment and Sustainability, Human Values
20	T.E Electrical Engineering	303141	Industrial and Technology Management	Integrates Environment and Sustainability, Professional Ethics
21	T.E Electrical Engineering	303146	Seminar	Integrates Human Values and Professional Ethics
22	T.E Electrical Engineering	303152	Internship	Integrates Environment and Sustainability, Professional Ethics and Human Values
23	B.E Electrical Engineering	303145	Project Stage I	Integrates Environment and Sustainability, Professional Ethics and Human Values
24	B.E Electrical Engineering	303152	Project Stage II	Integrates Environment and Sustainability, Professional Ethics and Human Values
25	S.E E&TC Engineering	204189	Electronic Skill Development	Integrates Environment and Sustainability
26	S.E E&TC Engineering	204199	Employability Skill Development	Integrates Professional Ethics and Human Values
27	S.E E&TC Engineering	204200	Project Based Learning	Integrates Professional Ethics
28	S.E E&TC Engineering	204190	Technical English For Engineers	Integrates Professional Ethics and Human Values
29	S.E E&TC Engineering	304190	Skill Development	Integrates Professional Ethics and Human Values
30	B.E E&TC Engineering	404193	Innovation and Entrepreneurship	Integrates Professional Ethics and Human Values

University Curriculum of all mentioned subjects and Courses integrates crosscutting is

Savitribai Phule Pune University
Second Year of Computer Engineering (2019 Course)
210259: Code of Conduct

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Tutorial: 01 Hours/Week	01[§]	Term work[§]: 25 Marks

Preamble:

Engineering is one of the important and cultured professions. With respect to any engineering profession, engineers are expected to exhibit the reasonable standards of integrity and honesty. Engineering is directly or indirectly responsible to create a vital impact on the quality of life for the society. Acceptably, the services provided by engineers require impartiality, honesty, equity and fairness and must give paramount importance to the protection of the public health, safety, and welfare. Engineers must perform under a standard of professional behavior that requires adherence to the principles of ethical conduct.

Prime aim is to recognize and evaluate ethical challenges that they will face in their professional careers through knowledge and exercises that deeply challenge their decision making processes and ethics.

Course Objectives:

- To promote ethics, honesty and professionalism.
- To set standards that are expected to follow and to be aware that If one acts unethically what are the consequences.
- To provide basic knowledge about engineering Ethics, Variety of moral issues and Moral dilemmas, Professional Ideals and Virtues
- To provide basic familiarity about Engineers as responsible Experimenters, Research Ethics, Codes of Ethics, Industrial Standards, Exposure to Safety and Risk, Risk Benefit Analysis

Course Contents

Preamble:

As applied sciences, Engineering and Technology are meant to come up with effective solutions to social problems making it imperative that the present generation of engineers and technologists understand the society they live in. Studying the social sciences can provide individuals with crucial answers and observations that could certainly help in understanding of one's life which can alleviate social relations. A broad perspective of nationalistic thinking will provide the students with the ability to be socially conscientious, more resilient and open to building an inclusive society.

Experiencing real-life situations and complex scenarios that arise in each situation will help the budding professions to contribute their skills and knowledge to helping people improve and understand their behaviour or psychological processes. Understanding how the world works begins with an understanding of oneself and gaining hands-on experience and/or thinking about human values and ethics will help trigger a sense of responsibility among the students and lead them to finding effective solutions.

Savitribai Phule Pune University Second Year of Computer Engineering (2019 Course) 210250: Humanity and Social Science		
Teaching Scheme	**Credit Scheme**	**Examination Scheme and Marks**
Tutorial: 01 Hours/Week	**01[$]**	**Term work[$]: 25 Marks**

Course Objectives:

To enable the students to explore aspects of human society and to acquire the intellectual, communication skills and develop characteristics that encourages personal fulfilment, meaningful professional life and responsible citizenship.

- To facilitate Holistic growth;
- To Educate about Contemporary, National and International affairs;
- To bring awareness about the responsibility towards society.
- To give an insight about the emergence of Indian society and the relevance of Economics.

Course Outcomes:

On completion of the course, learner will be–

CO1: **Aware** of the various issues concerning humans and society.

CO2: **Aware** about their responsibilities towards society.

CO3: Sensitized about broader issues regarding the social, cultural, economic and human aspects, involved in social changes.

CO4: **Able** to understand the nature of the individual and the relationship between self and the community.

CO5: **Able** to understand major ideas, values, beliefs, and experiences that have shaped human history and cultures.

1. **Introduction to Ethical Reasoning and Engineer Ethics:** Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas –Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy –Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.
2. **Professional Practice in Engineering :** Global Issues -Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct
3. **Ethics as Design** - Doing Justice to Moral Problems : Engineer's Responsibility for Safety - Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk
4. **Workplace Responsibilities and Rights** - Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination
5. **Computers, Software, and Digital Information**
6. **Responsibility for the Environment**

Unit V	Impact of Machine learning in Business Intelligence Process	07 Hours
Classification: Classification problems, Evaluation of classification models, Bayesian methods, Logi regression. **Clustering:** Clustering methods, Partition methods, Hierarchical methods, Evaluation clustering models. **Association Rule**: Structure of Association Rule, Apriori Algorithm		
#Exemplar/Case Studies	Business applications for comparing the performance of a stock over a per of time https://cleartax.in/s/stock-market-analysis	
***Mapping of Course Outcomes for Unit V**	CO5	
Unit VI	**BI Applications**	**07 Hours**

Tools for Business Intelligence, Role of analytical tools in BI, Case study of Analytical Tools: WEI KNIME, Rapid Miner, R;

Data analytics, Business analytics, ERP and Business Intelligence, BI and operation management, B inventory management system, BI and human resource management, BI Applications in CRM, Applications in Marketing, BI Applications in Logistics and Production, Role of BI in Finance, Applications in Banking, BI Applications in Telecommunications, BI in salesforce management

Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
410256: Project Work Stage II

Teaching Scheme:	Credit	Examination Scheme:
TH: 06 Hours/Week	06	Term work: 100 Marks Presentation: 50Marks

Prerequisite Courses: Project Stage I(410248)

Course Objectives:

- To follow SDLC meticulously and meet the objectives of proposed work
- To test rigorously before deployment of system
- To validate the work undertaken
- To consolidate the work as furnished report

Course Outcomes:

On completion of the course, student will be able to–

CO1: Show evidence of independent investigation

CO2: Critically analyze the results and their interpretation.

CO3: Report and present the original results in an orderly way and placing the open questions in the rightperspective.

CO4: Link techniques and results from literature as well as actual research and future research lines withthe research.

CO5: Appreciate practical implications and constraints of the specialist subject

Elective VI
410253(C): Business Intelligence

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 Hours/Week	03	In-Sem (Paper) : 30 Marks End-Sem (Paper): 70 Marks

Prerequisites Courses: Database Management System(310241), Data Science & Big data Analytics(310251), Machine Learning (410242)

Companion Course: Laboratory Practice VI(410256)

Course Objectives:

- To introduce the concepts and components of Business Intelligence (BI)
- To evaluate the technologies that make up BI (data warehousing, OLAP)
- To identify the technological architecture of BI systems
- To explain different data preprocessing techniques
- To identify machine learning model as per business need
- To understand the BI applications in marketing, logistics, finance and telecommunication sector

Course Outcomes: On completion of this course, the students will be able to

CO1: Differentiate the concepts of Decision Support System & Business Intelligence

CO2:Use Data Warehouse & Business Architecture to design a BI system.

CO3:Build graphical reports

CO4:Apply different data preprocessing techniques on dataset

CO5:mplement machine learning algorithms as per business needs

CO6:Identify role of BI in marketing, logistics, and finance and telecommunication sector

402051E: Electric and Hybrid Vehicle					
Teaching Scheme		**Credits**		**Examination Scheme**	
Theory	**3 Hrs./Week**	**Theory**	**3**	**In-Semester**	**30 Marks**
				End-Semester	**70 Marks**
Prerequisites: Mathematics, Physics, Chemistry, Systems in Mechanical Engineering, Basic Electrical Engineering, Electrical and Electronics Engineering, Kinematics of Machinery, Computer Aided Engineering, Design of Transmission Systems					

Savitribai Phule Pune University
Bachelor of Computer Engineering
Program Outcomes (POs)

Learners are expected to know and be able to–

PO1	**Engineering knowledge**	Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems.
PO2	**Problem analysis**	Identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics natural sciences, and Engineering sciences.
PO3	**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.
PO4	**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.
PO5	**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.
PO6	**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.
PO7	**Environment and Sustainability**	Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.

Course Objectives:

1. Introduce the concepts of electric vehicle and allied technologies
2. Learn the concept and types of hybrid electric vehicle
3. Identify and Judge application specific selection of Prime Movers, Energy Storage and Controllers required for e-vehicles
4. Recognize the e-Vehicle Configurations and Understand the Mechanics of vehicle movement
5. Design and Select the body frame with relevant suspension system and Testing of e-Vehicle as per Regulation/Licensing/Approval Organizations
6. Understand the Battery Charging techniques and management

Course Outcomes:

On completion of the course the learner will be able to; CO1. **UNDERSTAND** the basics related to e-vehicle CO2. **CLASSIFY** the different hybrid vehicles

CO3. **IDENTIFY** and **EVALUATE** the Prime Movers, Energy Storage and Controllers

CO4. **DISCOVER** and **CATAGORIZE** the Electric Vehicle Configuration with respect to Propulsion, Power distribution and Drive-Train Topologies

CO5. **DEVELOP** body frame with appropriate suspension system and **TESTING** of for e- Vehicles

CO6. **CLASSIFY** and **EVALUATE** Battery Charging techniques and management

Course Contents

Unit 1	**Introduction to Electric and Hybrid Vehicle**

History and evolution of Electric Vehicles, Comparison of Electric with Internal Combustion Engine Vehicles, Limitations of IC Engine Vehicles (ICEV), Exhaust Emission and Global warming, Environmental importance of Hybrid and Electric Vehicles, Overview of EV Challenges, Classification, Overview of EV Technologies, Advantages and Disadvantages, Economic and Environmental impacts of using Electrical Vehicles, Emerging Technologies for Electric Vehicle

Drives, Case Studies of Two-Wheeler, Three-Wheeler, and Four-Wheeler Electric Vehicles,

Unit 2	**Hybrid Electric Vehicle**

Classification of HEV: Architecture, Construction, Working, Advantages and Limitations of Conventional and Gridable HEV, Classification of Conventional HEV, Types of Gridable HEV, Tractive force, Power and Energy requirements for standard drive cycles of HEV

Hybrid Electric Drive-Trains: Basic concept of Hybrid Traction, introduction to various hybrid Drive-Train Topologies, Power flow Control in Hybrid Drive-Train Topologies, Fuel Efficiency Analysis

Control Strategy: Supervisory Control, Selection of Modes

Unit 3	**Prime Movers, Energy Storage and Controllers**

Brief introduction to Motors: Classification, Construction, Working, Control, Design criteria, Application and Design Examples, Selection of Motor, Structural Configuration of Motor Layout, Motor Safety and Maintenance, Motor Torque and Power Rating

Brief introduction to Energy Storage Systems: Classification - Types and Packs, Construction, Working, Comparison and Selection, Principle of Operation, Units of Battery/Fuel Cell Energy Storage, Battery Performance Parameters Estimation, Battery/Cell Modeling, Traction Batteries and their Capacity Calculation and Power Rating for standard drive cycles, Lifetime and Sizing Considerations, Power and Efficiency, Characteristic Curves, Battery Cooling/Thermal Control and Protection, Battery Safety and Maintenance, Auxiliary battery, Hybridization of energy storage devices, Ultra capacitor and Ultra flywheel

Controllers: Configuration based on power electronics, Torque/Speed Coupling, Speed and Torque Controllers, BCU, MCU, Speed Control for Constant Torque/Power Operation of all electric motors, Control Methods

Unit 4	**Electric Vehicle Configuration and Mechanics of Vehicle Movement**

Electric Vehicle Configuration with respect to Propulsion and Power distribution: Unicycle, Two-Wheeler (Bicycle, Dicycle, Motorcycle, Scooter, Scooteretts, Mopeds and Underbone), Three-Wheeler, and Four-Wheeler Electric Vehicles, Steering and Propulsion Configuration, Placement of Motors, Battery and Motion Transmission Systems

Electric Drive-Trains: Basic concept of Electric Traction, introduction to various Electric Drive-Train Topologies, Power flow Control in Electric Drive-Train Topologies, Fuel Efficiency Analysis, Mechanical Differential Vs. Electric Differential

Mechanics of Vehicle Movement: General description of vehicle movement, Power train Components and Sizing, Wheels and Tires, Load calculation, Torque/Traction Calculations, Power Calculation, Effect of Rolling, Pitch & Yaw on velocity and moments, Rolling

resistance and its equation, Aerodynamic Drag/Lift and its equation, Grading resistance, Road
resistance, Acceleration resistance, Total driving resistance, Dynamic equation, Brake System

Unit 5	**Electric Vehicle Design, Manufacturing, Testing & Homologation**

Frames and Suspension Design for varieties of Electric Vehicle Configuration: Introduction to Body loads, Driving dynamics and Comfort, Strength and Stiffness of chassis/frames, Types and constructional details of frames, Frame Materials, Frame building Problems, frame components, Front and Rear Suspension Systems, Panel meters and controls on Handle-bar/Dash-board, Body Manufacturing, Aesthetics and Ergonomics Consideration, Retrofitting and its associated Problems

Vehicle Testing & Homologation: Need of vehicle Testing and Homologation, National/International Testing/Regulation/Licensing/Approval Organizations and their Standards (AIS) for e-Vehicles, Hierarchy of Testing, Conformity of Production tests, Crash test, Side Impact Test, Rollover Test, Impact Test, Track Testing

Unit 6	**EV Charging Infrastructure Management**

Battery Charging: Basic Requirements for Charging System, Charging Methods and Standards, Converters, Charger Architectures, Grid Voltages, Frequencies and Wiring, Charger Functions, Real Power, Apparent Power, and Power Factor, Boost Converter for Power Factor Correction, Examples, Vehicle to Grid operation of EV's

Battery Management Systems: Necessity of Battery Management Systems, Typical Structure of BMSs, Representative Products, Keypoints of BMSs in Future Generation, Hazard/Safety Management

402050B: Energy Audit and Management					
Teaching Scheme		**Credits**		**Examination Scheme**	
Theory	**3 Hrs./Week**	**Theory**	**3**	**In-Semester**	**30**
				End-Semester	**70**

Prerequisites: Engineering Thermodynamics, Applied Thermodynamics, Heat and Mass Transfer, HVAC, Turbomachines

Course Objectives:

1. To impart basic knowledge to the students about current energy scenarios, energy conservation, energy audit and energy management.
2. To inculcate the systematic knowledge and skill in assessing the energy efficiency, energy auditing and energy management.
3. To carry out an energy audit of Institute/Industry/Organization

Course Outcomes:

On completion of the course the learner will be able to;

CO1. **EXPLAIN** the energy need and role of energy management

CO2. **CARRY OUT** an energy audit of the Institute/Industry/Organization

CO3. **ASSESS** the ENCON opportunities using energy economics

CO4. **ANALYSE** the energy conservation performance of Thermal Utilities CO5. **ANALYSE** the energy conservation performance of Electrical Utilities

CO6. **EXPLAIN** the energy performance improvement by Cogeneration and WHR method

Course Contents

Unit 1	**Energy Scenario and Management**

Energy needs of a growing economy, Current and long-term energy scenario - India and World, Concept of energy conservation and energy efficiency, Energy and environment, Need of Renewable energy, Principles of Energy management, Energy policy, Energy action planning, Energy security and reliability, Energy sector reforms.

Unit 2	**Energy Audit**

Need of Energy Audit, Types of energy audit, Energy audit methodology, Energy audit instruments, Analysis and recommendations of energy audit, Benchmarking, Energy audit reporting, Introduction to software and simulation for energy auditing, Current Energy Conservation Act and Electricity Act and its features.

Unit 3	**Energy Economics**

Costing of Utilities (Numerical): Determination of the cost of steam, fuels, compressed air and electricity

Financial Analysis Techniques (Numerical): Simple payback, Time value of money, Net Present Value (NPV), Return on Investment (ROI), Internal Rate of Return (IRR), Risk and Sensitivity analysis, Energy performance contracts and role of ESCOs.	
Unit 4	**Evaluation of Thermal Utilities**
Energy performance opportunities and assessment of Boilers and Furnaces (Numerical on direct method), Heat exchangers, Cooling towers, DG sets, Fans & blowers, Pumps, Compressors, Compressed air systems and HVAC systems. Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system.	
Unit 5	**Evaluation of Electrical Utilities**
Electricity billing, Electrical load management and maximum demand control, penalties, Power factor improvement and benefits, Selection and location of capacitors. Distribution and transformer losses, Harmonics. **Electrical motors:** Types, Efficiency, Selection, Speed control, Energy efficient motors Lamp types and their features, recommended illumination levels, Lighting system performance assessment and efficiency improvement (Numerical), Electricity saving techniques.	
Unit 6	**Cogeneration and Waste Heat Recovery**
Cogeneration: Need, applications, advantages, classification, Introduction to Trigeneration **Waste Heat Recovery:** Classification, Application, Concept of Pinch analysis, Potential of WHR in Industries, Commercial WHR devices, saving potential, CDM projects and carbon credit calculations. **Case Studies:** Energy Audit of Institute/MSMEs/Organization, Guidelines for Energy Manager and Energy Auditor examination conducted by BEE.	

402049: Energy Engineering					
Teaching Scheme		**Credits**		**Examination Scheme**	
Theory	**3 Hrs./Week**	**Theory**	**3**	**In-Semester**	**30 Marks**
Practical	**2 Hrs./Week**	**Practical**	**1**	**End-Semester**	**70 Marks**
				Term Work	**25 Marks**
				Oral	**25 Marks**

Prerequisites: Thermodynamics, Applied Thermodynamics, Heat Transfer, Turbo machines

Course Objectives:

1. To study the energy scenario, the components of thermal energy based plant, improved Rankine cycle
2. To understand details of steam condensing plant, cooling tower system, analysis of condenser, the environmental impacts and methods to reduce various pollution from energy systems
3. To study layout, component details of diesel engine power plant, hydel and nuclear energy systems
4. To understand components; layout of gas and improved power cycles
5. To learn basic principles of energy management, storage and economics of power generation
6. To study the working principle , construction of renewable energy systems

Course Outcomes:

On completion of the course the learner will be able to;

CO1:**EXPLAIN** the power generation scenario, the layout components of thermal power plant and **ANALYZE** the improved Rankine cycle.

CO2:**ANALYZE** the performance of steam condensers, cooling tower system; RECOGNIZE an environmental impact of energy systems and methods to control the same.

CO3:**EXPLAIN** the layout, component details of diesel engine plant, hydel and nuclear energy systems.

CO4:**ANALYZE** gas and improved power cycles.

CO5:**EXPLAIN** the fundamentals of renewable energy systems.

CO6:**EXPLAIN** basic principles of energy management, storage and economics of power generation.

Course Contents

Unit 1	**Energy Scenario and Thermal Energy based Power Plants**

Energy Scenario: global and Indian energy scenario, role of Government and Private

organizations,
energy crisis, energy security, energy policy, India's low carbon transition. **Thermal Energy Based Plant: layout of modern thermal energy based plant with different circuits, site selection, classification of coal, coal benefication, selection of coal for thermal power plant, slurry type fuels, in-plant handling of coal, pulverized fuel handling systems, FBC systems, high pressure boilers, improved Rankine cycle: Rankine cycle with only reheating and only regeneration (Numerical Treatment) , energy conservation in boilers**

Unit 2	**Steam Condensers, Cooling Towers and Environmental Impact of Energy System**

Steam condensers: need, elements of steam condensing plant, classification, Dalton's law of partial pressure, condenser efficiency, vacuum efficiency, cooling water requirements (Numerical Treatment), air leakage and its effects on condenser performance, air pumps (Numerical Treatment for Air Pump capacity), steam condenser market.

Cooling Towers: need, classification of condenser water cooling systems, classification of cooling pond and cooling towers. environmental effects of cooling towers, next generation cooling towers

Environmental impact of energy system: different pollutants from energy plants, methods to control pollutants: types of scrubbers; ash handling system; dust collections; ESP, carbon credits and footprints, water treatment in thermal energy based plant

Unit 3	**Diesel, Hydel, Nuclear Energy systems**

Diesel engine power plant: general layout; different systems of DEPP, plant layout of high/medium /low capacity DEPP, performance operating characteristics based on heat rate, advantages; disadvantages; applications; methods of energy conservation

Hydel energy: basics of hydrology, hydrograph, flow duration curve, mass curve (Numerical Treatment), hydel power plant (HPP)- site selection, classification of HPP (Based on head, nature of load, water quantity), criteria for turbine selection, components of HPP- dams; spillways; surge tank and forebay, advantages and disadvantages of HPP.

Nuclear energy: nuclear fission/fusion, elements of NPP, types of nuclear reactor (PWR, BWR, CANDU, LMCR, GCR, Fast Breeder) nuclear fuels, moderators, coolants, control rod and shielding, nuclear waste disposal, nuclear power development programme of India**.**

Unit 4	**Gas and Improved Power cycle**

Gas turbine power plant: components, general layout of GTPP, open & closed cycle gas turbine plant, Brayton cycle analysis for thermal efficiency, work ratio, maximum & optimum pressure ratio, methods to improve thermal efficiency of GTPP: only inter-cooling; only reheating & only regeneration cycle (numerical treatment),

Improved cycle based Power Plant: gas and steam combined cycle plant, Cogeneration, introduction to tri-generation, steam power plants with process heating (Numerical Treatment), Integrated Gasification Combined Cycle (IGCC) plant, Kalina (Cheng) Cycle.

Unit 5	Energy Management, Storage and Economics of Power Generation

Energy management and storage: energy management with storage systems, energy demand estimation, energy pricing, thermal energy storage methods.

Power plant instrumentation: layout of electrical equipment, switch gear, circuit breaker, protective devices, measurement of high voltage, current and power.

Economics of power generation: cost of electrical energy, fixed and operating cost [methods to determine depreciation cost] (numerical treatment), load curves, performance and operation characteristics of power plants, load division, all terminologies related to fluctuating load plant, tariff (numerical treatment), analysis of energy bill

Unit 6	Renewable Energy Systems

Solar thermal and photovoltaic energy: solar thermal plant based on flat plate collector; solar photovoltaic systems, applications, economics and technical feasibility.

Wind Energy: wind availability, basic components of wind mills, performance operating characteristics, wind solar hybrid power plants, Cost economics and viability of wind farm.

Geothermal Energy: typical geothermal field, superheated steam system, flash type, binary cycle plant**,** economics of geothermal energy.

Tidal Energy: components, single basin, double basin systems

Ocean Thermal Energy: working principle, Claude /Anderson /hybrid cycle

Wave Energy: dolphin type wave machines

MHD Power Generation: working principle, open/ close cycle MHD generator

Fuel cell: main components, working Principle

Biomass Energy: biomass gasifier

Hydrogen Energy: principle of hydrogen production, hydrogen storage, applications.

402041: Heating, Ventilation, Air Conditioning and Refrigeration					
Teaching Scheme		**Credits**		**Examination Scheme**	
Theory	**3 Hrs./Week**	**Theory**	**3**	**In-Semester**	**30 Marks**
Practical	**2 Hrs./Week**	**Practical**	**1**	**End-Semester**	**70 Marks**
				Oral	**25 Marks**

Prerequisites: Thermodynamics, Applied Thermodynamics, Fluid Mechanics, Heat and Mass Transfer.

Course Objectives:

1. To understand and compare different refrigerants with respect to properties, applications and Environmental issues and Air refrigeration systems.
2. To understand Multistage compression cycles and multistage evaporator systems.
3. To understand various components, operating and safety controls employed in Refrigeration and Air Conditioning systems and advanced refrigeration systems.
4. To understand the basic air conditioning processes on psychometric charts, human comfort and to provide the knowledge of indoor and outdoor air quality requirements.
5. To study the ventilation and infiltration in air conditioning and duct design for various comfort conditions and industrial air conditioning systems.
6. To understand advanced A/C systems and heat pump.

Course Outcomes:

On completion of the course the learner will be able to;

CO1.**ANALYSE** different air-craft refrigeration systems and **EXPLAIN** the properties, applications and environmental issues of different refrigerants.

CO2.**ANALYSE** multi pressure refrigeration system used for refrigeration applications.

CO3.**DISCUSS** types of compressors, condensers, evaporators and expansion valves along with regulatory and safety controls and **DESCRIBE** Trans critical and ejector refrigeration systems.

CO4.**ESTIMATE** cooling load for air conditioning systems used with concern of design conditions and indoor quality of air.

CO5.**DESIGN** air distribution system along with consideration of ventilation and infiltration.

CO6.**EXPLAIN** the working of types of desiccants, evaporative, thermal storage, radiant cooling, clean room and heat pump systems.

Course Contents

Unit 1	**Gas Cycle Refrigeration and Refrigerants**

Gas Cycle Refrigeration: Application to air-craft refrigeration, Simple system, Bootstrap, Regenerative, reduced ambient system, Concept of Dry Air Rated Temperature (DART)

Refrigerants: Introduction, Definition and requirement, Classification of refrigerants, Designation of refrigerants, Desirable properties of Refrigerants-Thermodynamic, Chemical and Physical.

Properties of ideal refrigerant. Environmental issues like ODP, GWP & LCCP. Selection of environment friendly refrigerants, Alternative refrigerants, Secondary refrigerants, Anti-freeze solutions, Zoetrope's and Azeotropes, Refrigerant recovery, reclaims, recycle and recharge.

Unit 2	**Multi Pressure Systems**

Multistage or Compound Systems: Need of multi staging, Two stage compression with flash gas removal, flash intercooler and complete multistage compression system.

Multi Evaporator Systems: Single compressor-individual expansion valve, Single compressor-multiple expansion valve, Individual compressor-multiple expansion valve, Individual compressor with compound compression and flash inter cooling. (Limited to two evaporators).

Ammonia-CO_2 cascade cycle. (Only theoretical approach).

Unit 3	**Practical aspects of Vapor Compression and Advanced Refrigeration Systems**

Major components of refrigeration cycle: Types of compressors, Characteristics of reciprocating and centrifugal compressors, Types of evaporators, Types of condensers and Types of expansion valves.

Safety Controls: LP/HP cut-off, Low temperature control, Frost control, Motor overload control, Oil pressure failure control. Capacity controls for different compressors.

Advanced Refrigeration System: Trans critical cycle and their types, Simple ejector refrigeration system (analysis and numerical)

Unit 4	**Applied Psychrometry**

Psychrometric Chart, Psychrometric processes using BPF, ADP, SHF, RSHF, GSHF, ESHF, ERSHF and adiabatic mixing of two air streams. Heat load estimation: - Air conditioning, heating & cooling load calculations.

Envelop Load estimation: Concept of sol-air temperature, Time lag & Decrement method and ETD or CLTD methods.

Thermal Comfort: Basic parameters, Thermodynamics of human body, Thermal comfort and Comfort charts, Factors affecting thermal comforts.

Indoor Air Quality (IAQ): Indoor air contaminants, Basic strategies to improve indoor air quality.

Outdoor Design Conditions: Outdoor air requirements for occupants, Use of outdoor weather data in design, Outdoor weather characteristics and their influence.

Unit 5	**Ventilation, Infiltration & Air Distribution systems (Ducts)**

Ventilation and infiltration: Natural ventilation, Mechanical ventilation.
Duct Design: Definition of duct and types of ducts, Economic factors influencing duct layout, Materials for ducts and its specification, Flow through duct, Pressure in ducts, Friction loss in ducts, Friction chart for circular ducts, Equivalent diameter of a circular duct for rectangular sections, Methods of duct designs. (Numerical treatment on duct design).

Air Distribution System: Factors considered in air distribution system, (simple numerical). Types of air distribution devices. Fan coil unit, Fan laws, Types of fans used in air conditioning applications, Types of supply air outlets, Selection and location of outlets, Filters, Diffusers, Grillers, and Dampers.

Unit 6	**Advanced Air Conditioning Systems**

Advanced AC Systems: Working of summer, winter and year-round AC systems, all air system, all water system, air water system, variable refrigerant flow and variable air volume systems, unitary and central air conditioning.

Desiccant-Based Air Conditioning Systems: Introduction, Sorbents & Desiccants, Dehumidification, Liquid spray tower, Solid packed tower, Rotary desiccant dehumidifiers, Hybrid cycles, Solid desiccant Air-Conditioning (Theoretical treatment).

Evaporative Cooling Air Conditioning Systems, Thermal storage Air Conditioning systems, clean room Air Conditioning systems, Radiant cooling. (No numerical), Heat pumps and its different circuits.

302055: Internship/Mini project				
Teaching Scheme**		**Credits**	**Examination Scheme**	
		04	**TW**	**100 Marks**

Prerequisites: Knowledge of design, manufacturing processes, modeling, and mechanical systems

Course Objectives:

Internship provides an excellent opportunity to learner to see understand the conceptual aspects learned in classes and deployed into the practical world. Industry/on project experience provides much more professional experience as value addition to classroom teaching.

1. To encourage and provide opportunities for students to get professional/personal experience through internships.
2. To learn and understand real life/industrial situations.
3. To get familiar with various tools and technologies used in industries and their applications.
4. To nurture professional and societal ethics.
5. To create awareness of social, economic and administrative considerations in the working environment of industry organizations.

Course Outcomes:

On completion of the course, learners should be able to

CO1. **DEMONSTRATE** professional competence through industry internship.

CO2. **APPLY** knowledge gained through internships to complete academic activities in a professional manner.

CO3. **CHOOSE** appropriate technology and tools to solve given problem.

CO4. **DEMONSTRATE** abilities of a responsible professional and use ethical practices in day to day life.

CO5. **DEVELOP** network and social circle, and **DEVELOPING** relationships with industry people.

CO6. **ANALYZE** various career opportunities and **DECIDE** career goals.

****Guidelines:**

Internships are educational and career development opportunities, providing practical experience in a field or discipline. Internships are far more important as the employers are looking for employees who are properly skilled and having awareness about industry environment, practices and culture. Internship is structured, short-term, supervised training often focused around particular tasks or projects with defined time scales.

Core objective is to expose technical students to the industrial environment, which cannot be simulated/experienced in the classroom and hence creating competent professionals in the industry and to understand the social, economic and administrative considerations that influence the working environment of industrial organizations.

Engineering internships are intended to provide students with an opportunity to apply conceptual knowledge from academics to the realities of the field work/training. The following guidelines are proposed to give academic credit for the internship undergone as a part of the Third Year Engineering curriculum.

302042: Heat and Mass Transfer					
Teaching Scheme		**Credits**		**Examination Scheme**	
Theory	**3 Hrs./Week**	**Theory**	**3**	**In-Semester**	**30 Marks**
Practical	**2 Hrs./Week**	**Practical**	**1**	**End-Semester**	**70 Marks**
				Practical	**50 Marks**

Prerequisites: First and Second Law of Thermodynamics, Fluid properties, Continuity equation, Differential and Integral Calculus, Ordinary differential and Partial Differential Equations, Numerical solution for Differential Equations.

Course Objectives:

1. **IDENTIFY** the laws for different modes of heat transfer.
2. **UNDERSTAND** the properties and economics of thermal insulation and **ANALYZE** heat transfer through fins and thermal systems with lumped heat capacitance.
3. **ANALYZE** the natural and forced convective mode of heat transfer in various geometric configurations.
4. **UNDERSTAND AND REALIZE** various laws with their interrelations and analyze Radiation heat transfer in black and grey bodies/surfaces with or without radiation shields.
5. **UNDERSTAND** the fundamentals and laws of mass transfer and its applications.
6. **ANALYZE** various performance parameters for existing heat exchanger and **DEVELOP** methodologies for designing a heat exchanger under prescribed conditions and for a particular application, with references TEMA standards

Course Outcomes: On completion of the course, learner will be able to

CO1. **ANALYZE** & **APPLY** the modes of heat transfer equations for one dimensional thermal system.

CO2. **DESIGN a** thermal system considering fins, thermal insulation and & Transient heat conduction.

CO3. **EVALUATE** the heat transfer rate in natural and forced convection & validate with experimentation results.

CO4. **INTERPRET** heat transfer by radiation between objects with simple geometries, for black and grey surfaces.

CO5. **ABILITY** to analyze the rate of mass transfer using Fick's Law of Diffusion and understands mass diffusion in different coordinate systems.

CO6. **DESIGN & ANALYSIS** of heat transfer equipment's and investigation of its performance.

Course Contents

Unit 1	**Fundamentals of Heat Transfer**	**08 Hrs.**

Basic Concepts: Different Modes and Laws of heat transfer, 3-D heat conduction equation in Cartesian coordinates (with derivation), and its simplified equations, simplified equations in cylindrical and spherical coordinates (simplified equations, no derivation) thermal conductivity,

thermal diffusivity, electrical analogy, Thermal contact Resistance.

Boundary and initial conditions: Temperature boundary condition, heat flux boundary condition, convection boundary condition, radiation boundary condition.

1-D steady state heat conduction without and with heat generation: Heat conduction without heat generation in plane wall, composite wall, composite cylinder, composite sphere. Heat conduction with heat generation in Plane wall, Cylinder and Sphere with different boundary conditions.

Unit 2	**Heat Transfer through Extended Surfaces & Transient Heat Conduction**	**08 Hrs.**

Thermal Insulation – Critical thickness of insulation, Types and properties of insulating materials, Safety considerations in thermal insulation, Economic and cost considerations, Payback period, Numerical on payback period.

Heat transfer through extended surfaces: Types of fins and its applications, Governing Equation for constant cross sectional area fins, Solution for infinitely long fin (with derivation), adequately long fin with insulated end tip and short fins (no derivation), Fin Efficiency & Effectiveness of fins, estimation of error in Temperature measurement by thermometer.

Transient heat conduction: Validity and criteria of lumped system analysis, Biot Number, Fourier Number, Time Constant and Response of thermocouple, Use of Heisler Charts for plane wall, cylinder and sphere

Unit 3	**Convection**	**08 Hrs.**

Principles of Convection: Local and average heat transfer coefficient, Hydrodynamic and Thermal boundary layer for a flat plate and pipe flow.

Forced Convection: Physical significance of non-dimensional numbers, Empirical correlations for flat plate, pipe flow, and flow across cylinders, spheres, tube banks.

Free Convection: Physical significance of non-dimensional numbers, Free convection from a vertical, horizontal surface, cylinder and sphere. Mixed Convection

Boiling and Condensation: Types of boiling, Regimes of pool boiling, Film wise condensation, Drop wise condensation (No Numerical treatment), Critical heat flux.

Unit 4	**Radiation**	**07 Hrs.**

Thermal Radiation; definition of various terms used in radiation mode; Stefan-Boltzmann law, Kirchhoff's law, Planck's law and Wein's displacement law. Intensity of radiation and solid angle; Lambert's law; Radiation heat exchange between two black surfaces, configuration or view factor. Radiation heat exchange between grey surfaces, Electrical analogy for radiation, Radiation shields, Numerical.

Unit 5	Mass Transfer	07 Hrs.
Physical origins, applications of mass transfer, Mixture Composition, Phase diagram, Fick's Law of Diffusion with numerical treatment, Restrictive Conditions, Mass diffusion coefficient, Conservation of Species, The Mass Diffusion equation – Cartesian coordinates deviation, cylindrical coordinates and Spherical coordinates (no derivation), Boundary and initial conditions.		
Unit 6:	**Heat Exchangers and Equipment Design**	**07 Hrs.**
Heat Exchangers: Classification and applications of heat exchangers, Heat exchanger analysis – LMTD for parallel and counter flow heat exchangers, Effectiveness– NTU method for parallel and counter flow heat exchangers, cross flow heat exchangers, LMTD correction factor, Heat Pipe, Introduction to electronic cooling - Active and passive methods of augmented heat transfer. **Process Equipment Design:** Condenser Design, Introduction to TEMA standards, Design considerations for heat exchangers, Materials of construction and corrosion, Temperature effects, Radiation effects, Economic consideration, Condenser and Heat exchanger design and performance calculations, Design of shell and tube type Heat Exchanger		

202043 - Engineering Thermodynamics		
Teaching Scheme	**Credits**	**Examination Scheme**
Theory : 03 Hr./Week Practical : 02 Hr./Week	**04** Theory : 03 Practical : 01	In-Semester : 30 Marks End-Semester : 70 Marks Oral 25 Marks

Prerequisite Courses

Higher Secondary Science courses, Engineering Mathematics - I and II, Engineering Physics, Engineering Chemistry

Course Objectives

1. To introduce the fundamentals of thermodynamics.
2. To understand the concepts of laws of thermodynamics.
3. To apply the concepts of thermodynamics towards open and closed systems.
4. To be acquainted with Entropy generation and Exergy Analysis.
5. To understand the behavior of a Pure substance and to analyze Vapor power cycles.
6. To undertake the performance analysis of a steam generator.

Course Outcomes

On completion of the course, learner will be able to

CO1. DESCRIBE the basics of thermodynamics with heat and work interactions.CO2. APPLY laws of thermodynamics to steady flow and non-flow processes.

CO3. APPLY entropy, available and non-available energy for an Open and Closed System,

CO4. DETERMINE the properties of steam and their effect on performance of vapor power cycle.CO5. ANALYSE the fuel combustion process and products of combustion.

CO6. SELECT various instrumentations required for safe and efficient operation of steam generator.

Course Contents

Unit I **Fundamentals of Thermodynamics** **[07 Hr.]**

Introduction, Review of basic definitions, Zeroth law of Thermodynamics, Macro and Microscopic Approach, State Postulate, State, Path, Process and Cycles, Point function and Path function, quasi static process, Equilibrium, **Temperature** (concepts, scales, international fixed points and measurement of temperature), Constant volume gas thermometer and constant pressure gas thermometer, mercury in glass thermometer.

First Law of Thermodynamics: Concept of heat and work, Sign convention and its conversion. First law of thermodynamics, Joules experiments, Equivalence of heat and work. Application of first law to flow and non-flow Processes and Cycles. Steady flow energy equation (SFEE), Applications of SFEE to various devices such as Nozzle, Turbine, Compressors, Boilers etc. PMM-I kind.

Unit II **Ideal Gas and Second law of Thermodynamics** **[08 Hr.]**

Properties and Processes of Ideal Gas: Ideal Gas definition, Gas Laws: Boyle's law, Charle's law, Avogadro's Law, Equation of State, Ideal Gas constant and Universal Gas constant, Ideal gas Processes- on P-v and T-s diagrams, Constant Pressure, Constant Volume, Isothermal, Adiabatic, Polytropic, Throttling Processes (Open and Closed systems), Calculations of Heat transfer, Work done, Internal Energy.

Second Law of Thermodynamics: Limitations of first law of thermodynamics, Thermal reservoir, Heat Engine, Refrigerator and Heat pump: Schematic representation, Efficiency and Coefficient of Performance (COP), Kelvin-Planck & Clausius Statement of the Second law of Thermodynamics; PMM-II kind, Equivalence of the two statements; Clausius Inequality, Concept of Reversibility and Irreversibility, Carnot Theorem/Principles, Carnot Cycle.

Unit III **Entropy and Availability** **[08 Hr.]**

Entropy: Entropy as a property, Clausius Inequality, Principle of increase of Entropy Principle, Entropy changes for an Open and Closed System, Change of Entropy for an ideal gas and Pure Substance, Concept of Entropy generation. Entropy - a measure of Disorder.

Availability: Available and Unavailable Energy, Concept of Availability, Availability of heat source at constant temperature and variable temperature, Availability of non-flow and steady-flow Systems.

Unit IV **Properties of Pure substances & Thermodynamics of Vapor Cycle** **[07 Hr.]**

Properties of Pure substances: Formation of steam, Phase changes, Properties of steam, Use of Steam Tables, Study of P-v, T-s and h-s plots (Mollier Chart) for steam, Dryness fraction and its determination, Study of steam calorimeters (Barrel, Separating, Throttling and combined) Non-flow and Steady flow Vapour Processes, Change of Properties, Work and Heat transfer.

Thermodynamics of Vapour Cycle: Rankine Cycle, Comparison of Carnot cycle and Rankine cycle, Introduction to Steam power Plant, Efficiency of Rankine Cycle, Relative Efficiency, Effect ofVarying operating parameters like Superheat, Boiler and Condenser Pressure on performance of Rankine cycle, Modified Rankine Cycle.

Unit V **Fuels and Combustion** **[07 Hr.]**

Types of fuels, Proximate and ultimate analysis of fuel, Combustion theory, Combustion Equations,Theoretical and Excess air requirements, Equivalence ratio, Analysis of products of combustion,
Calorific value - HCV & LCV. Bomb and Boys gas Calorimeters. Flue Gas Analysis using Orsat Apparatus, Exhaust Gas analyzer, Enthalpy of formation, Adiabatic flame temperature.

Unit VI **Steam Generators & Boiler Draught** **[08 Hr.]**

Steam Generators: Classification, Constructional details of low pressure boilers, Primary Features of high pressure (Power) boilers, Location, Construction and working principle of boiler, Boiler mountings and accessories, Instrumentations required for safe and efficient operation, Introduction to IBR Act, Boiler performance Calculations-Equivalent Evaporation, Boiler efficiency, Heat balance Sheet.

Boiler Draught: Classification, Necessity of Draught, Natural draught, Determination of Height of chimney, Diameter of chimney, condition for maximum discharge, Forced draught, Induced draught, Balanced draught, Draught losses.

Savitribai Phule Pune University, Pune

Second Year Civil Engineering (2019 Pattern)

Awareness to Civil Engineering Practices

Audit Course I

Teaching Scheme:

Practical: 01 hrs/week

(Certificate to be issued by institute based on performance assessment)

Civil Engineering is the oldest engineering profession comprising of a variety of sub-disciplines such as Structural Engineering, Geotechnical, Water resources, Environmental Engineering, Construction technology, Transportation Engineering etc. Undergraduate programs are designed with different theoretical approaches on the application of basic sciences to solve different societal problems by engineering knowledge. However, there is a need to make the students aware about how the Civil Engineering industry operates and how theories taught in different courses are applied in practice. The students can learn from the experience gained from different workplaces such Civil Engineering consultancies, contracting companies, construction sites etc. The course aims to provide insight of the different practices followed by the industry such as use of different documents & contracts in Civil Engineering practice, drawings required, engineering ethics, duties and responsibilities of the engineers, site records and diaries, health and safety practices on site.

Course Objectives:

1. To provide basic overview of functioning of different Civil Engineering related industries / firms.
2. To create awareness about application of different drawings, contract documents in Civil Engineering.
3. To provide insight of code of ethics, duties and responsibilities, health and safety as a Civil Engineer.

Course Outcomes:

On completion of the course, learner will be able to…

CO1: Describe functioning/working of different types of industries/sectors in Civil Engineering.

CO2: Describe drawings and documents required and used in different Civil Engineering works.

CO3: Understand the importance of Code of Ethics to be practiced by a Civil Engineer and also understand the duties and responsibilities as a Civil Engineer.

CO4: Understand different health and safety practices on the site.

Course Contents (During 1hr. Practical Session per week)

Unit I: Sectors in Civil Engineering **(03 Hours.)**

Details of different Sectors/sub-disciplines in Civil Engineering along with the following details: description, eminent institutes in India & abroad, related research institutes, noteworthy projects, higher education, latest & ongoing research in the domain, jobs opportunities in government as well as private sector.

Suggestion for effective content delivery:

Lecture cum interaction by alumni of your college working in different sectors of Civil Engineering

Unit II: Drawings and Documents **(03 Hours.)**

Suggestion for effective content delivery:

i.] Visit to various construction sites/ architectural firms/ structural engineering firms etc. to understand drawings, documents & working culture.

ii.] Lecture by professional practitioner

Unit III: Engineering Ethics **(03 Hours.)**

Introduction, moral issues and moral dilemmas. Code of ethics in Civil Engineering followed by Construction Industry Development Council (CIDC) of India, national & international associations and institutes. Effective case studies (Minimum 2 case studies).

Suggestion for effective content delivery:

Case study based content delivery method, Lecture by professional practitioner

Unit IV: Construction Site Safety **(03 Hours.)**

Importance of site safety. Different health and safety parameters during actual execution of Civil Engineering constructions. Safety measures: conventional and modern.

Suggestion for effective content delivery:

On site visit & lecture by professional practicing Safety Engineer.

Guidelines for Assessment (Any one or more of following but not limited to)

1. Group discussion
2. Presentation
3. Mini Project / Activity
4. Site visit report
5. Guest lecture report

Savitribai Phule Pune University, Pune
Second Year Civil Engineering (2019 Pattern)
Road Safety Management
Audit Course I

Teaching Scheme:
Practical: 01 hrs/week

(Certificate to be issued by institute based on performance assessment)

Road transport remains the least safe mode of transport, with road accidents representing the main cause of death of people. The boom in the vehicle population without adequate road infrastructure, poor attention to driver training and unsatisfactory implementation of regulations have been responsible for increase in the number of accidents. India's vehicle population is negligible as compared to the world statistics; but the comparable proportion for accidents is substantially large. The need for strict enforcement of law to ensure greater safety on roads and an environment-friendly road transport operation is of paramount importance. Safety and security are growing concerns for businesses, governments and the traveling public around the world, as alsoin India. It is, therefore, essential to take new initiatives in raising awareness, skill and knowledge of students as one of the important stake holders who are expected to follow the rules and policies
of the government in order to facilitate safety of individual and safe mobility of others.

Course Objectives:

1. To provide basic overview on road safety & traffic management issues in view of the alarming increase in vehicular population of the country.
2. To explain the engineering & legislative measures for road safety.
3. To discuss measures for improving road safety education levels among the public.

Course Outcomes:

On completion of the course, learners will be able to…

CO1: Summarize the existing road transport scenario of our country

CO2: Explain the method of road accident investigation

CO3: Describe the regulatory provisions needed for road safety

Course Contents

Unit I: Human Values and Engineering Ethics

Morals, values and ethics, integrity, work ethic, civic virtue, valuing time, cooperation, commitment, empathy, self-confidence, stress management, senses of engineering ethics, Kohlberg's theory, Gilligan's theory, models of professional roles, uses of ethical theories.

Unit II: Research Ethics and Codes of Ethics

Industrial standardization, ethical code and its importance, ethical accountability, law in engineering and engineering as social experimentation.

Unit III: Safety, Responsibilities and Rights

Safety and risk, assessment of safety and risk, risk benefit analysis and reducing risk collegiality, collective bargaining, confidentiality, conflicts of interest, professional rights, employee rights, intellectual property rights(IPR), discrimination and utilitarianism.

Unit IV: Professional Etiquette

Etiquette at meetings, public relations office (PRO)s etiquettes, technology etiquette phone etiquette, email etiquette, social media etiquette, video conferencing etiquette, interview

SEMESTER VI

Savitribai Phule Pune University, Pune
TE Civil (2019 Pattern) w. e. f. June 2021
301012: Waste Water Engineering

Teaching scheme	Credit	Examination scheme
Lectures: 03 Hours/week	03	In semester exam: 30 Marks End semester exam: 70 Marks

Pre-requisites

Basic Concepts of Engineering Sciences and Mathematics

Course objectives

01 To introduce students about the need of sanitation infrastructure, wastewater treatment, sludge management system and to identify potential of wastewater for recycle and reuse

02 To inculcate an ability to learn the working principle, operation and design of various units of wastewater treatment plant

Course outcomes

On successful completion of this course, the learner will be able to:

01 Recall sanitation infrastructure, quantification and characterization of wastewater, natural purification of streams

02 Design preliminary and primary unit operations in waste water treatment plant

03 Understand theory and mechanism of aerobic biological treatment system and to design activated sludge process

04 Understand and design suspended and attached growth wastewater treatment systems

05 Explain and apply concept of contaminant removal by anaerobic, tertiary and emerging wastewater treatment systems

06 Compare various sludge management systems and explain the potential of recycle and reuse of wastewater treatment

Course Contents

Unit I: Sanitation Infrastructure System **(06 Hours)**

Sanitation infrastructure and wastewater quantification: wastewater, sources and types, need for safe sanitation, importance of sanitation infrastructure (centralized, decentralized, onsite and offsite sanitation), wastewater collection and conveyance, quantitative estimation of wastewater, sewage, storm water, self-cleansing velocity and non-scouring velocity in sanitary sewer, hydraulic design of circular sanitary sewer, necessity and location of pumping station. Wastewater characteristics: methods of sampling, conventional and emerging contaminants (physical, chemical and biological) in domestic and industrial wastewater (sugar, dairy, distillery), treatability index, effluent discharge standards as per CPCB norms. Self-purification of natural streams: oxygen sag curve, Streeter - Phelps equation and terminology (without derivation and numerical), application and limitations.

Savitribai Phule Pune University, Pune
TE Civil (2019 Pattern) w. e. f. June 2021
301011 a: Audit Course I: Professional Ethics and Etiquettes

Teaching scheme	Credit	Examination scheme
Tutorial: 01 Hours/week	--	Grade

Professional ethics is the underlying concept behind the successful accomplishment of any act of a professional towards achieving the individual and societal goals. These goals should ultimately result in morally, legally, ethically and even culturally acceptable good things for all. Engineers being special group of professionals need to be more conscious of their acts since their duties, rights and responsibilities permeate into the society and the surroundings. To practice professional ethics, understanding of values and concepts are essential.

Course objectives

01 To create awareness on professional ethics and human values.
02 To provide basic familiarity about Engineers as responsible experimenters, research ethics, codes of ethics, industrial standards.
03 To inculcate knowledge and exposure on safety and risk.
04 To expose students to right attitudinal and behavioral aspects.

Course outcomes

On successful completion of this course, the learner will be able to:

01 Understand the basic perception of profession, professional ethics, various moral issues and uses of ethical theories
02 Understand various social issues, industrial standards, code o ethics and role of professional ethics in engineering field.
03 Follow ethics as an engineering professional and adopt good standards and norms of engineering practice.
04 Apply ethical principles to resolve situations that arise in their professional lives

Course Contents

Unit I: Human Values and Engineering Ethics

Morals, values and ethics, integrity, work ethic, civic virtue, valuing time, cooperation, commitment, empathy, self-confidence, stress management, senses of engineering ethics, Kohlberg's theory, Gilligan's theory, models of professional roles, uses of ethical theories.

Unit II: Research Ethics and Codes of Ethics

Industrial standardization, ethical code and its importance, ethical accountability, law in engineering and engineering as social experimentation.

Unit III: Safety, Responsibilities and Rights

Safety and risk, assessment of safety and risk, risk benefit analysis and reducing risk collegiality, collective bargaining, confidentiality, conflicts of interest, professional rights, employee rights, intellectual property rights(IPR), discrimination and utilitarianism.

Unit IV: Professional Etiquette

Etiquette at meetings, public relations office (PRO)s etiquettes, technology etiquette phone etiquette, email etiquette, social media etiquette, video conferencing etiquette, interview

203151: Soft Skill

Teaching Scheme	Credits	Examination Scheme [Marks]
Practical : 02 Hrs/ Week	**Pr**:01	**Term Work**: 25 Marks

Course Objective: The course aims to:-

- To possess knowledge of the concept of Self-awareness and Self Development.
- To understand the importance of Speaking Skills, listening skills, Presentation Skills and leadership skills.
- To gain the knowledge of corporate grooming & dressing, Email & telephone etiquettes, etiquette in social & office setting.
- To get conversant with Team work, Team effectiveness, Group discussion, Decision making.
- To recognize the importance of time management and stress management.

Course Outcome: Students will be able to :-

CO1: DoSWOC analysis.
CO2: Develop presentation and take part in group discussion.
CO3: Understand and implement etiquette in workplace and in society at large.
CO4: Work in team with team spirit.
CO5: Utilize the techniques for time management and stress management.

Unit 01 : Self-Awareness & self-Development: (4Hrs)

A) Self-Assessment , Self-Appraisal, SWOT, Goal setting - Personal & career - Self Assessment, Self-Awareness, Perceptions and Attitudes, Positive Attitude, Values and Belief Systems, Self-Esteem, Self-appraisal, Personal Goal setting,

B) Career Planning, Personal success factors, Handling failure, Depression and Habit, relating SWOT analysis & goal setting and prioritization.

Unit 02 : Communication Skill: (6 Hrs)

A) Importance of communication, types, barriers of communication, effective communication.

B) Speaking Skills: Public Speaking, Presentation skills, Group discussion- Importance of speaking effectively, speech process, message, audience, speech style, feedback, conversation and oral skills, fluency and self-expression, body language phonetics and spoken English, speaking techniques, word stress, correct stress patterns, voice quality, correct tone, types of tones, positive image projection techniques.

C) Listening Skills:Law of nature- you have 2 ears and 1 tongue so listen twice and speak once is the best policy, Empathic listening, Avoid selective listening

D) Group Discussion:Characteristics, subject knowledge, oral and leadership skills, team management, strategies and individual contribution and consistency.

E) Presentation skills:Planning, preparation, organization, delivery.

F) Written Skills: Formal & Informal letter writing, Report writing, Resume writing - Sentence structure, sentence coherence, emphasis. Paragraph writing. Letter writing skills – form and structure, style and tone. Inquiry letters, Instruction letters, complaint letters, Routine business letters, Sales Letters etc.

Unit 03 : Corporate / Business Etiquette: (2 Hrs)

Corporate grooming & dressing, Email & telephone etiquette, etiquette in social & office setting: Understand the importance of professional behavior at the work place, Understand and Implement etiquette in workplace, presenting oneself with finesse and making others comfortable in a business setting. Importance of first impression, Grooming, Wardrobe, Body language, Meeting etiquette (targeted at young professionals who are just entering business environment), Introduction to Ethics in engineering and ethical reasoning, rights and responsibilities.

Unit 04 : Interpersonal relationship: (4 Hrs)

A) Team work, Team effectiveness, Group discussion, Decision making – Team Communication. Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team Development, Team Problem Solving, Building the team dynamics. Multicultural team activity.

B) Group Discussion- Preparation for a GD, Introduction and definitions of a GD, Purpose of a GD, Types of GD, Strategies in a GD, Conflict management, Do's and Don'ts in GD

Unit 05 : Leadership skills: (2 Hrs)

Leaders' role, responsibilities and skill required - Understanding good Leadership behaviors, Learning the difference between Leadership and Management, Gaining insight into your Patterns, Beliefs and Rules, Defining Qualities and Strengths of leadership, Determining how well you perceive what's going on around you, interpersonal Skills and Communication Skills, Learning about Commitment and How to Move Things Forward, Making Key Decisions, Handling Your and Other People's Stress, Empowering, Motivating and Inspiring Others, Leading by example,effective feedback.
Unit 06 : Other skills: (2 Hrs) A) Time management- The Time management matrix, apply the Pareto Principle (80/20 Rule) to time management issues, to priorities using decision matrices, to beat the most common time wasters, how to plan ahead, how to handle interruptions , to maximize your personal effectiveness, how to say "no" to time wasters, develop your own individualized plan of action. B) Stress management- understanding the stress & its impact, techniques of handling stress. C) Problem solving skill, Confidence building Problem solving skill, Confidence building

203152: Project Based Learning		
Teaching Scheme **Practical** : 04 Hrs/ Week	**Credits** **PR**:02	**Examination Scheme** [Marks] **Term Work**: 50 Marks
Preamble: For better learning experience, along with traditional classroom teaching and laboratory learning, project-based learning has been introduced to motivate students to learn by working in a group cooperatively to solve a problem. Project-Based Learning (PBL) is a student-centered and experimental approach to education promoting 'deeper learning' through active exploration of real-world problems and challenges. A central goal of PBL is to facilitate the deeper learning process and support students' acquisition of complex cognitive competencies, e.g., rigorous content knowledge and critical thinking skills. The PBL engages students in the problem definition, design process, contextual understanding, and systems thinking approaches. In the PBL approach, learning based on memorization is de-emphasized and more emphasis is given on understanding and application of engineering design principles. Because of frequent assessments throughout the course, plagiarism can be more easily controlled.		
Course Objectives: Objectives of this course are to 1. Impart technical knowledge and skills, and develop deeper understanding to integrate knowledge and skills from various areas. 2. Build critical thinking, problem-solving, communication, collaboration and creativity, and innovation amongst students 3. Make students aware of their own academic, personal, and social developments. 4. Develop habits of self-evaluation and self-criticism, against self-competency and trying to see beyond own ideas and knowledge		
Course Outcomes: At the end of this project-based learning, students will be able to **CO1:** Identify, formulate, and analyze the simple project problem. **CO2:** Apply knowledge of mathematics, basic sciences, and electrical engineering fundamentals to develop solutions for the project. **CO3:** Learn to work in teams, and to plan and carry out different tasks that are required during a project. **CO4:** Understand their own and their team-mate's strengths and skills. **CO5:** Draw information from a variety of sources and be able to filter and summarize the relevant points. **CO6:** Communicate to different audiences in oral, visual, and written forms.		

303141: Industrial and Technology Management

Teaching Scheme			Credits		Examination Scheme	
Theory	03	Hr/Week	**TH**	03	**ISE**	30 Marks
					ESE	70 Marks

Course Objectives: This course aims to

- Possess knowledge of types of business organizations.
- Explore the fundamentals of Industrial economics and Management.
- Understand the basic concepts of Technology management and Quality management.
- Analyze and differentiate between marketing management and financial management.
- Recognize the importance of Motivation, Group dynamics, Teamwork, leadership skill and entrepreneurship.
- Explain the fundamentals of Human Resource management.
- Identify the importance of Intellectual property rights and understand the concept of patents, copy rights and trademarks.
- Software programming to construct and use simple mathematical model.
- Ability to carry out basic manufacturing and testing procedure.

Course Outcomes: At the end of this course, student will be able to

CO1	Differentiate between different types of business organizations and discuss the fundamentals of economics and management.
CO2	Explain the importance of technology management and quality management.
CO3	Explain the importance of IPR and role of Human Resource Management.
CO4	Understand the importance of Quality and its significance.
CO5	Describe the characteristics of marketing & its types and overview of financial Management.
CO6	Discuss the qualities of a good leader and road map to Entrepreneurship.

Unit 01	**Introduction to Management and Economics**	**07 hrs**

A) Management: Meaning, scope, function, and importance of management. Difference between administration and management.

B) Industrial Economics: Definition of economics, Demand and Supply concept, Demand Analysis. Types of Demand, Determinants of Demand, Law of demand and supply, Elasticity of demand and supply, Law of Diminishing Marginal utility, Demand forecasting: Meaning and methods.

C) Business Organizations: Line organization, Staff organization and Functional Organization, (Project, Matrix, Committee Organization.)

D) Business Ownership and its Types: Types of business ownership, Sole proprietorship, Partnership (Act 1934), LLP (Limited Liability Partnership) (Act 2008). One person company, Joint Stock Company: Public Limited and Private Limited, Public Sector Undertaking (PSU).

Unit 02	Technology Management	05 hrs
A) Technology Management: Definition of technology Management and its relation with society, development, application and its scope. **B) Classification of Technology Management:** Classification of technology management at various levels- its importance on National Economy, Ethics in technology management, Critical factors in technology management.		
Unit 03	**Intellectual Property Rights (IPR) & Human Resource Management (HRM)**	**06 hrs**
A) Introduction to Intellectual Property Rights (IPR): Meaning of IPR, Different forms of IPR, Patents, Criteria for securing Patents. Patent format and structure, Copy rights and trademark (Descriptive treatment only). **B) Human Resource Management:** Introduction, importance, scope, HR planning, Recruitment, selection, training and development, Performance management.		

Unit 04	Quality Management	06 hrs
A) Quality Management: Definition of quality, continuous improvement, Types of quality, Quality of design, Seven QC Tools, Poka Yoke (Mistake Proofing), Quality circles, Kaizen. TQM, 5S (Case study of Toyota, descriptive treatment). Six-Sigma. Basic software used for inventory management and quality management like Zoho inventory, Oracal, Netsuite, Vyapar, Quick book commerce. **B) Quality Management Standards (Introductory aspects only):-** The ISO9001:2000 Quality Management System Standard-The ISO14001:2004, ISO26000, ISO 10004:2012, ISO 9001:2012 ISO 9001:2016, Environmental Management System Standard.		
Unit 05	**Marketing and Financial Management**	**06 hrs**
A) **Marketing Management**: Meaning of Market, Marketing strategy, motives, market characteristics and its types, Perfect Competition, Monopoly, Monopolistic completion and Oligopoly. New product development, Product life cycle, Marketing and selling, methods of selling, marketing planning. Market survey and market research, Online Marketing (Digital Marketing). B) **Financial Management:** Definition of financial management, cost Concept, Types of costs (Fixed, Variable, average, marginal, and total cost) and methods of costing price, capital. Debit, credit, Profit and loss statement, Balance sheet, Depreciation Analysis, causes and significance, methods of calculation of depreciation, Taxation system, and type of taxes.		
Unit 06	**Motivational Theory and Entrepreneurship**	**06 hrs**
A) Motivation: Introduction to Motivation, theories of work motivation, Content Theories: Maslow's Hierarchy of Needs, Herzberg's Two factor theory, McClelland's Three Needs Theory, McGregor's Theory X and Theory Y. Process Theories: Adam's Equity Theory, Vroom's Expectancy Theory, Taylor's Motivation Theory **B) Leadership:** Importance of Leadership, Types of Leadership: Autocratic, Democratic and Laissez-Faire Leadership, qualities of good Leader. Group dynamics: Types and interactions of groups, stages of group dynamics: Norming, Storming, Forming, Performing and Adjourning. **C) Entrepreneurship**: Importance and limitations of rational decision making, Decision making under certainty, uncertainty and risk. Incentives for small business development, Government policies and incentives, Case study on Small scale industries in India.		

303146: Seminar						
Teaching Scheme			**Credits**		**Examination Scheme**	
SEM	01	Hr/Week	**SEM**	01	**TW**	50 Marks

Course Objectives:

1. Gaining of actual knowledge (terminology, classification, methods and advanced trends)
2. Learning fundamental principles, generalization or theories.
3. Discussion and critical thinking about topics of current intellectual importance.
4. Developing specific skills, competencies, and points of view needed by professionals in the field most closely related to the course.

Course Outcomes: At the end of this course, student will be able to

CO1	Relate with the current technologies and innovations in Electrical engineering.
CO2	Improve presentation and documentation skill
CO3	Apply theoretical knowledge to actual industrial applications and research activity.
CO4	Communicate effectively.

Seminar should be based on a detailed study of any topic related to the advance areas/applications of Electrical Engineering. Topic should be related to Electrical Engineering. However, it must not include contents of syllabus of Electrical Engineering. It is expected that the student should collect the information from journals, internet and reference books in consultation with his/her teacher/mentor, have rounds of discussion with him/her. The report submitted should reveal the student assimilation of the collected information. Mere compilation of information from the internet and any other resources is discouraged.

Format of the Seminar report should be as follows:

1. The report should be neatly typed on white paper. The typing shall be with normal spacing, Times New Roman (12 pt) font and on one side of the paper. (A-4 size).
2. Illustrations downloaded from internet are not acceptable.
3. The report should be submitted with front and back cover of card paper neatly cut and bound together with the text.
4. Front cover: This shall have the following details with Block Capitals
   a. Title of the topic.
   b. The name of the candidate with roll no. and Exam. Seat No. at the middle.
   c. Name of the guide with designation below the candidate's details.
   d. The name of the institute and year of submission on separate lines at the bottom.
5. Certificate from institute as per specimen, Acknowledgement and Contents.
6. The format of the text of the seminar report should be as follows
   I. The introduction should be followed by literature survey.
   II. The report of analytical or experimental work done, if any.
   III. The discussion and conclusions shall form the last part of the text.
   IV. They should be followed by nomenclature and symbols used.
   V. The Reference Books are to be given at the end.
7. The total number of typed pages, excluding cover shall from 20 to 25 only.
8. All the pages should be numbered.
9. Two spiral bound copies of the seminar report shall be submitted to the college.
10. Candidate shall present the seminar before the examiners.
11. The total duration of presentation and after-discussion should be about 30 minutes.

The assessment for the subject shall be based on:

1. Content. 2. Presentation 3. Report

303152: Internship						
Teaching Scheme			**Credits**		**Examination Scheme**	
IN	04	Hr/Week	**IN**	04	**TW**	100 Marks

Preamble

Internship is a short-term industrial working experience for the students. The internship aims at providing entry-level exposure to a particular industry. It is expected that students should spend time working on relevant projects or part of the project and acquire learning about the field, along with developing industry connections, and employability skills.

Course Objectives:

1. Encourage and provide opportunities to the students to acquire professional learning experiences.
2. Empower students to relate and then apply the theoretical knowledge in real-life industrial situations.
3. Provide exposure for handing and using various tools, measuring instruments, meters, and technologies used in industries.
4. Enable students to develop professional and employability skills and expand their professional network.
5. Empower students to apply the internship learnings to the academic courses and project completions.
6. Impart professional and societal ethics in students through the internship.
7. Make students aware of social, economic, and administrative aspects influencing the working environment of the industry.

Course Outcomes: At the end of this course, student will be able to

CO1	Understand the working culture and environment of the Industry and get familiar with various departments and practices in the industry.
CO2	Operate various meters, measuring instruments, tools used in industry efficiently and develop technical competence.
CO3	Apply internship learning in other course completions and final year project management, i.e. topic finalization, project planning, hardware development, result interpretations, report writing, etc.
CO4	Create a professional network and learn about ethical, safety measures, and legal practices.
CO5	Appreciate the responsibility of a professional towards society and the environment.
CO6	Identify career goals and personal aspirations.

Guidelines: The guidelines related to the internship are given below.

Duration: Guidelines related to duration are as follows.

1. The internship should be started after semester 5 and should be completed before the commencement of semester 6.
2. It should be for at least 4 to 6 weeks.
3. It should be assessed and evaluated in semester 6.

403145: Project Stage I						
Teaching Scheme			**Credits**		**Examination Scheme**	
SEM/PW/IN	4	Hrs./Week	SEM/PW/IN	2	ORAL	50
					Term work	50

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Preamble:

Project is an important part of the engineering curriculum covered in the final year. It is divided into Project Stage I and Project Stage II at Semesters I and II of the Final Year. This project is a substantial piece of work that will require creative activity and original thinking. The project aims to provide students with a transitional experience from the academic world to the professional world. The objectives, outcomes, and guidelines for Project Stage I are given below.

Course Objectives:

The objectives of this course are to:

1. Provide an opportunity to learn new software, interdisciplinary theory, concepts, technology, etc. not covered in earlier subjects.
2. Empower students to use engineering knowledge and skills learned in previous courses to deliver a product that has passed through the design, analysis, testing, and evaluation.
3. Encourage multidisciplinary project work through the integration of knowledge.
4. Allow students to develop problem-solving, analysis, synthesis, and evaluation skills.
5. Encourage teamwork.
6. Improve students' communication skills by asking them to produce both a professional report and to give an oral presentation.

Course Outcomes:

Course outcomes can be different for the different projects undertaken by the student groups. However, in general, the course outcomes for Project Stage-I can be stated as follows.
At the end of this course, students should be able to:
CO1:Define the project problem statement and identify the scope of the project.
CO2:Search the appropriate research papers, standards and e-resources and write a literature survey.
CO3:Identify tools, techniques, methods, concepts, measuring devices, and instruments required for the project to define the methodology of the project.
CO4:Justify the selection of electrical, electronic and mechanical components for the project prototyping
CO5:Simulate or develop a system for software or hardware verification.
CO6:Write a project report with proper interpretation of results.

Guidelines for students:

1. Form a group of 3-4 students.
2. Select a project problem statement based on an industrial or societal issue and ideate on it.
3. Research on the project topic through existing theories, literature, technology, patents, etc.
4. Define objectives, scope, and outcomes of the project in the 1st presentation.
5. Maintain a notebook to keep records of all the meetings, discussions, notes, etc. This is to be done by the individual student.
6. Some of the parameters mentioned in the above table will be evaluated and assessed at the group

403152: Project Stage II						
Teaching Scheme			**Credits**		**Examination Scheme**	
SEM/PW/IN	12	Hrs./Week	SEM/PW/IN	6	ORAL	50
					Termwork	100

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Preamble:

Project is an important part of the engineering curriculum covered in the final year. It is divided into Project Stage I and Project Stage II in Semesters I and II of the Final Year. This project is a substantial piece of work that will require creative activity and original thinking. The project aims to provide students with a transitional experience from the academic world to the professional world. The objectives, outcomes, and guidelines for Project Stage II are given below.

Course Objectives:

The objectives of this course are to:
1. Provide an opportunity to learn new software, interdisciplinary theory, concept, technology, etc. not covered in earlier subjects
2. Empower students to use engineering knowledge and skills learned in previous courses to deliver a product that has passed through the design, analysis, testing, and evaluation
3. Encourage multidisciplinary project work through the integration of knowledge
4. Allow students to develop problem-solving, analysis, synthesis, and evaluation skills.
5. Encourage teamwork.
6. Improve students' communication skills by asking them to produce both a professional report and to give an oral presentation
7. Exposed to the project management skills and ethical practices in project

Course Outcomes:

Course outcomes can be different for the different projects undertaken by the student groups. However, in general, the course outcomes for Project Stage-II can be stated as follows.
At the end of this course, students should be able to:
CO1: Identify tools, techniques, methods, concepts, measuring devices, and instruments required for the project to define the methodology of the project
CO2: Justify the selection of electrical, electronic and mechanical components for the project prototyping
CO3: Select the appropriate testing method for system performance evaluation
CO4: Interpret results obtained by simulation, and hardware implementation and decide on further action or write a conclusion
CO5: Write a project report and research paper on the project work

Savitribai Phule Pune University Bachelor of Computer Engineering **Program Outcomes (POs)**		
Learners are expected to know and be able to–		
PO1	**Engineering knowledge**	Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems.
PO2	**Problem analysis**	Identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics natural sciences, and Engineering sciences.
PO3	**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.
PO4	**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.
PO5	**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.
PO6	**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.
PO7	**Environment and Sustainability**	Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.

Savitribai Phule Pune University Second Year of Electronics / E & Tc Engineering (2019 Course) 204189: Electronic Skill Development Lab		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Practical: 02 hrs. / week	**01**	**Term Work: 25 Marks**
Prerequisite Courses, if any: Basic Electronics Engineering, Fundamentals of Programming, Open-source electronics platform based on easy-to-use hardware and software (preferably Arduino)		
Companion Course, if any: Any one of the following: 1. Jeremy Blum PCB tutorials. 2. OrCAD basic Tutorials.		

List of Assignments [Min. 10 has to be completed]	
Group A: Application of Electronics Principles in Practice	
1.	Electronic Components and Connections (Bread boarding).
2.	Introduction and applications using Arduino and micro python.
3.	Using Sensors & Actuators and their interfacing with Arduino (Motor Driver with relays , Reversible motor, SSR).
4.	Wireless Connectivity to Arduino .
Group B: Hardware Design, Fault Finding, Testing, Repair and Measuring	
5.	Drawing layout of PCB using PCB design software.
6.	Single layer PCB design for a simple electronic circuit.
7.	Using test equipment for testing, fault finding & repair etc.
8.	Use of measuring equipment for measurement of signals.
9.	Using Simulation software for design & testing of electronic circuits.
Group C: Assembly, SMD Overview, Power Budgeting, Batteries (Lead Acid , LiPo), Solar	
10.	Assemble and utilize mechanical parts such as DC Motor, AC Motor, Stepper motor Solenoid, sensors etc., connect and assemble mechanical parts to form a working unit , Wire and form cables. industry standards
11.	Assemble and use various types of parts and surface mounted devise parts, Assemble parts to standard determined by IPC-A-610, Work to correct sequences and tolerances, Accurately solder components using lead free solder to comply with
12.	Calculation of Power budget for an electronic circuit.
13.	Study & Use of various types of Batteries.

Savitribai Phule Pune University Second Year of Electronics / E & Tc Engineering (2019 Course) 204199: Employbility Skills Development		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Theory: 02 hrs. / week **Practical: 02 hrs. / week**	**02 + 01 = 03**	**Term work: 50 Marks**
Prerequisite Courses, if any: --		
Companion Course, if any: --		
Course Objectives: • Develop good communication skills – both oral as well as written. • Encourage creative and critical thinking among students. • Nurture collaborative behavior to work efficiently in groups.		
Course Outcomes: On completion of the course, learner will be able to - CO1: Define personal and career goals using introspective skills and SWOC assessment. Outline and evaluate short-term and long-term goals. CO2: Develop effective communication skills (listening, reading, writing, and speaking), self- management attributes, problem solving abilities and team working & building capabilities in order to fetch employment opportunities and further succeed in the workplace. CO3: Be a part of a multi-cultural professional environment and work effectively by enhancing inter-personal relationships, conflict management and leadership skills.		

Savitribai Phule Pune University Second Year of Electronics / E & Tc Engineering (2019 Course) 204200: Project Based Learning		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Practical: 04 hrs. / week	**02**	**Term Work: 50 Marks**

Preamble:

The main stream engineering education follows traditional classroom teaching, in which the major focus is mainly on the lecturer and the student has very little (if any) choice on the learning process. However rapid development in engineering and technology requires adopting a teaching approach that would assist students not only in developing a core set of industry relevant skills, but also enable them to adapt to changes in their professional career.

PBL is an approach to design Electronic Systems Curricula for making electronics more appealing to students. Since electronics is an important grounding for other disciplines (computer science, signal processing, and communications), this approach proposes the development of multidisciplinary projects using the PBL strategy for increasing the attractiveness of the curriculum. Promoting electronics as grounding for other disciplines can be done by defining a new curriculum that includes practical courses (laboratories) in which the students develop whole systems involving multidisciplinary knowledge.

Course Objectives: On completion of the course, learner will be able to -

- To emphasize project-based learning activities that are long-term, interdisciplinary and student-centric.
- To inculcate independent and group learning by solving real world problem with the help of available

Second Year of Electronics / E & Tc Engineering (2019 Course)

204190: Mandatory Audit Course - 3

Teaching Scheme:	Credit	Examination Scheme:
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List of Courses to be opted (Any one) under Mandatory Audit Course 3

- Technical English For Engineers
- Ecology and Environment
- Ecology and Society
- German I
- Science, Technology and Society
- Introduction to Japanese Language and Culture

GUIDELINES FOR CONDUCTION OF AUDIT COURSE

In addition to credits courses, it is mandatory that there should be audit course (non-credit course) from second year of Engineering. The student will be awarded grade as AP on successful completion of audit course. The student may opt for two of the audit courses (One in each semester). Such audit courses can help the student to get awareness of different issues which make impact on human lives and enhance their skill sets to improve their employability. List of audit courses offered in the semester is provided in the curriculum. Student can choose one of the

304190: Skill Development		
Teaching Scheme:	**Credit**	**Examination Scheme:**
Practical: 02 hrs. / week	**01**	**Term work: 25 Marks**

Prerequisite Courses, if any:

1. Basics of Electronics Components
2. Working of Operational amplifier
3. Basics of Electronics measurement instruments and Tools

Companion Course, if any: --

Course Objectives:

- To build and upgrade practical knowledge of .an individual.
- To make students Employable with required skill set.
- To promote youth work to assist "Make in India" initiative.
- To grow and build confidence among students on specific skill sets.
- To cultivate Entrepreneur mindset after getting required experience.
- To improve professional skills such as moral/ethics/team work/communication skill/lifelong learning etc.

Course Outcome: After Successfully completing the course,

CO1: Student should recognize the need to engage in independent and life-long learning in required skill sets.

CO2: Student needs to experience the impact of industries on society by visiting different industries and understand the importance of industrial products for analog and digital circuits and systems.

CO3: Student has to make use of the modern electronic and IT Engineering Tools and Technologies for solving electronic engineering problems.

CO4: Student would be able to communicate effectively at different technical and administrative levels.

Fourth Year of E & Tc Engineering (2019 Course) 404193: Innovation and Entrepreneurship		
Examination Scheme:	**Credit**	**Examination Scheme:**
Tutorial: 02 Hrs. / Week	**02**	**Term Work: 50 Marks**

Prerequisite Courses, if any:

1. Project Management

Companion Course, if any:

Course Objectives:

1. To know innovation and entrepreneurship.
2. To be trained in design thinking.
3. To comprehend idea generation.
4. To gain knowledge of starting a venture.
5. To study about patents and patent filing.
6. To become skilled at digital marketing

Course Outcomes: On completion of the course, learner will be able to

CO1: Understand Innovation, Entrepreneurship and characteristics of an entrepreneur.

CO2: Develop a strong understanding of the Design Process and its application in variety of business settings.

CO3: Generate sustainable ideas.

CO4: Explore various processes required to be an entrepreneur.

CO5: Understand patents and its process of filing.

CO6: Choose and use appropriate social media for marketing.

SPPU NIRBHAY KANYA ABHIYAN

Name of event: **Expert lecture and Training on Self Defense for Women**

Date of event: 21/03/2024

Time of event: : 10:00 am

Academic Year: 2023-24

Location: Board Room: B Building Hall Room No 514

No. of Girl Student / teaching / Non-teaching present or attended Event: 180

Organizer: STUDENT DEVELOPMENT CELL *TSSMs_BSCOER_ Narhe_Pune.*

Activity Information:

STUDENT DEVELOPMENT CELL *TSSMs_BSCOER_* had organized **Expert lecture and Training on Self Defense for Women** on 21ST February, 2024 at B Bulding Hall R.No 514.The experts invited for the event were Mr. Naraesh Mhetre and Mrs Pllavi Patil from Universal fighting and Fitness Club, Pune. The program started with the guidance of Dr. G.A.Hinge principal BSCOER Narhe. Then Mr. Naraesh Mhetre addressed the girl students about the necessity of self-defence for women . He also mentioned that we should take care of ourselves and the society. The experts then started the training to all the girl students and explained the different defence techniques with the help of demonstration. Total 180 participants attended the training including female staff, Prof. Ambhaikar S.A, Prof Bhale P.P. were present for the activity. Prof. R.N.Pote concluded the event.

. Outcome of this Activity:

Self-defense training is a life skill that helps girls to be more aware of their surroundings and be prepared for the unexpected at any time. Through the self-defense training, the girls become confident psychologically, intellectually and physically strong enough to protect themselves in the event of distress


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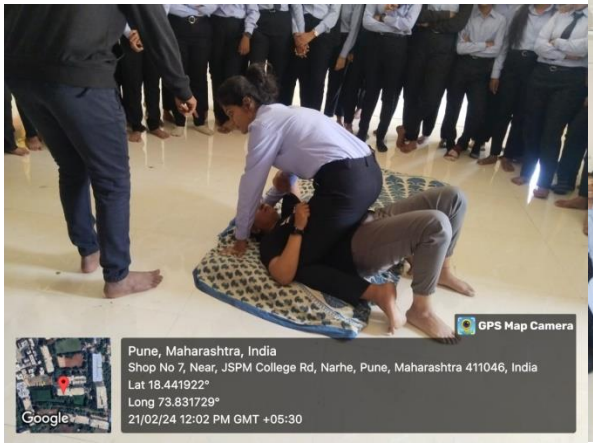
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Glimpses of Self Defence Training

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