

TABLE -1 First Engineering _Structure for Semester-I

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credits			
		Theory	Practical	Tutorial	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
107001	Engineering Mathematics-I	03	--	01	30	70	25	--	--	125	03	--	01	04
107002/ 107009	Engineering Physics / Engineering Chemistry	04	02	--	30	70	--	25	--	125	04	01	--	05
102003	Systems in Mechanical Engineering	03	02	--	30	70	--	25	--	125	03	01	--	04
103004 / 104010	Basic Electrical Engineering / Basic Electronics Engineering	03	02	--	30	70	--	25	--	125	03	01	--	04
110005/ 101011	Programming and Problem Solving / Engineering Mechanics	03	02	--	30	70	--	25	--	125	03	01	--	04
111006	Workshop [@]	--	02	--	--	--	--	25	--	25	--	01	--	01
Total		16	10	01	150	350	25	125	--	650	16	05	01	22
101007	Audit Course 1 ^{&}	02	Environmental Studies-I											

Induction Program : 2 weeks at the beginning of semester-I and 1 week at the beginning of semester-II

TABLE -2 First Engineering _Structure for Semester-II

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credits			
		Theory	Practical	Tutorial	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
107008	Engineering Mathematics-II	04	--	01	30	70	25	--	--	125	04	--	01	05
107002/ 107009	Engineering Physics/ Engineering Chemistry	04	02	--	30	70	--	25	--	125	04	01	--	05
103004 / 104010	Basic Electrical Engineering / Basic Electronics Engineering	03	02	--	30	70	--	25	--	125	03	01	--	04
110005/ 101011	Programming and Problem Solving / Engineering Mechanics	03	02	--	30	70	--	25	--	125	03	01	--	04
102012	Engineering Graphics ^Ω	01	02	01	--	50	25	--	--	75	01	01	--	02
110013	Project Based Learning [§]	--	04	--	--	--	25	50	--	75	--	02	--	02
Total		15	12	02	120	330	75	125	--	650	15	05	02	22
101014	Audit Course 2 ^{&}	02	Environmental Studies-II											
107015		--	Physical Education-Exercise and Field Activities											

SE Civil

Savitribai Phule Pune University, Pune														
SE(Civil Engineering) 2019 Course														
(With effect from Academic Year 2020-21)														
Semester-III														
Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit			
		Theory	Practical	Tutorial	IN-Sem	End-Sem	TW	PR	OR	Total	TH	PR	TUT	Total
201001	Building Technology and Architectural Planning	03	-	-	30	70	--	-	-	100	03	--	--	03
201002	Mechanics of structure	03	-	-	30	70	-	-	-	100	03	-	-	03
201003	Fluid Mechanics	03	-	-	30	70	-	-	-	100	03	-	-	03
207001	Engineering Mathematics III	03	--	--	30	70	--	--	--	100	03	-	--	03
207003	Engineering Geology	03	-	-	30	70	-	-	-	100	03	-	-	03
201004	Building Technology and Architectural Planning Lab	-	04	-	-	-	50	-	-	50	-	02	-	02
201005	Mechanics of structure Lab	-	04	-	-	-	-	-	50	50	-	02	-	02
201006	Fluid Mechanics Lab	-	02	-	-	-	-	-	50	50	-	01	-	01
207002	Engineering Mathematics III Tutorial	--	--	01	--	--	25	--	--	25	--	-	01	01
207004	Engineering Geology Lab	-	02	-	-	-	25	-	-	25	-	01	-	01
201007	Audit Course 1 Awareness to civil Engineering Practices / Road Safety Management / Foreign Language	--	01	-	-	Grade	-	-	-	Grade	--	--	-	--
Total		15	13	01	150	350	100	--	100	700	15	06	01	22

Abbreviations:
H : Theory TW: Term Work PR : Practical OR: Oral TUT : Tutorial

Note: Interested students of S.E. (Civil) can opt any one of the audit course from the list of audit courses prescribed by BoS (Civil Engineering)

Note: The Underlined portion of the syllabus will be covered by video lectures/ on-line lectures/ flip classroom, self study, NPTEL course lecture and/or using relevant ICT technique

Savitribai Phule Pune University, Pune
SE(Civil Engineering) 2019 Course
 (With effect from Academic Year 2020-21)

Semester-IV

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit			
		Theory	Practical	Tutorial	IN-Sem	End-Sem	TW	PR	OR	Total	TH	PR	TUT	Total
201008	Geotechnical Engineering	03	-	-	30	70	--	-	-	100	03	--	--	03
201009	Survey	03	-	-	30	70		-	-	100	03	-	-	03
201010	Concrete Technology	03	-	-	30	70	-	-	-	100	03	-	-	03
201011	Structural Analysis	03	-	--	30	70	-	-	-	100	03	-	--	03
201012	Project management	03	--	-	30	70	--	--	--	100	03		-	03
201013	Geotechnical Engineering Lab	-	02	-	-	-	-	-	50	50	-	01	-	01
201014	Survey Lab	-	04	-	-	-	-	50	-	50		02		02
201015	Concrete Technology Lab	-	02	-	-	-	25		-	25	-	01	-	01
201016	Structural Analysis Tutorial	--	-	01	--	--	25	-	-	25	--	-	01	01
201017	Project Based Learning	-	04	-	-	-	50		-	50	-	02	-	02
Total		15	12	01	150	350	100	50	50	700	15	06	01	22

Abbreviations:

TH : Theory TW: Term Work PR : Practical OR: Oral TUT : Tutorial

Note: The Underlined portion of the syllabus will be covered by video lectures/ on-line lectures/ flip classroom, self study, NPTEL course lectures and/or using relevant ICT technique

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 as 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.)

Types of drawings in different construction projects. Contract agreement & other documents in different construction projects.

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 also in 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

CO4: Identify the safety issues for a road and make use of IRC's road safety manual for conducting road safety audit.

Course Contents (During 1hr Practical Session per week)

Unit I: Existing Road Transport Scenario

(02 Hours.)

Introduction, national & international statistics related to road transport. Factors responsible for increase in vehicle growth. Share of public transport: importance and current scenario (national & international)

Suggestion for effective content delivery: Displaying updated and authentic statistics & real time scenario images during the session.

Unit II: Road Accidents & its Investigation

(03 Hours.)

Definition of road accident. National & international statistics related to road accidents. Causes of road accident. Remedies / Measures for control road accidents. Methods for accident investigation. Condition diagram & collision diagram. Black spots & its identification based on accident data.

Suggestion for effective content delivery:

- i.] Activity related to drawing condition & collision diagram based on actual accident data.
- ii.] Activity related to identification of black spots based on actual accident data

Unit III: Motor Vehicle Act & Central Motor Vehicle Rules (03 Hours.)

The Motor Vehicle Act of 1988. Central Motor Vehicle Rules (CMVR) of 1989. Amendments to CMVR – 2017 & 2019.

Suggestion for effective content delivery:

- i.] Guest lecture by RTO Officer / Traffic Police Officer.
- ii.] Public awareness campaign

Unit IV: Road Safety Audit (RSA) (04 Hours.)

Introduction & importance of RSA. Methodology, phases and checklists for Road Safety Audit as per IRC SP: 88 – 2010 (Manual on Road Safety Audit)

Suggestion for effective content delivery:

Mini project – Conducting Road Safety Audit on minimum 2 km (both directions included) road stretch in the nearby vicinity.

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

- 1. Guest Lectures.
- 2. Visits and reports.
- 3. Assist government authorities like Municipal corporations, RTO in Road Safety Audits
- 4. Mini Project

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

- 1. Written Test
- 2. Practical Test
- 3. Presentation
- 4. Report

Savitribai Phule Pune University, Pune
Second Year Civil Engineering (2019 Course)

201017 Project Based Learning

Credits: 02

Teaching Scheme:

Practical : 04hrs/week

Examination Scheme:

Term Work: 50 Marks

Preamble:

Project Based Learning (PBL) was introduced in curriculum of First Year Engineering in Semester II (Course code- 110013) in 2019 course. In that course, students in group might have planned, managed and completed a task/ project/ activity which addressed the stated problem. In a continuation with this, PBL is introduced in core course of Civil Engineering. PBL demonstrates the power of student projects to develop college, community connections, applied research skills and higher levels of student thinking. PBL is a dynamic approach to teaching in which students explore real-world problems and challenges simultaneously developing 21st century Civil Engineering skills while working in collaborative groups. The aim of this course is to demonstrate the important attributes like communication, presentation, organization, time management, research, inquiry, self-assessment, group participation, leadership and critical thinking. Performance assessed on an individual basis and takes into account the quality of task/project/activity completed, the depth of content understanding demonstrated and the contributions made to the ongoing process of project realization. PBL allows students to reflect upon their own ideas and opinions and make decisions that affect project outcomes and the learning process in general.

Course Objectives:

1. To engage students in constructive learning environment and develop self-learning abilities.
2. To develop critical thinking and solving civil engineering problems by exploring and proposing sustainable solutions.
3. To integrate knowledge and skills from civil and other engineering areas.
4. To develop professional skills and project management.

Course Outcomes:

After completion of course the students will be able to

1. Identify the community/ practical/ societal needs and convert the idea into a product/ process/ service.
2. Analyse and design the physical/ mathematical/ ICT model in order to solve identified problem/project.
3. Create, work in team and applying the solution in practical way to specific problem.

Course Content

- Introduction to Project Based Learning, Traditional vs. Cognitive Learning, Why PBL? , Principles of Problem Design Seven Steps of Problem Design, Online PBL, Applications and Research Trends Case Studies in Civil Engineering.

Group Structure:

- Working in mentor – monitored groups. The students identify, plan, manage and complete a task/ project/ activity which address the stated problem related to civil engineering.
- There should be team/group of maximum four students.
- A supervisor / mentor faculty teacher assigned to individual groups.

Selection of Project/Problem:

At start of course revision of PBL, significance, guidelines and evaluation parameters should be discussed commonly at start of semester. In this session basics PBL, in brief research methodology points relevant to PBL, sample case studies related to civil engineering and brief information about patent, copy right and publications should be given.

Selection of project/problem related to any technical aspect of civil engineering is recommended or if any project/problem selected in first year engineering related to civil engineering can be continued if enough potential is there. Give preference to select project/problem related to solving any problem/ issue for which suitable model can be developed or software can be used. The project/problem selected could have different alternative solutions which could be theoretical, practical, working model, demonstration or software analysis. The project/problem selected may have multi-disciplinary approach to get the solution. Problem needs to refer back to a particular practical, scientific, or technical domain. It is recommended to include hands-on activities, organizational and field visits, expert consultation to make students aware with current use of technologies. Proper representation of project/problem, course work and report on the results and conclusion is important for assessment of course.

Assessment:

The institution/head/mentor is committed to assessing and evaluating both students' performance and program effectiveness. Progress and review of PBL is monitored regularly on weekly basis. It is recommended to appoint one teaching faculty as a mentor per group/ batch and it will be duty of mentor to perform monitoring and continuous assessment of individual students as well as entire group for their performance. College/ Department is required to provide necessary assistance. It is the responsibility of students to follow guidelines of their group mentor, maintain self-discipline, authentic collaboration, peer learning and personal responsibility, motivation and adopt interactive learning environment. The institution/department should support students in this regard through guidance/orientation programs and the provision of appropriate resources and services. Supervisor/mentor and Students must actively participate in assessment and evaluation processes. Intermittent review and assessment of each group should be done after six weeks from the start of the semester. Each group has to submit their work at end of semester during the end review. Group may demonstrate their knowledge and skills through presentation by developing a model/product/poster and report. Individual assessment for each student (Understanding individual capacity, role and involvement in the project). Group assessment (roles defined, distribution of work, intra-team communication and togetherness).

Evaluation and Continuous Assessment:

Prepare "**PBL Log Book**" which includes record of activities performed and evaluation carried out with appropriate remarks. Maintain regular record on weekly basis. Records and documents must also be maintained at student level. Continuous assessment sheet must be prepared by each faculty

which consists assessment made on weekly basis also performance made during mid-review and end-review. PBL log book must be maintained as a record even after completion of semester. It will serve as document which will reflect the punctuality, accountability, technical writing ability and project workflow.

Recommended parameters for assessment, evaluation and weightage:

Evaluation criteria and respective percentage weightage for marks.

1. Idea Inception = 5%
2. Solution provided/ final product at end of course = 50% (Individual assessment and team assessment).
3. Documentation in the form of PBL report (typed, hard copy) = 15%
4. Presentation/ Demonstration of model/ PPT/ poster = 10%
5. Participation/ involvement in group activity =10%
6. Publication/ participation on technical platform = 10%

Course assessment rubrics can be prepared based on the given evaluation parameters for excellent, moderate, acceptable and not acceptable.

References:

1. M. Savin-Baden and C. Howell Major, Foundations of Problem-based Learning. McGraw-Hill Education, 2004
2. T. J. Newby, D. A. Stepich, J. D. Lehman and J. D. Russell, Instructional technology for teaching and learning: Designing instruction, integrating computers, and using media. Englewood Cliffs, NJ: Merrill/Prentice-Hall, 1996
3. S. N. Alessi and S. R. Trollip, Multimedia for learning: methods and development. Needham Heights, MA: Allyn& Bacon, 2001
4. Guerra, Aida, Ulseth, Ronald, Kolmos, Anette, PBL in Engineering Education: International Perspectives on Curriculum Change, Springer, 2017
5. Mahnaz Moallem Woei Hung Nada Dabbagh, The Wiley Handbook of Problem-Based Learning, Wiley, 2019
6. Jane I. Krauss, Suzanne K. Boss, Thinking Through Project-Based Learning: Guiding Deeper Inquiry.
7. John Larmer, David Ross, John R. Mergendollar, Project Based Learning (PBL) Starter Kit.
8. William N. Bender, Project-Based Learning: Differentiating Instruction for the 21st Century.
9. Bob Lenz, Justin Wells, Sally Kingston, Transforming Schools Using Project-Based Learning, Performance Assessment, and Common Core Standards.
10. Suzie Boss with John Larmer (ASCD/Buck Institute for Education), Implementing Project-Based Learning Solutions by Suzie Boss

Website for references

1. www.pblwork.org
2. www.my.pblworks.org
3. www.swayam.gov.in/nd2_ntr20_ed12/preview
4. www.schoolology.com

Format of PBL report: Sequence of pages:

- i) Front Cover Page ii) Certificate iii) Acknowledgement iv) Synopsis v) Contents vi) List of

Savitribai Phule Pune University, Pune
TE (Civil Engineering) 2019 Pattern
(With effect from Academic Year 2021-22)

SEMESTER: V

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit					
		Theory	Practical	Tutorial	IN-Sem	End-Sem	TW	PR	OR	Total	TH	TW	PR	OR	TUT	Total
301001	Hydrology and Water Resources Engineering	03	--	--	30	70	--	--	--	100	03	--	--	--	--	03
301002	Water Supply Engineering	03	--	--	30	70	--	--	--	100	03	--	--	--	--	03
301003	Design of Steel Structures	03	--	--	30	70	--	--	--	100	03	--	--	--	--	03
301004	Engineering Economics and Financial Management	03	--	--	30	70	--	--	--	100	03	--	--	--	--	03
301005	Elective I	03	--	--	30	70	--	--	--	100	03	--	--	--	--	03
301006	Seminar	--	--	01	--	--	50	--	--	50	--	--	--	--	01	01
301007	Hydrology and Water Resources Engineering Lab	--	02	--	--	--	25	--	--	25	--	01	--	--	--	01
301008	Water Supply Engineering Lab	--	02	--	--	--	--	50	--	50	--	--	01	--	--	01
301009	Design of Steel Structures Lab	--	04	--	--	--	--	--	50	50	--	--	--	02	--	02
301010	Elective I Lab	--	02	--	--	--	25	--	--	25	--	01	--	--	--	01
301011	Audit Course I: Professional Ethics and Etiquettes/ Sustainable Energy Systems	--	--	01	--	GR	--	--	--	GR	--	--	--	--	--	--
Total		15	10	02	150	350	100	50	50	700	15	02	01	02	01	21

Abbreviations: TH : Theory, TW: Term Work, PR : Practical, OR: Oral, TUT : Tutorial, GR: Grade

Elective I: 301005

S N	Course Code	Course Name
01	301005 a	Advanced Fluid Mechanics and Hydraulic Machines
02	301005 b	Research Methodology and IPR
03	301005 c	Construction Management
04	301005 d	Advanced Concrete Technology
05	301005 e	Matrix Methods of Structural Analysis
06	301005 f	Advanced Mechanics of Structures

SEMESTER-VI																
Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit					
		Theory	Practical	Tutorial	IN-Sem	End-Sem	TW	PR	OR	Total	TH	TW	PR	OR	TUT	Total
301012	Waste Water Engineering	03	--	--	30	70	--	--	--	100	03	--	--	--	--	03
301013	Design of RC Structures	03	--	--	30	70	--	--	--	100	03	--	--	--	--	03
301014	Remote Sensing and GIS	03	--	--	30	70	--	--	--	100	03	--	--	--	--	03
301015	Elective II	03	--	--	30	70	--	--	--	100	03	--	--	--	--	03
301016	Internship	--	--	--	--	--	100	--	--	100	--	04	--	--	--	04
301017	Waste Water Engineering Lab	--	02	--	--	--	--	--	50	50	--	--	--	01	--	01
301018	Design of RC Structures Lab	--	04	--	--	--	--	--	50	50	--	--	--	02	--	02
301019	Remote Sensing and GIS Lab	--	02	--	--	--	50	--	--	50	--	01	--	--	--	01
301020	Elective II Lab	--	02	--	--	--	50	--	--	50	--	01	--	--	--	01
301021	Audit Course II: Leadership and Personality Development/ Industrial Safety	--	--	01	--	GR	--	--	--	GR	--	--	--	--	--	--
Total		12	10	01	120	280	200	--	100	700	12	06	--	03	--	21

Abbreviations: TH : Theory, TW: Term Work, PR : Practical, OR: Oral and TUT : Tutorial, GR: Grade

Elective II: 301015

S N	Course Code	Course Name
01	301015 a	Advanced Engineering Geology with Rock Mechanics
02	301015 b	Soft Computing Techniques
03	301015 c	Advanced Surveying
04	301015 d	Advanced Geotechnical Engineering
05	301015 e	Architecture and Town Planning
06	301015 f	Solid Waste Management

Savitribai Phule Pune University, Pune
TE Civil (2019 Pattern) w. e. f. June 2021
301002: Water Supply Engineering

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

Pre-requisites

Fundamentals of Surveying, Building Planning and Fluid Mechanics

Course objectives

- 01 To make students understand importance of water infrastructure with respect to needs of various users.
- 02 To discuss and demonstrate the principles of water treatment plant and layout.
- 03 To inculcate and impart design principles and working of WTP components
- 04 To interpret need of contemporary issues in water treatment.

Course outcomes

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

- 01 Define identify, describe reliability of water sources, estimate water requirement for various sectors
- 02 Ascertain and interpret water treatment method required to be adopted with respect to source and raw water characteristics
- 03 Design various components of water treatment plant and distribution system.
- 04 Understand and compare contemporary issues and advanced treatment operations and process available in the market, including packaged water treatment plants.
- 05 Design elevated service reservoir capacity and understand the rainwater harvesting.
- 06 Understand the requirement of water treatment plant for infrastructure and Government scheme.

Course Contents

Unit I: Basics of Water Supply Engineering (06 Hours)

Introduction to water supply scheme: importance of water infra structure and introduction to water infrastructure in India, data collection required for implementing water supply schemes, components and layouts. Design periods, factors affecting design periods. Quantity: rate of water consumption for various purposes like domestic, industrial, institutional, commercial, fire demand and water system losses, factors affecting rate of demand, population forecasting, including numerical. Quality: physical, chemical, radioactivity and bacteriological characteristics, heavy metals. Standards as per IS 10500-2012.

Unit II: Principles of Water Treatment (06 Hours)

Water treatment: principles of water treatment operations and processes, water treatment flow sheets with respect to various sources, criteria for site selection for WTP. Aeration: principle

and concept, necessity, methods, removal of taste and odour, design of aeration fountain. Sedimentation: plain and chemical assisted, principle, efficiency of an ideal settling basin, types of sedimentation, settling velocity, types of sedimentation tanks, design of plain sedimentation tank, introduction and design of tube settlers.

Unit III: Design of Water Treatment Plant (06 Hours)

Coagulation and flocculation: necessity of coagulation, principle of coagulation, common coagulants alum and ferric salts, introduction to other coagulant aids like bentonite clay, lime stone, silicates and polyelectrolytes etc, introduction to natural coagulants, concept of mean velocity gradient and power consumption, design of flocculation chamber, design of clariflocculator. Filtration: theory of filtration, mechanism of filtration, filter materials, types: rapid, gravity, pressure filter, multimedia and dual media filters, components, under-drainage system, working and cleaning of filters, operational troubles, design of rapid sand gravity filters.

Unit IV: Introduction to Advanced Water Treatment Methods (06 Hours)

Disinfection: mechanism, factors affecting disinfection, types of disinfectants, types and methods of chlorination, break point chlorination, bleaching powder estimation. Water softening methods and demineralization: lime-soda, ion-exchange, R. O. and electrodialysis, fluoridation and defluoridation, introduction to advanced water treatment systems (nano technology), introduction to desalination and various methods of desalination

Unit V: Water Distribution System, Rain Water Harvesting and GIS (06 Hours)

Water distribution system: system of water supply: continuous and intermittent system, different distribution systems and their components, ESR: design of ESR capacity, wastage and leakage of water: detection and prevention. Rainwater harvesting: introduction, need, methods and components of domestic rainwater harvesting system. Design of roof top rainwater harvesting system, use of GIS and drone technology in water management: source, treatment and distribution

Unit VI: Water Treatment Plant for Infrastructure (06 Hours)

Introduction to Packaged WTP in townships, large commercial buildings, educational institutes, necessity (on-site water treatment), WTP for swimming pools, Building plumbing: introduction to various types of home plumbing systems for water supply and waste water disposal, high rise building plumbing, pressure reducing valves, break pressure tanks, storage tanks, building drainage for high rise buildings, various kinds of fixtures and fittings used for water saving such as water saving aerators, Government of India initiatives such as SMART city mission and AMRUT mission for improvement of infrastructure sector, service level benchmarks in urban infrastructure and introduction to Jal Jeevan Mission and its implication in rural India.

Text Books

- 01 Water Supply Engineering, S. K. Garg, Khanna Publishers, New Delhi.
- 02 Water Supply and Sanitary Engineering, G. S. Birdie and J. S. Birdie, Dhanpat Rai Publishing Company, New Delhi.

Savitribai Phule Pune University, Pune
TE Civil (2019 Pattern) w. e. f. June 2021

301006: Seminar

Teaching scheme	Credit	Examination scheme
Tutorial: 01 Hours/week	01	Term Work: 50 Marks

Pre-requisites

Fundamentals of Civil Engineering

Course objectives

- 01 Identify technical / practical problems in the field of civil engineering.
- 02 Inculcate the ability to describe, interpret and analyze technical content.
- 03 Develop competence in preparing report which will enhance critical thinking and develop the skill of technical writing along with presentation.

Course outcomes

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

- 01 Appraise the current civil engineering research / techniques / developments / interdisciplinary areas.
- 02 Review and organize literature survey utilizing technical resources, journals etc.
- 03 Evaluate and draw conclusions related to technical content studied.
- 04 Demonstrate the ability to perform critical writing by preparing a technical report.
- 05 Develop technical writing and presentation skills.

Term Work

The seminar report should contain the following. Internal guides may prepare a continuous evaluation sheet of each individual and refer as continuous assessment for term work marks.

- 01 Introduction of the topic, its relevance to civil engineering, need for the study, aims and objective, limitations.
- 02 Literature review from books, journals, conference proceedings, published reports / articles / documents. The literature review should be from published literature in the last five years.
- 03 Theoretical contents related to the chosen topic and case studies if applicable.
- 04 Concluding remarks or summary.
- 05 References

Examination: The students must prepare presentation on seminar topic and present in presence of pair of examiners through a viva-voce examination.

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

etiquette, dressing etiquettes : for interview, offices and social functions, ethical values: importance of work ethics.

Reference books

- 01 Ethics in Engineering Practice and Research, Caroline Whitbeck, Cambridge Press
 - 02 Intellectual Property Rights, Prabhuddha Ganguli, Tata Mc-Graw –Hill, New Delhi.
 - 03 Professional Ethics and Etiquette (Mastering Career Skills), Checkmark
 - 04 Professional Ethics And Human Values, A Alavudeen, Firewall
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Savitribai Phule Pune University, Pune
TE Civil (2019 Pattern) w. e. f. June 2021

301011 b: Audit Course I: Sustainable Energy Systems

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

Course objectives

- 01 To understand the impact of engineering solutions on a global, economic, environmental and societal context.
- 02 To design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

Course outcomes

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

- 01 To demonstrate an overview of the main sources of renewable energy.
- 02 To understand benefits of renewable and sustainable energy systems.

Course Contents

Unit I: Introduction and Energy Fundamentals

Sustainable energy systems: issues for the 21st century, the critical challenges for a sustainable energy future, sustainable energy system: definitions, indicators, physics of energy: laws of thermodynamics energy forms and conversion, first and second laws and efficiencies devices: heat engines, refrigerators and heat pumps instantaneous and average power.

Unit II: Introduction to Renewable Energy

Wind energy, wind turbine technologies, wind resources and modeling, energy performance and environmental impacts, economics and economic development impacts, photovoltaic: PV and BIPV technologies, solar resources and modeling, energy performance and environmental impacts, economics and net metering.

Unit III: Biomass Electricity

Biomass technologies, introduction biomass productivity and modeling bio power: MSW, willows/switch grass/poplar, wood waste, bio-mass: transport fuels bio fuels, bio ethanol, biodiesel, algal, jatropha bio fuels and water land use impacts, food Vs fuel, renewable fuels standards.

Unit IV: Building Energy

Technologies and policy, smart buildings, lighting and LEDs, Heating/cooling, technologies

Reference books

- 01 Sustainable Energy Systems and Applications, İbrahim Dinçer, Calin Zamfirescu, Springer
- 02 Fundamentals of Renewable Energy Systems, D. Mukherjee, Atlantic

03 An introduction to global warming, John R. Barker and Marc H. Ross Am. J. Phys.

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

1. Guest Lectures.
2. Visits to sites
3. Studying reports of case studies

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

1. Written Test
 2. Practical Test
 3. Presentation
 4. Report
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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.

Unit II: Preliminary and Primary Wastewater Treatment (06 Hours)

Treatment: stages, (preliminary, primary, secondary and tertiary treatment), sewage/effluent treatment plant - flow diagram, unit operation and process, preliminary and primary treatment, screens: types, hydraulics, velocity and head loss, design of screens, disposal of screenings. Grit chamber: sources of grit, importance of grit chamber, types, control of velocity, proportional flow weir, parshall flume, design of grit chamber, disposal of grit, skimming tanks: sources of oil and grease, importance of removal, methods of oil and grease removal. Equalization and neutralization tanks: introduction, application and benefits. Primary sedimentation tank: types of settling, types of sedimentation tanks, assumptions, efficiency, factors affecting efficiency, design of primary sedimentation tank.

Unit III: Secondary Treatment: Aerobic Suspended Growth (06 Hours)

Aerobic secondary treatment: unit operations and processes for secondary treatment, principle of biological treatment, role of microorganism in wastewater treatment, types of microorganisms, microbial metabolism, microbial growth pattern in batch and continuous system, requirements of microbial growth. Activated sludge process (ASP): Conventional plug flow ASP, biochemical reactions, hydraulic and organic loading, F/M ratio, mean cell residence time, aeration method, oxygen requirement, assumptions, design of ASP, sludge volume index, sludge recycle and rate of return sludge, operational problems and maintenance in ASP, modifications in ASP.

Unit IV: Secondary Treatment: Aerobic Suspended and Attach Growth (06 Hours)

Suspended growth system: oxidation pond: bacteria – algae symbiosis, design of oxidation pond, advantages & disadvantages of oxidation ponds. Aerated lagoons: Principle, advantages & disadvantages of aerated lagoons, design of aerated lagoon. Constructed wetlands, phytoremediation and root zone technology: principle, advantages, disadvantages, applications/attached growth system: trickling filter: principle, different TF media & their characteristics, standard rate and high-rate filters, single stage & two stage filters, design using NRC formula, recirculation, ventilation, under drain system, operational problems, control measures. Rotating biological contactors: Principle, advantages, disadvantages, applications

Unit V: Anaerobic Tertiary and Emerging Treatment (06 Hours)

Anaerobic treatment: septic tank: suitable conditions and situations, biological principle, method of treatment and disposal of septic tank effluent and design of septic tank. Anaerobic lagoon: principle, advantages & disadvantage, applications. Up-flow anaerobic sludge blanket (UASB) reactor: principle, advantages & disadvantage, applications. Tertiary (advanced) treatment: objectives, introduction to nutrients removal processes, adsorption, ion exchange, membrane processes, advanced oxidation processes, disinfection. Emerging wastewater treatment systems: sequencing batch reactor (SBR), membrane bio reactors (MBR), moving bed bio reactor (MBBR), fluidized membrane bio reactor (FMBR), packed bed reactor (PBR), advantages, limitations and applications

Unit VI: Sludge Management System and Reuse of Water (06 Hours)

Sludge management system: primary and secondary sludge, quantity and characteristics,

sludge thickening by gravity thickener, sludge centrifugation, introduction to aerobic digestion, principle of anaerobic digestion, stages of digestion, bio – gas production, characteristics & applications, factors governing anaerobic digestion, design of sludge digester, sludge dewatering, sludge drying beds, sludge incineration, sludge disposal/ reuse, challenges in sludge management. Wastewater recycle and reuse: driving factors for recycle and reuse, recycling of grey water, municipal sewage, storm water and industrial effluent, reuse opportunities in municipal, industrial, agricultural sector, regulatory guidelines: WHO, US EPA

Text Books

- 01 Manual on Sewerage & Sewage Treatment published by Ministry of Urban Development, New Delhi, Third Edition
- 02 Waste Water Treatment & Disposal, Metcalf & Eddy, McGraw Hill Education (India) Private Limited

Reference Books

- 01 Environmental Engineering, Peavy Rowe, McGraw Hill Education (India) Private Limited
- 02 Wastewater Treatment for Pollution Control and Reuse, Arceivala and Asolekar, McGraw Hill Education (India) Private Limited
- 03 Industrial Wastewater Treatment, A. D. Patwardhan, Eastern Economy Edition, PHI Learning Private Limited
- 04 Sewage Disposal & Air Pollution Engineering, S. K. Garg, Khanna Publication
- 05 Standard Methods for examination of water and wastewater, Mary Franson, American Public Health Association

IS Codes

- 01 IS 3025: 2013, Methods of Sampling and Test (Physical, Chemical and Biological) for Water and Waste Water, Bureau of Indian Standards, New Delhi
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Savitribai Phule Pune University, Pune
TE Civil (2019 Pattern) w. e. f. June 2021

301021 a: Audit Course II: Leadership and Personality Development

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

Personality is considered as one of the integral part of an individual's existence, where a student is concerned paying close attention to Personality which is extremely important. To enhance holistic development of students and improve their employability skills

Course objectives

- 01 To develop inter personal skills and be an effective goal oriented team player.
- 02 To develop professionals with idealistic, practical and moral values.
- 03 To develop communication and problem solving skills.
- 04 To develop engineer attitude and understand its influence on behavior

Course outcomes

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

- 01 Enhanced holistic development of students and improve their employability skills

Course Contents

Unit I: Introduction to Personality and working towards developing it

Definition and basic of personality, analyzing strength & weaknesses, corporate the orison personality development, increasing vocabulary, body language, preparation of self introduction

Unit II: Communication skill and handling attitude

Communication skills, listening, communication barriers, overcoming these barriers, building self esteem and self confidence, working on attitudes .i.e. aggressive, assertive, and submissive

Unit III: Leadership Techniques in Personality development

Introduction to leadership, leadership styles, group dynamics, team building

Unit IV: Stress and time management skills

Interpersonal relationships, analysis of ego states, transactions, and life positions, stress management, causes, impact & managing stress, introduction to conflict management, time management, concept of time management, steps towards better time management

Reference books

- 01 Soft skills, Career Development Centrel, Green Pearl Publications
- 02 Seven Habits of Highly Effective Teens, Sean, Fireside Publishers. New York.
- 03 How to win Friends and Influence People, Carnegie Dale Simon & Schuster, New York.
- 04 I am ok, You are ok, Thomas A Harris, Harper and Row, New York
- 05 Emotional Intelligence, Daniel Coleman, Bantam Book

Savitribai Phule Pune University, Pune
TE Civil (2019 Pattern) w. e. f. June 2021

301021 b: Audit Course II: Industrial Safety

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

Course objectives

01 Health environment and security covers virtually every important area in administration

Course outcomes

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

01 Analyze the safety problem with its solution

Course Contents

Unit I: Introduction of safety

Elements of safety programming, safety management, upgrading developmental programmers: safety procedures and performance measures, education, training and development in safety.

Unit II: Safety Performance Planning Safety Performance

An overview of an accident, it is an accident, injury or incident, the safety professional, occupational health and industrial hygiene, understanding the risk, emergency preparedness and response, prevention of accidents involving hazardous substances.

Unit III: Accident Prevention

What is accident prevention, maintenance and inspection, monitoring techniques, general accident prevention, safety education and training.

Unit IV: Safety Organization

Basic elements of organized safety, duties of safety officer, safe work practices, safety sampling and inspection, job safety analysis (JSA), safety survey, on-site and off-site emergency plan, reporting of accidents and dangerous occurrences.

Reference books

- 01 Industrial Safety, Health Environment and Security, Basudev Panda, Laxmi Publications
- 02 Industrial safety and Environment, A. K. Gupta, Laxmi Publication
- 03 Industrial Safety Management, L. M. Deshmukh, Tata McGraw-Hill

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

1. Guest Lectures.
2. Visits to sites
3. Studying reports of case studies

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

1. Written Test
 2. Practical Test
 3. Presentation
 4. Repor
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SAVITRIBAI PHULE PUNE UNIVERSITY
Board of Studies in Civil Engineering
Structure for B.E. Civil 2015 Course (w. e. f. June 2018)

Semester-I											
Subject code	Subject	Teaching Scheme			In-Semester Assessment	TW	Pract /Or	End-Semester Exam	Total	Credit	
		Hrs/Week	Lect	Tu						Pr	Th
401 001	Environmental Engineering II	3	--	2	30	--	50	70	150	3	1
401002	Transportation Engineering	3	--	2	30	50	--	70	150	3	1
401 003	Structural Design and Drawing III	4	--	2	30	--	50	70	150	4	1
401 004	Elective I	3	--	2	30	50	--	70	150	3	1
401 005	Elective II	3	--	--	30	--	--	70	100	3	--
401 006	Project (Phase-I)	--	2	--	--	--	50	--	50	--	2
Total :		16	2	8	150	100	150	350	750	16	6
										22 Credits	

Semester-II											
Subject code	Subject	Teaching Scheme			In-Semester Assessment	TW	Or	End-Semester Exam	Total	Credit	
		Hrs/Week	Lect	Tu						Pr	Th
401 007	Dams and Hydraulic Structures	3	--	2	30	--	50	70	150	3	1
401008	Quantity Surveying, Contracts and tenders	3	--	2	30	--	50	70	150	3	1
401 009	Elective III	3	--	2	30	50	--	70	150	3	1
401 010	Elective IV	3	--	2	30	50	--	70	150	3	1
401 006	Project	--	6	--	--	50	100	--	150	--	6
Total :		12	6	8	120	150	200	280	750	12	10
										22 Credits	

Following will be the list of electives.

Semester I

Elective-I 401 004	Elective-II 401 005
1. Structural Design of Bridges	1. Matrix Methods of Structural Analysis
2. Systems Approach in Civil Engineering	2. Integrated Water Resources Planning and Management
3. Advanced Concrete Technology	3. TQM & MIS in Civil Engineering
4. Architecture and Town Planning	4. Earthquake Engineering
5. Advanced Engineering Geology with Rock Mechanics	5. Advanced Geotechnical Engineering

Semester-II

Elective-III 401 009	Elective-IV 401 010
1. Advanced Structural Design	1. Construction Management
2. Statistical Analysis and Computational Methods in Civil Engineering	2. Advanced Transportation Engineering
3. Hydropower Engineering	3. Advanced foundation Engineering.
4. Air Pollution and control	4. Coastal Engineering
5. Finite Element Method in Civil Engineering	5. Open Elective
6. Airport and Bridge Engineering	a) Plumbing Engineering
	b) Green Building Technology
	c) Ferrocement Technology
	d) Sub sea Engineering
	e) Geoinformatics

Savitribai Phule Pune University, Pune

BE Civil 2015 Course

Syllabus

Semester-I

401 001 Environmental Engineering – II

Teaching Scheme:

Lectures: 3 Hrs/week

Practical: 2 Hrs/week

Examination Scheme:

Paper In-sem : 30 Marks (1Hr.)

Paper End-sem : 70 Marks (2.5 Hrs.)

Oral : 50 Marks

Unit I

(6 Hrs.)

Sewage quantity: Collection and conveyance of sewage, sources of sewage, variations in sewage flow, Flow quantity estimation (sewage and storm water quantification), design of storm water system, Design of circular sanitary sewers. Pumping of sewage, necessity, location. Effect of change of life style on sewage quality.

Characteristics of sewage: Methods of sampling, Physical, chemical and biological characteristics, Quality requirements for disposal and recycle/reuse of sewage as per CPCB norms.

Stream sanitation: Self-purification of natural streams, river classification as per MoEF & CC, Govt. of India; Oxygen Sag Curve, Streeter - Phelps equation and terminology (without derivation and numerical). National river cleaning plan.

Unit II

(6Hrs.)

Sewage treatment: Pollution due to improper disposal of sewage, Introduction to sewage treatment, preliminary, primary, secondary and tertiary treatment, Unit operation and Process flow diagram for sewage treatment, Theory and design of screen chamber, Grit Chamber and Primary sedimentation tank as per the Manual of CPHEEO.

Unit III

(6 Hrs.)

Theory & design of secondary treatment units: Introduction to unit operations and processes for secondary treatment. Principles of biological treatments, role of microorganism in wastewater treatment.

Activated sludge process: Theory and design of ASP, sludge volume index, sludge bulking & control, modifications in ASP. Operational problems and maintenance in ASP. Concept of Sequential batch reactor (SBR) .

Trickling filter: Biological principle, different T.F media & their characteristics, design of standard rate and high rate filters using NRC formula, single stage & two stage filters, recirculation, ventilation, operational problems, control measures, theory of rotating biological contactors.

Unit IV

(6 Hrs.)

Low cost treatment methods for rural areas

Oxidation pond: Bacteria – algae symbiosis, design of oxidation pond as per the manual of CPHEEO, advantages & disadvantages of oxidation ponds.

Aerated lagoons: Principle, aeration method, advantages & disadvantages of aerated Lagoons, design of aerated lagoon.

Introduction and theory of Phytoremediation technology for wastewater treatment. Introduction and theory of root zone cleaning system.

Unit V

(6 Hrs.)

Onsite Sanitation Treatment systems: Septic tank, up-flow anaerobic filter. and Package Sewage Treatment Plant- Working principle, advantages and disadvantages. Introduction to MBR, MBBR and FMBR.

Anaerobic digester: Principle of anaerobic digestion, stages of digestion, bio – gas production its characteristics & application, factors governing anaerobic digestion,. Dewatering of sludge by gravity thickener, sludge drying bed, decanters. Methods of sludge treatment and disposal, advantages & disadvantages. Up-flow Anaerobic Sludge Blanket (UASB) Reactor– Principle, advantages & disadvantages.

Unit VI

(6 Hrs.)

Industrial waste water treatment: Equalization and neutralization. Application of preliminary, primary and secondary treatment for industrial wastewater as per the CPCB norms.

Sources of waste water generation from manufacturing process, characteristics of effluent, different methods of treatment & disposal of effluent for the following industries: Sugar, dairy and distillery. Discharge standards as per CPCB norms.

Recycle & reuse of treated wastewater: Gardening, sewage farming, W.C. Flushing, reuse in industry.

Term Work:

A. Compulsory Assignment:

1. Brief report on Sewer materials, choice of materials, testing of sewer pipes, sewer appurtenances.
2. Design of septic tank.

B. Experiments:

The term work shall consist of a journal giving details of at least 8 out of 12 of the following experiments conducted in Environmental Engineering laboratory, of which, **Sr.No.12 is compulsory.**

Determination of

1. Solids -Total solids, suspended solids, volatile solids, settle able solids & non settle able solids.
2. Sludge Volume Index.
3. Dissolved oxygen.
4. Bio-Chemical Oxygen Demand.
5. Chemical Oxygen Demand.
6. Electrical Conductivity.
7. Determination of Phosphates by spectrophotometer.
8. Determination of Nitrates by spectrophotometer.
9. Determination of heavy metals like Cr⁶⁺ or Zn or Ni or Cd.
10. Determination of total nitrogen by Kjeldal method.
11. Visit to domestic / Industrial wastewater treatment plant & its detailed reports.

12. Computer aided design of Sewage Treatment Plant (STP) OR Effluent Treatment Plant (ETP) of Sugar or Dairy Industry using suitable software (C programming or any other suitable software).

Note: - Term Work should include a detailed analysis of practical interpretation, significance and application of test results.

Text Books:

1. Environmental studies by Rajgopalan- Oxford University Press.
2. Waste Water Treatment & Disposal – Metcalf & Eddy - TMH publication.
3. Environmental Engg. - Peavy, Rowe - McGraw Hill Publication.
4. Waste Water Treatment – Rao & Dutta.

Reference Books:

5. Waste Water Engg. – B.C. Punmia & Ashok Jain - Arihant Publications.
6. Water Supply & Waste Water Engg.- B.S.N. Raju – TMH publication.
7. Sewage Disposal & Air Pollution Engg. – S. K. Garg – Khanna Publication.
8. Environmental Engg. – Davis - McGraw Hill Publication.
9. Manual on sewerage and sewage treatment – Public Health Dept., Govt. of India.
10. Standard Methods by APHA.

I.S. Codes:

I.S. 3025 (all parts).

e – Resources:

- i) <http://nptel.iitm.ac.in/courses-contents/IIT Kanpur and IIT Madras>.
- ii) <http://cpcb.nic.in>
- iii) <http://moef.nic.in>

401 002 Transportation Engineering

Teaching scheme

Lectures: 3 Hrs/week

Practical: 2 Hrs/week

Examination Scheme

In-Sem Exam: 30 Marks 1 Hr.

End-Sem Exam: 70 Marks 2.5 Hrs.

Term work: 50 Marks

Unit I

(6 Hrs.)

Highway Development & Planning:

History, Development Plans, Classification of roads, Road Patterns, road development in India - Vision 2021 & Rural Road Development Vision 2025, Current road projects in India; highway alignment and highway project report preparation (Planning surveys & Master Plans based on saturation system).

Unit II:

(6 Hrs.)

Geometric design of highways:

Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems, Highway drainage, Importance of highway drainage, subsurface and surface drainage systems.

Unit III

(6 Hrs.)

Traffic engineering & control:

Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control devices (signs, signals, islands, road markings); Accident studies, types of road intersections; parking studies; highway lighting.

Unit IV

(6 Hrs.)

Pavement materials:

Materials used in Highway Construction and related tests - Soil subgrade and CBR Test, Stone aggregates, bituminous binders, bituminous paving mixes, viscosity based gradation of bitumen, Modified Bitumen (Cutbacks, Emulsions, Crumbed Rubber Modified Bitumen – CRMB, Polymer Modified Bitumen-PMB, Foamed Bitumen), Marshall Stability Mix Design and Test (All 5 test parameters).

Unit V

(6 Hrs.)

Pavement Design:

Introduction; flexible pavements – Computation of design traffic (Vehicle Damage Factor VDF, Lane distribution factor LDF, Traffic growth rate); stresses in flexible pavements; design guidelines for flexible pavements as per IRC 37-2012 (steps only); rigid pavements- components and functions; factors affecting design; stresses in rigid pavements (ESWL); design guidelines for concrete pavements as per IRC 58-2015 (steps only); joints in CC pavements, problems.

Unit VI

(6 Hrs.)

A. Pavement Construction:

Construction process of GSB, WBM, WMM; Cemented base, Introduction to bituminous works such as prime coat, tack coat, seal coat, Built-up Spray Grout (BSG), Asphaltic Concrete (AC) or Bituminous Concrete (BC), Bituminous Macadam (BM), Dense Bituminous Macadam (DBM) and premix carpet, Dry lean Concrete (DLC), Pavement Quality Concrete (PQC).

B. Modern Trends in Highway Materials, Construction & Maintenance:

Mastic Asphalt, Cold Mix Asphalt Technology, Warm Mix Asphalt Technology, Recycled/Reclaimed Asphalt Pavement (RAP) (Manual Series - 2), Concept of Super pave Mix Design (Super pave Series 2), Non-Destructive Evaluation of Pavements (Falling Weight Deflectometer FWD).

Term work:

Term work shall consist of the following:

A. Practicals:

I. Tests on Aggregate (Any Five) :

1. Aggregate Impact Value Test
2. Aggregate Crushing Strength Test
3. Los Angeles Abrasion Test
4. Shape Test (Flakiness Index and Elongation Index)
5. Specific Gravity and Water Absorption Test by basket method
6. Stripping Value Test
7. Soundness Test

II. Tests on Bitumen (Any Five):

1. Penetration Test
2. Ductility Test
3. Viscosity Test (Tar Viscometer)
4. Softening Point Test
5. Flash Point & Fire Point Test
6. Specific Gravity Test
7. Bitumen Extraction Test

III. Tests on Aggregate Bitumen Combined:

1. Marshall Stability Test

IV. Tests on Soil Subgrade:

1. California Bearing Ratio Test (CBR Test)

B. Technical visits to:

- 1) Road Construction and/or RAP Site
- 2) Hot mix Plant with detailed report

Text Books:

1. Highway engineering – S.K. Khanna, C.E.G. Justo & A. Veeraragavan, Nem Chand and Brothers, Roorkee
2. Principles of Highway Engineering and Traffic Analysis (4th edition) F. L. Mannering, Scott S. Washburn, Wiley India
3. Principles and practices of Highway engineering –Dr. L.R. Kadiyali, Khanna Publishers Delhi.

Reference Books:

1. A Course in Highway Engineering – S.P. Bindra, Dhanpat Rai and Sons, Delhi.
2. Principles of Transportation Engineering – G.V. Rao Tata MacGraw Hill Publication
3. Highway Engineering – Rangawala, Charotar publishing House, Anand 388001 (Gujrat)
4. Principles of Transportation Engineering – Partha Chakraborty, Animesh Das, Prentice Hall of India Pvt. Ltd., New Delhi.
5. Highway and Bridge Engineering – B.L. Gupta, Amit Gupta Standard publishers Distributors, Delhi.

Other References:

1. National Cooperative Highway Research Program (NCHRP)
2. Federal Highway Authority (FHWA)

Codes:

1. I.S. 1201 TO 1220-1978, IS 73, IS 2386 PART I to V
2. I.R.C. 58- 2015, IRC 37-2012
3. Specifications for Road and Bridge works (MORTH) 5th Revision, New Delhi.

e – Resources:

1. www.nptel.iitm.ac.in/courses/iitkanpur
2. www.cdeep.iitb.ac.in/nptel
3. www.fhwa.dot

401004 Elective-I (5) Advanced Engineering Geology with Rock Mechanics

Teaching Scheme:
Lecture: 3 Hrs/week
Practical: 2 Hrs/week

Exam. Scheme:
In Sem: 30 Marks (1 Hr.)
End Sem: 70 Marks (2.5 Hrs.)
Termwork: 50 Marks

Unit I: (6 Hrs.)

Indian Geology, Seismic Zones and Geological Studies in Engineering Projects.

Geological Map of India with special reference to Maharashtra. Distribution and Geological characters of Major rock formations of India. Engineering characters of major rock formations of India. Engineering characters of major rock formations of India. Engineering characters of major rock formations of India. Engineering characters of major rock formations of India.

The study of Plate Tectonics and highlights of Seismic Zones of India. Importance of geological studies in engineering investigations.

Unit II (6 Hrs.)

Geohydrological characters of rock formations and Geological process of Soil formations

Geohydrological characters of major rock formations of India:

Geohydrological characters and factors controlling various characters of rocks. Introduction to morphometric analysis. Various water conservation techniques, effect of over exploitation of tube wells, bore wells and dug wells. Artificial recharge, rainwater harvesting, watershed development and necessity of geological studies. Relevant case studies highlighting success and failure of these techniques.

Geological Process of Soil formations:

Effect of climate on formation of soil. Soil profile of different states in India.

Rock weathering conditions favorable for decomposition, disintegration, residual and transported soils.

UNIT III (5 Hrs.)

Resource Engineering, Role of Geology in planning and development.

Resource Engineering:

Utility of various rock formations as construction material. Illustrative case studies.

Geological Hazards and mitigation.

Role of Geology in planning and development:

Influence of geological factors upon urban development & planning. Reclamation of abandoned grounds and mining regions, illustrative examples.

UNIT IV:

(6 Hrs.)

Rock Mechanics and Geophysical techniques.

Rock Mechanics:

General principles of rock mechanics. Dependence of physical and mechanical properties of rocks on geological characters.

Analyzing and evaluating of core recovery, R.Q.D. and Joint Frequency Index.

Various Methods of Geomechanical classifications of rocks such as Terzaghi, U.S.B.M, R.M.R., R.S.R., Q- system, Deer and Miller, Bieniawski's geomechanical classification etc.

Geophysical techniques :

Electrical Resistivity method and Seismic method of exploration. Evaluation and analyzing the data produced through electrical resistivity for the determination of thickness of overburden, locating ground water potential zones which leads for strengthening the major civil projects.

UNIT V

(7 Hrs.)

Subsurface Geological Explorations for various projects; Foundation Treatments, Tail Channel Erosion.

Subsurface Explorations for Dams, Reservoir, Percolation Tanks:

The strength and water tightness of rocks found at the dam, reservoir and percolation tank site.

Case studies illustrating the success and failure of major projects owing to negligence of geological studies. Earthquakes occurring in the areas of some dams and RIS theories.

Geological Foundation Treatments for various Civil Engineering Projects:

Foundation investigation during construction of projects for assessing various geological defects in rocks and suggesting appropriate remedial measures by various methods of grouting.

Erosion of Tail Channels:

Geological reasons for selection of site for spillway, causes of erosion of tail channel. Relevant Case studies.

Unit VI:**(6 Hrs.)****Geological exploration for Tunnels and Bridges*****Geological exploration for Tunnels:***

Variations in methodology of investigation for different types of tunnels for different purposes, location, spacing, angles & depths of drill holes suitable for different types of tunnels.

Difficulties introduced in various geological formation and their unfavorable field characters. Standup time of rock masses and limitations of it.

Dependence of protective measures such as guniting, rock bolting, shotcreting, steel fiber shotcreting, permanent steel supports, lagging concreting & grouting above permanent steel supports on geological conditions. Illustrative case studies.

Bridges Investigation for bridge foundation, difference in objectives of investigation of bridge foundation. Bridge foundation based on nature & structure of rock. Foundation settlements. Case studies.

Practical Work / Term Work

- i. Study of Geological map and seismic zone map of India **(2 Practicals)**
- ii. Study of Morphometric Analysis of river, (topsheet will be made available by the college) **(1 Practical)**
- iii. Study of Soil Profile, weathering index and clay geology. **(1 Practical)**
- iv. Use of electrical resistivity method for determining depth of bedrock. **(1 Practical)**
- v. Engineering Classification of rocks and Computation of RQD & Joint Frequency Index **(1 Practical)**
- vi. Interpretation of drill hole data. Logging of drill cover, preparation of Litho logs & interpretation of drill data. Preparing geological cross sections from drill hole data & using them for designing of civil engineering structures representing following case studies.
 - 1. Dipping sedimentary formation.
 - 2. Faulted region.
 - 3. Folded region.
 - 4. Locating spillway.
 - 5. Tunnels in Tectonic areas.
 - 6. Tunnels and open cuts in non-tectonic areas. **(6 Practicals)**
- vii. A compulsory guided tour to study geological aspects of an engineering projects & writing a report based on studies carried out during visits to civil engineering projects.

Note:

Field visits will be made to different places around study area and one study tour to important geological places.

The practical journal will be examined as term work.

REFERENCE BOOKS AND TEXT BOOKS:

1. Jaeger J. C., Cook N. & Zimmerman R. – Fundamentals of Rock Mechanics, Blackwell Scientific Publications.
2. Goodman R. E. – Introduction to Rock Mechanics, John Wiley & Sons.
3. Bieniawski Z. T. - Engineering Classification of jointed Rock Masses.
4. M. B. Dobbrin - Introduction to Geophysical Prospecting, McGraw Hill Inc., USA.
5. B. P. Verma - Introduction to Rock Mechanics, Khanna Pub New Delhi.
6. Keller E A - Environmental Geology, Prentice – Hall Publication.
7. Subinoy Gangopadhyay - Engineering Geology, Oxford University Press.
8. Vasudev Kanithi – Engineering Geology, Universities Press.
9. Dr. J. B. Auden Commemorative Volume – Indian Soc. Of Engineering Geology, Calcutta.
10. Seminar on Engineering and Geological Problems in Tunneling (Part 1 & 2) – Indian Society of Engineering Geology, New Delhi.

Handbooks:

- a. Gupte R. B. (1980) – P. W. D. Handbook Chapter –6, Part-II ‘Engineering Geology Government of Maharashtra.
- b. Tunneling India '94, “Central Board of Irrigation and Power”, New Delhi.
- c. Manual on Rock Mechanics, Central Board of Irrigation and Power, New Delhi, 1988.
- d. Handbook of Geology in Civil engineering, Robert Fergusson, Legget, Mc- Graw hill.

I. S. Codes

- a. IRC code of practice for Road Tunnels. IRC-78-2000; IS-12070; IS-1336 Part I and II.
- b. I. S. 4453-1967 Code of practice for Exploration, pits, trenches, drifts & shaft.
- c. I. S. 6926-1973 Code of practice for diamond drilling for site investigation river valley project.
- d. I. S. 4078-1967 Code of practice for Logging and Storage of Drilling Core.
- e. I. S. 5313-1969 Guide for core drilling observation.

e- Resources:

1. www.ebd.co.in/undergraduate/eng
2. www.library.iisc.ernet.in
3. www.iitb.ac.in
4. www.nptel.iitm.ac.in
5. Free online course-swayam-<https://swayam.gov.in>
6. Open source course management – <https://moodle.org>

401 005 Elective II (3) TQM and MIS in Civil Engineering

Teaching scheme:
Lectures: 3 Hrs/week

Examination scheme:
In semester exam: 30 marks---1 Hr.
End semester exam: 70 marks—2.5 Hrs.

Unit I: Quality in Construction (6 Hrs)

- a) Quality – Various definitions and interpretation. Importance of quality on a project in the context of global challenges, Factors affecting quality of construction, Reasons for poor quality & measures to overcome, Contribution of various Quality Gurus(Juran, Deming, Crosby, Ishikawa).
- b) Evolution of TQM- QC, TQC, QA, QMS, TQM.

Unit II: TQM & Six Sigma (6 Hrs)

- a) TQM – Necessity, advantages , 7QC tools, Quality Function Deployment(QFD).
- b) Six sigma – Importance, levels.
- c) Defects & it's classification in construction. Measures to prevent and rectify defects.

Unit III: ISO & Quality Manual (6 Hrs)

- a) Study of ISO 9001 principles.
- b) Quality manual – Importance, contents, documentation. Importance of check-lists in achieving quality. Typical checklist for concreting activity, formwork activity, steel reinforcement activity.
- c) Corrective and Preventive actions, Conformity and NC reports.

Unit IV: Management Control & Certifications (6 Hrs)

- a) Benchmarking in TQM, Kaizen in TQM.
- b) Quality Circle.
- c) Categories of cost of Quality.
- d) CONQAS, CIDC-CQRA certifications.

Unit V: Techniques in TQM Implementation and awards (6 Hrs)

- a) 5 'S' techniques.
- b) Kaizen.
- c) Failure Mode Effect Analysis (FMEA).

- d) Zero Defects.
- e) National & International quality awards- Rajeev Gandhi Award, Jamuna Lal Bajaj Award, Golden Peacock Award, Deming Prize, Malcolm Baldrige award.

Unit VI: MIS

(6 Hrs)

- a) Introduction to Management Information systems (MIS) Overview, Definition.
- b) MIS and decision support systems, Information resources, Management subsystems of MIS, MIS based on management activity whether for operational control, management control, strategic control.
- c) Study of an MIS for a construction organization associated with building works.

Text Books:

1. Total Quality Management-- Dr. Gunmala Suri and Dr. Puja Chhabra Sharma—Biztantra.
2. Quality Control and Total Quality Management by P.L.Jain- Tata McGraw Hill Publ. Company.
3. Total Quality Management - Dr. S.Rajaram and Dr. M. Sivakumar—Biztantra.
4. Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd.

Reference Books:

1. Juran's Quality Handbook – Juran Publication. Importance of quality on a project in the context of global challenges. Importance of quality on a project in the context of global challenges.
2. Management –Principal, process and practices by Bhat – Oxford University Press.
3. Financial management by Shrivastava- Oxford University Press.
4. Management Information Systems – Gordon B. Davis, Margrethe H. Olson – Tata McGraw Hill Publ. Co.
5. Total Project Management – The Indian Context - P.K.Joy Macmillan India Ltd.

E- Sources:

www.nptel.ac.in , www.mobile.enterpriseappstoday.com

401 005 Elective II (4) Earthquake Engineering

Teaching scheme:
Lectures: 3 Hrs/week

Examination scheme:
In semester exam: 30 marks---1 Hr.
End semester exam: 70 marks—2.5 Hrs.

Unit I

Introduction to earthquakes: (6 Hrs.)

Geology of earth, configuration of tectonic plates in a globe, influence of Geology on earthquake, behavior of plates, their motion and effects, causes of earthquake and their Characteristics, Earthquake parameters, magnitudes, intensity, scales, classification of earthquake seismic zoning of India, seismic coefficients for different zones, .Lessons from past earthquake: - **Study of damages caused due to past, earthquakes in/ outside India and remedial measures.**

Unit II (6 Hrs.)

Theory of vibrations:

Vibrations - definition, causes, classifications. Single Degree of Freedom systems (SDOF) - Free, forced, damped, un-damped vibrations with basic examples. Introduction to Multi-degrees of Freedom systems (MDOF) - derivations of related equations and solutions to two degree and three degree of freedom systems.

Unit III (6 Hrs.)

Static analysis of earthquake forces:

Introduction to IS1893 (Part-I): Seismic design Philosophy, provision, Seismic coefficient method.

Unit IV (6 Hrs.)

Dynamic analysis of earthquake forces:

Response Spectra, estimation of story shear, effect of unsymmetrical geometry and masses, mass center and stiffness center, estimation of story shear for symmetrical and torsion for unsymmetrical buildings. Effect of infill masonry and shear walls.

Unit V

(6 Hrs.)

Earthquake force calculation and analysis and design of frames

Estimation of combined effect of lateral forces and vertical loading on multi storeyed frames. Design any intermediate continuous beam of the frames for combined effect of loadings, Concept of ductile detailing, IS 13920 provisions for RC frame.

Unit VI

(6 Hrs.)

Introduction of different control systems: Passive control: base isolation and active control: bracing system. Strengthening and Retrofitting techniques, methodology of retrofitting for walls, slabs roofs columns, foundations etc. for buildings in stones, bricks, RCC. Introduction to **Disaster Management**: Types of Disaster, Phases of disaster management, Disaster rescue, psychology and plan of rescue operations.

Notes:

Every design should confirm to latest versions of IS 1893, 4326, 13920, 13827, 13828, 13935

Text Books:

1. Earthquake resistance design of structure by Duggal- Oxford University Press.
2. Earthquake – Resistant Design of Building Structures-Dr. Vinod Hosur-- Wiley India.
3. Earthquake Tips NICEE, IIT, Kanpur.
4. Elements of Earthquake Engineering by Jaikrishna and Chandarsekaran.
5. Earthquake resistant design of structures- Agarwal, Shrikhande, PHI learning.

Reference Books:

1. Dynamics of structure by Clough R.W. and Penzin J. McGraw Hill Civil Engineering Series.
2. Dynamics of structure by Anil Chopra, Prentice Hall India Publication.
3. Dynamics of structure by Mario Paz, CBSPD Publication.
4. Geo-technical Earthquake Engineering by Kramer S. L. Prentice Hall India Publication.
5. Introduction to Structural Dynamics by John M. Biggs.
6. Mechanical Vibrations by V. P. Singh.
7. Relevant Latest Revisions of IS codes.

401006 Project Phase-I

Teaching Scheme:

Tutorial: 2 Hrs/week

Examination Scheme:

TW: 50 Marks.

Project phase I Term Work will be evaluated for an individual student based on the seminar presented on the work done in first semester and submission of the report. If the student fails to present the seminar and submit the report, he / she will be marked absent in project examination. The project work phase I shall be consist of any one of the following nature in Civil Engineering related subjects.

1. **Experimental investigation.**
2. Software development.
3. **Benefits cost economic analysis.**
4. **Case study with own design.**
5. **Working model design and fabrication.**
6. **Case study with development of methodology using soft computing tools.**

It is mandatory to present a seminar in presence of Internal and External Examiners and submit preliminary project report based on work done in first semester. The report shall contain finalization of topic, literature survey, planning schedule/ flow chart for completion of project. The report shall be typed or printed and hard/spiral bound. The project work to be taken up individually or in groups. The group shall not be of more than 4 students. References shall be mentioned at the end as per universal standards as mentioned in any international journal of professional body.

Format of project report: Sequence of pages:

- | | | | |
|---------------------|---------------------|----------------------|---------------|
| i) Front Cover Page | ii) Certificate | iii) Acknowledgement | iv) Synopsis |
| v) Contents | vi) Notations | vii) List of Tables | viii) List of |
| Figures | ix) List of Graphs. | | |

Chapter 1 Introduction (This consists of: 1.1 Introduction of the Project Work; 1.2 Problem Statement, 1.3 Objectives and 1.4 Scope of the Project Works, 1.5 Research Methodology, 1.6 Limitations of study, 1.7 Expected outcome.

Chapter 2 Literature Review from minimum 10 articles (It shall include theoretical support, details regarding work done by various persons, methods established, any new approach. It should preferably highlight the development in the field of research chronologically as reflected from books, journals etc.).

Chapter 3 Planning Schedule/ Flow Chart For Completion of Project References and Bibliography (The references and bibliography shall include name of author/code/manual/book, title of paper/code/manual/book, name of the journal, month & year of publication, volume number/ISBN number, page number x-y. The references and bibliography shall be as per universal standards as mentioned in any international journal of professional body).

Report Printing details:

1. Report shall be typed on A4 size Executive Bond paper with single spacing preferably on Both sides of paper.
2. Margins: Left Margin: 37.5 mm, Right Margin: 25 mm, Top Margin: 25 mm, Bottom Margin: 25 mm.
3. Give page number at bottom margin at center.
4. Size of Letters: Chapter Number: 16 font size, Times New Roman in Capital Bold Letters, Chapter Name: 12 Font size in Capital Bold Letters, Main Titles (1.1, 2.5 etc): 16 Font size in Bold Letters Sentence case, Sub Titles (1.1.5, 4.5.1 etc): 14 Font size in Bold Letters-Sentence case. All other matter: 12 Font size sentence case.
5. No blank sheet be left in the report.
6. Figure name: 12 Font size in sentence case Bold- Below the figure.
7. Table title -12 font size in sentence case- Bold-Above the table.

401006 Project work

Teaching Scheme:

Tutorial: 6 Hrs/week

Examination Scheme:

TW : 50 Marks.

Oral : 100 Marks.

Project Work will be evaluated for an individual student based on the presentation of the work done in a year(I Sem + II Sem) and submission of the report .The student may work in a group during project work, if any.

The project work shall consist of any one of the following nature in Civil Engineering related subjects.

1. **Experimental investigation.**
2. Software development.
3. **Benefit : Cost economic analysis.**
4. **Case study with own design.**
5. Working model design and fabrication.
6. Case study with development of methodology using soft computing tools.

The details of report writing and preparation of report will be similar to that of as mentioned in syllabus of Project Phase I in first semester.

Evaluation of Project work in final exam. Will be done by the pair of internal guide having minimum 3 years approved experience as teacher and external guide.

It is recommended to promote the students to present a paper based on project work in appropriate conference / journal.

Teaching scheme:
Lectures: 3 Hrs/week
Practical: 2 Hrs/week

Examination scheme:
In semester exam: 30 Marks---1 Hr.
End semester exam: 70 Marks—2.5 Hrs.
Oral: 50 Marks

Unit I **(6 Hrs.)**

Introduction and Approximate Estimates:

- a) **Introduction to estimates and related terms:** Definition of estimation and valuation. Significance (application) of the Course. Purpose of estimation. Type of estimates, data required for estimation as a pre requisite. Meaning of an item of work, and enlisting the items of work for different Civil Engineering projects. Units of measurement. Mode of measurement of building items/ works. Introduction to components of estimates: face sheet, abstract sheet (BOQ), measurement sheet, Rate Analysis, lead statement. Provisional sum & prime cost items, contingencies, work charge establishment, centage charges. Introduction to D. S. R.
- b) **Approximate Estimates:** Meaning, purpose, methods of approximate estimation of building & other civil engineering projects like roads, irrigation/ water supply, sanitary engineering, electrical works.(Theory & Numericals).

Unit-II **(6 Hrs.)**

Taking out quantities & Detailed estimate:

- a) **Detailed estimates:** Factors to be considered while Preparing Detailed Estimate, Detailed estimate of R.C.C framed structures using IS 1200, Concept of Estimation of Load Bearing Structure (PWD & Centre Line Method).
- b) **Bar Bending Schedule:** Preparing Bar Bending Schedule for all RCC members of building.

Unit-III **(6 Hrs.)**

Specifications and Rate Analysis:

- a) **Specifications:** Meaning & purpose, types. Drafting detailed specifications for materials, quality, workmanship, method of execution, mode of measurement and payment for major items like, excavation, stone/ brick masonry, plastering, ceramic tile flooring, R.C.C. work.

b) Rate Analysis: Meaning and factors affecting rate of an item of work, materials, sundries, labour, tools & plant, overheads & profit. Task work or out turn, factors effecting task work. Working out Rate Analysis for the items mentioned in specifications above.

Unit IV

(6 Hrs.)

Valuation:

a) Valuation: Purpose of valuation. Meaning of price, cost and value. Factors affecting

‘Value’. Types of value: only Fair Market Value, Book Value, Salvage/ Scrap Value, Distressed Value and Sentimental Value. Concept of free hold and lease hold property. Estimation versus valuation. Methods of depreciation & obsolescence, Sinking Fund, Years Purchase.

b) Methods of Valuation of Building: Rental Basis, Land & Building basis, Direct Comparison Method, Profit based method, Belting of Land, Development method.

Unit V

(6 Hrs.)

Tendering and Execution of Works:

a) Tenders: Definition. Methods of inviting tenders, tender notice, tendering procedure, Pre and post qualification of contractors, tender documents. 3 bid/ 2 bid or single bid system. Qualitative and quantitative evaluation of tenders. Comparative statement, Pre-bid conference, acceptance/ rejection of tenders. Various forms of BOT & Global Tendering, E-tendering.

b) Methods of Executing Works: PWD procedure of work execution, administrative approval, budget provision, technical sanction. Methods of execution of minor works in PWD: Piecework, Rate List, Daily Labour. Introduction to registration as a contractor in PWD.

Unit VI

(6 Hrs.)

Contracts and Arbitration:

a) Contracts: Definition, objectives & essentials of a valid contract as per Indian Contract

Act (1872), termination of contract. Types of contracts: only lump sum, item rate, cost plus.

Conditions of contract: General and Specific conditions. Conditions regarding EM, SD, and time as an essence of contract, conditions for addition, alteration, extra items, testing of materials, defective work, subletting, etc. Defect liability period, liquidated damages, retention money, interim payment or running account bills, advance payment, secured advance, final bill.

b) Arbitration: Introduction to Arbitrations as per Indian Arbitration & Conciliation Act (1996) Meaning and need of arbitration, qualities and powers of an Arbitrator.

Term Work:

The following exercises should be prepared and submitted:

1. Report on contents, use of current DSR & Drafting detailed specification for major items of works.
2. Working out quantities using C-L and PWD method for a small single storied load bearing structure up to plinth and Preparing Abstract Sheet using DSR(Regional)
3. Detailed Estimate of a single storied R.C.C framed building using D.S.R.
4. Working out quantities of steel reinforcement for a column footing, a column, a beam and a slab by preparing bar bending schedule.
5. Working out rate analysis for the items as in the specifications of Assignment No. 1.
6. Preparing Valuation of a Residential building and writing report using O-1 form.
7. Estimating quantities for any one of the following using appropriate software.
 - a) A Factory Shed of Steel Frame
 - b) Underground Water Tank
 - c) Pipe Culvert
 - d) Road / Railway Track/ Runway
8. Drafting of tender notice, Preparation of Schedule A & B and Conditions of Contract regarding time, labour payment, damages for RCC Framed Structure (Assignment No. 3) and collecting minimum of 3 tender notices of Civil Engineering Works.

Oral Examination: Based on the Term Work.

Reference Books:

1. Estimating and Costing in Civil Engineering: Theory and Practice: B.N Dutta - S. Dutta & Company, Lucknow.
2. Estimating, Costing Specifications & valuation in Civil Engineering: M. Chakraborty.
3. Estimating and Costing: R. C. Rangwala - Charotar Publ. House, Anand.
4. Theory and Practice of Valuation: Dr. RoshanNamavati, Lakhani Publications.
5. Valuation Principles and Procedures: Ashok Nain, Dewpoint Publ.
6. Laws for Engineers : Dr. Vandana Bhat and Priyanka Vyas –Published by PRO-

CARE,5/B,/Sagarika Society,Juhu Tara Road,Juhu,Santacruz(W),Mumbai-400049
procure@technolegal.org).

Handbooks:

1. Standard Contract Clauses for Domestic Bidding Contracts: Ministry of Statistics and Program Implementation, Government of India.
2. FIDIC Document: Federation International Des Ingenieurs Conseils i.e. International Federation of Consulting Civil Engineers, Geneva, Switzerland.
3. Indian Practical Civil Engineers' Handbook: P. N. Khanna, UBS Publi. Distri. Pvt. Ltd. (UBSDP).

Codes:

1. IS 1200 (Part 1 to 25): Methods of Measurement of Building & Civil Engg. Works.
2. IS 3861-1966: Method of Measurement of Areas and Cubical Contents of buildings.
3. D. S. R. (District Schedule of Rates) for current year.
4. PWD Redbooks, Vol 1 & 2.

e – **Resources:** nptel.iitm.ac.in

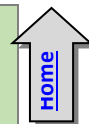
Savitribai Phule Pune University
Second Year of Computer Engineering (2019 Course)
 (With effect from Academic Year 2020-21)

Semester-III

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
210241	Discrete Mathematics	03	-	-	30	70	-	-	-	100	03	-	-	03
210242	Fundamentals of Data Structures	03	-	-	30	70	-	-	-	100	03	-	-	03
210243	Object Oriented Programming (OOP)	03	-	-	30	70	-	-	-	100	03	-	-	03
210244	Computer Graphics	03	-	-	30	70	-	-	-	100	03	-	-	03
210245	Digital Electronics and Logic Design	03	-	-	30	70	-	-	-	100	03	-	-	03
210246	Data Structures Laboratory	-	04	-	-	-	25	50	-	75	-	02	-	02
210247	OOP and Computer Graphics Laboratory	-	04	-	-	-	25	25	-	50	-	02	-	02
210248	Digital Electronics Laboratory	-	02	-	-	-	25	-	-	25	-	01	-	01
210249	Business Communication Skills	-	02	-	-	-	25	-	-	25	-	01	-	01
210250	Humanity and Social Science	-	-	01	-	-	25	-	-	25	-	-	01	01
210251	Audit Course 3													
Total Credit											15	06	01	22
Total		15	12	01	150	350	125	75	-	700	-	-	-	-

Semester-IV

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
207003	Engineering Mathematics III	03	-	01	30	70	25	-	-	125	03	-	01	04
210252	Data Structures and Algorithms	03	-	-	30	70	-	-	-	100	03	-	-	03
210253	Software Engineering	03	-	-	30	70	-	-	-	100	03	-	-	03
210254	Microprocessor	03	-	-	30	70	-	-	-	100	03	-	-	03
210255	Principles of Programming Languages	03	-	-	30	70	-	-	-	100	03	-	-	03
210256	Data Structures and Algorithms Laboratory	-	04	-	-	-	25	25	-	50	-	02	-	02
210257	Microprocessor Laboratory	-	02	-	-	-	25	-	25	50	-	01	-	01
210258	Project Based Learning II	-	04	-	-	-	50	-	-	50	-	02	-	02
210259	Code of Conduct	-	-	01	-	-	25	-	-	25	-	-	01	01
210260	Audit Course 4													
Total Credit											15	05	02	22
Total		15	10	02	150	350	150	25	25	700	-	-	-	-



Savitribai Phule Pune University
Second Year of Computer Engineering (2019 Course)

210249: Business Communication Skills

Teaching Scheme Practical: 02 Hours/Week	Credit Scheme 01⁵	Examination Scheme and Marks Term Work ⁵ : 25 Marks
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Course Objectives:

- To facilitate Holistic growth ;
- To make the engineering students aware, about the importance, the role and the content of business communication skills ;
- To develop the ability of effective communication through individual and group activities;
- To expose students to right attitudinal and behavioural aspects and to build the same through various activities;

Course Outcomes:

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

CO1: Express effectively through verbal/oral communication and improve listening skills

CO2: Write precise briefs or reports and technical documents.

CO3: Prepare for group discussion / meetings / interviews and presentations.

CO4: Explore goal/target setting, self-motivation and practicing creative thinking.

CO5: Operate effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership qualities.

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual needs to include prologue (about University/program/ institute/ department/foreword/preface), curriculum of course, conduction and Assessment guidelines, topics under consideration concept objectives, outcomes, guidelines, references.

Guidelines for Student's Laboratory Journal and Term Work Assessment

The student must prepare the journal in the form of report elaborating the activities performed. Continuous assessment of laboratory work is to be done based on overall performance and performance of student at each assignments. Each Laboratory assignment assessment will assign grade/marks based on parameters with appropriate weightage.

Suggested parameters for overall assessment as well as each Laboratory assignment assessment include- timely completion of assignment, performance, punctuality, neatness, enthusiasm, participation and contribution in various activities- SWOT analysis, presentations, team activity, event management, group discussion, Group exercises and interpersonal skills and similar other activities/assignments and Well presented, timely and complete report.

Recommended Assessment and Weightage Parameters:

(Attendance 30%, Assignments/activities-Active participation and proactive learning 50% and report 20%)

Students must submit the report of all conducted activities conducted. The brief guidelines for report preparations are as follows:

1. One activity report must be of maximum 3 pages;
2. **Combined Report of all activities with cover pages, table of contents and certificate (signed by instructor) is to be submitted in soft copy (pdf) format only.**
3. The report must contain:
 - General information about the activity;
 - Define the purpose of the activity;
 - Detail out the activities carried out during the visit in chronological order;
 - Summarize the operations / process (methods) during the activities;
 - Describe what you learned (outcomes) during the activities as a student;

Guidelines for Laboratory Conduction

The instructor may frame assignments to enhance skills supporting career aspects. Multiple set of activity based assignments can be prepared and distributed among batches.

Every student must be given adequate opportunity to participate actively in each activity. An exercise can be designed to allow multiple skills exposure for example a group task encouraging discussions, team building, value sharing, leadership and role play all at the same time.

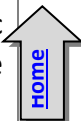
MOOC at Swayam:§

https://swayam.gov.in/nd2_imb19_mg14/preview

Virtual Laboratory:

- <https://ve-iitg.vlabs.ac.in/>

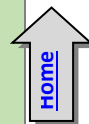
Sr. No.	Suggested List of Laboratory Experiments/Assignments
1	<p>SWOT analysis</p> <p>The students should be made aware of their goals, strengths and weaknesses, attitude, moral values, self-confidence, etiquettes, non-verbal skills, achievements. through this activity. SWOT Analysis, Confidence improvement, values, positive attitude, positive thinking and self-esteem. The concern teacher should prepare a questionnaire which evaluate students in all the above areas and make them aware about these aspects</p>
2	<p>Personal and Career Goal setting – Short term and Long term</p> <p>The teacher should explain to them on how to set goals and provide template to write their short term and long term goals.</p>
3	<p>Public Speaking</p> <p>Any one of the following activities may be conducted :</p> <p>1. Prepared speech (Topics are given in advance, students get 10 minutes to prepare the speech and 5 minutes to deliver.) 2. Extempore speech (Students deliver speeches spontaneously for 5 minutes each on a given topic) 3. Story telling (Each student narrates a fictional or real life story for 5 minutes each) 4. Oral review (Each student orally presents a review on a story or a book read by them)</p>
4	<p>Reading and Listening skills</p> <p>The batch can be divided into pairs. Each pair will be given an article (any topic) by the teacher. Each pair would come on the stage and read aloud the article one by one. After reading by each pair, the other students will be for correct answers and also for their reading skills. This will evaluate their reading and listening skills. The teacher should give them guidelines on improving their reading and listening skills. The teacher should also give passages asked questions on the article by the readers. Students will get marks on various topics to students for evaluating their reading comprehension.</p>
5	<p>Group discussion</p> <p>Group discussions could be done for groups of 5-8 students at a time Two rounds of a GD for each group should be conducted and teacher should give them feedback.</p>
6	<p>Letter/Application writing</p> <p>Each student will write one formal letter, and one application. The teacher should teach the students how to write the letter and application. The teacher should give proper format and layouts.</p>
7	<p>Report writing</p> <p>The teacher should teach the students how to write report .The teacher should give proper format and layouts. Each student will write one report based on visit / project / business proposal.</p>
8	<p>Resume writing- Guide students and instruct them to write resume</p>



9	Presentation Skill Students should make a presentation on any informative topic of their choice. The topic may be technical or non-technical. The teacher should guide them on effective presentation skills. Each student should make a presentation for at least 10 minutes.
10	Team games for team building - Students should make to participate in team activity.
11	Situational games for role playing as leaders
12	Faculty may arrange one or more sessions from following: Yoga and meditation. Stress management, relaxation exercises, and fitness exercises. Time management and personal planning sessions.
13	Mock interviews- guide students and conduct mock interviews
14	Telephonic etiquettes -To teach students the skills to communicate effectively over the phone. Students will be divided into pairs. Each pair will be given different situations, such as phone call to enquire about job vacancy, scheduling a meeting with team members, phone call for requesting of urgent leave from higher authorities. Students will be given 10 min to prepare. Assessment will be done on the basis of performance during the telephone call.
15	Email etiquettes -To provide students with an in-depth understanding of email skills. Students will be made to send e-mails for different situations such as sending an e-mail to the principal for a leave, inviting a friend for a party, e-mail to enquire about room tariff of a hotel. Students will be assessed on the basis of e-mail such as clarity, purpose and proof reading of e-mail.

[@The CO-PO Mapping Matrix](#)

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	2	1	-
CO3	-	-	-	-	-	-	-	-	2	-	-	1
CO4	-	-	-	-	-	-	-	-	-	2	-	2
CO5	-	-	-	-	-	-	-	-	3	-	-	2



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 ^s	Term work ^s : 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.

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.

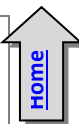
Experiencing real-life situations and complex scenarios that arise in each situation will help the budding professions to contribute their skills and knowledge to helping people improve and understand their behaviour or psychological processes. Understanding how the world works begins with an understanding 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.

Course Structure: The tutorial sessions to be divided into 2 groups

1. Interactive Sessions to be conducted in classroom
2. Interactive Activities to be conducted Outside Classroom

MOOC/ Video Lectures available at^s:

- <https://nptel.ac.in/courses/109/103/109103023/>
- <https://nptel.ac.in/courses/109/107/109107131/>
- Teachers will play the role of interventionists and instigating students to apply their thinking abilities on social concepts
- As facilitators and mentors teachers will coax the students to thinking out-of-the-box to come up with creative solutions
- Teachers should focus on instilling a sense of social consciousness through the activities conducted indoors and outdoors.



Change of Mindset

- Since the course deviates from technical subjects, students will have to be counseled into the importance of social sciences
- A background understanding of the importance of this course in their professional and personal life will have to be enumerated to the students
- Teachers will have to rationalize the course outcomes to get the students invested in the activities being conducted

Designing of Course

- Since students lack prior knowledge, it is imperative that the tutorials conducted be engaging in its activities
- Focus of the sessions should be the learning outcome of each activity conducted either in the class or outside the class
- All activities designed should be as close to real-life making them relatable and applicable
- Student-engagement should be a priority so that the knowledge internalized will be higher
- The activities chosen can be modified to cater to the college location and social context
- The learning should be focused on application of ethics and values during each activity
- The chosen sessions should cater to giving the students the opportunity to be involved and engaged in their role as contributors to society and the nation at large

Basic function of the tutor

- To present a holistic view of the curriculum and the role of this course in it and emphasizing the benefit of the sessions towards developing communications skills, critical thinking and problems solving

Grouping

- The class will be divided into groups of 20 students
- The blend of cultural and social diversity will enhance the learning at the end of each activity
- Teachers will have to be mentored to handle sensitive issues diplomatically while encouraging students to stand up for their beliefs
- The groups will have to have inter-personal sessions so that they get to understand their team members better and work cohesively
- Management support and encouragement to engage students in life-enriching experiences is important

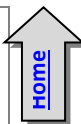
Assessment of Learning

- It is important for tutors to make sure that assessment is consistent with learning objectives of each activity
- Assessment of students should be focused on the students' ability to internalize the learning
- Tutors need to understand meaningful ways of assessing students' work to motivate learning

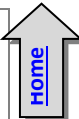
Tutorial Conduction and Term Work guidelines

Interactive Sessions to be conducted during Tutorial (in classroom)

1. PREPARED SPEECH ON CURRENT AFFAIRS
 - a. Purpose – Get students to stay abreast and invested in national current affairs
 - b. Method – Each student has to read an editorial from any national paper (English), find out more information on the topic and present it to the class; ending the session with his/her opinion on the matter
 - c. Outcome – Awareness of national state of affairs. Improve on oratory skills. Instil the thinking and contemplative skills and form non-judgmental opinions about an issue
2. UNDERSTANDING INDIA'S CULTURAL DIVERSITY
 - a. Purpose – Expose students to the intricacies of Indian cultural across various states
 - b. Method – Each student (or a small group of students in case the number of students is large) has to pick a state and come to the tutorial session prepared with a PPT that will showcase the demographic, sociographic and cultural information of that state
 - c. Outcome – Information about the beauty of Indian cultural diversity. Enhance exploratory skill, communication skills and learn to present using technological tools.



3. WRITING AN ARTICLE ON ANY SOCIAL ISSUE
 - a. Purpose – Highlight various social and cultural evil malevolence existing in our country and express one’s opinion on how it can be changed
 - b. Method – Each student will have to write a 200 word essay on any of existing social malice that is prevalent in society. On evaluation, the top 5 essays can be displayed on the college wall magazine and rewarded if deemed appropriate
 - c. Outcome – Learn to raise one’s voice against the wrong doings in communities. Build writing skills, improve language and gain knowledge about how to write an impactful essay
4. GROUP DISCUSSION ON COMMUNAL TOPIC
 - a. Purpose – Make students aware of the issues that are pertinent in a society and express a learned opinion about it
 - b. Method – Students in groups of 20 each will discuss a relevant and grave issue that is dogging the nation. Alternatively, topics from current affairs (National budget, democratic process, economical strengthening of the country).
 - c. Outcome – Develop group communication skills. Learn to speak up one’s opinion in a forum. Cultivate the habit of presenting solution-driven arguments making them contributors in any team
5. QUIZ ON SOCIAL BEHAVIOR
 - a. Purpose – Augment proper social etiquette among students and make them responsible citizens
 - b. Method – Conduct a quiz on traffic rules using audio-visual aids or using dumb charades where one student has to enact the traffic rule and the others have to guess that rule
 - c. Outcome – Grasp of various traffic rules and driving etiquette. Build verbal and non-verbal communication skills
6. SCREEN A MOVIE (FOCUS ON POSITIVITY AND POWER OF THE MIND)
 - a. Purpose – Expose students to introspective skills and try to develop a positive thinking in life
 - b. Method – Screen a movie / a documentary / a video that focuses on the power of the mind and how to create affirmations in one’s life. At the end of the movie, students can be asked to express their opinions and write down what changes / improvements they plan to take in their choices thereafter. This can be followed by a guest lecture by expert/s or workshop
 - c. Outcome – Comprehend the areas of improvement within themselves. Understand the importance of staying positive and develop affirmations
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- c. Outcome – Comprehend the areas of improvement within themselves. Understand the importance of staying positive and develop affirmations
9. DEBATE ON A TOPIC FROM SOCIAL SCIENCES
- a. Purpose – Educate students about various domains in social sciences and develop an interest towards gaining knowledge about these topics
 - b. Method – Various topics from various domains of social sciences can be chosen and students in pairs can pick a topic and present their arguments for or against the topic. Time for each debate will be 10 minutes maximum
 - c. Outcome – Recognize the significance of social sciences in our lives. Cultivate the habit to present forceful arguments while respecting the opponents perspective and enhance verbal skills.

Interactive Activities to be conducted during Tutorial (Outside Classroom)

1. WASTE MANAGEMENT and CLEAN CAMPUS
 - a. Purpose: Create awareness among students about the significance of a clean environment and social responsibility to deter littering and segregate waste
 - b. Method: Students (in groups) will be given charge of areas of campus and will be expected to clean that segment. Also, they will be entrusted with the responsibility to collect, separate waste and hand over to the housekeeping authority
 - c. Outcome: Develop the habit to maintain cleanliness at home as well as learn to respect community areas at college or workplace. It will also encourage them become ambassadors among their peers to advocate protection of the environment
2. MAKING A VIDEO ON SOCIAL WASTAGES.
 - a. Purpose: Instil among students a sense of responsibility towards judiciously using natural resources like water and electricity
 - b. Method: Using their phones / hand-held devices, groups of students will make a 3 – 4 minute short film that will highlight irresponsible behavior in terms of wastage of water, leaving lights, fans and other electrical appliances on when not in use, defacing public and campus property by scribbling on walls and common areas. They will make awareness for the same among students. The creative videos will be posted on the college website and social media as an encouragement
 - c. Outcome: Conscientious behavior towards saving public utility resources. Explore the use of audio-visual tools to create more meaningful messages that can effect a change in society
3. RELAY MARATHON (3 – 5 kms)
 - a. Purpose: Propagate a social message by way of a sport activity
 - b. Method: A group of students will begin the race with banner / placard in hand that contains a social message. The group runs for 500 meters and hands over the banner / placard to the next group of students. This chain of exchange will continue for 3 – 5 kms.
 - c. Outcome: Become aware of the need for fitness and encouragement towards healthier lifestyle. Students will also be able to express their creativity in terms of meaningful messages and gain attention towards worthy social causes from the community in and around the campus.
4. TREE PLANTATION ON CAMPUS
 - a. Purpose: Involve students to actively participate in environment protection and develop greener surroundings
 - b. Method: Each student will plant a sapling and take care of that plant until it is able to sustain itself. Alternatively, students can organize a tree plantation drive in a public area and nurture it
 - c. Outcome: Besides increase in plants in the locality, students will feel a sense of empowerment and become social contributors towards protecting the environment.
5. VISIT TO AN OLD AGE HOME / ORPHANAGE
 - a. Purpose: Build a sense of responsibility towards the less fortunate in our society and feel privileged to be able to effect real change in the world around us



- b. Method: Students have to visit an old age home or orphanage in the vicinity of the college. They can interact with the inmates, probably donate utilities to the charity organization and/or probably stage a few inclusive activities with the residents of the place. After the visit, students can submit a brief report about their experience
- c. Outcome: Learn first-hand about the conditions and social situations that the no-so-privileged members of our society have to endure to survive and go beyond their embarrassment to interact with the destitute which will help students appreciate the importance of Indian family values
6. STREET PLAY ACTIVITY
- a. Purpose: Create awareness in themselves as well as people in the community on various social evils that need to be eradicated
- b. Method: Students will prepare and enact a street play on any pertinent issues in society. The topics suggested can be perils of mobile phones / online fraud / safety for girls / mental and physical health of the youth.
- c. Outcome: Allow students to deliberate and think deeply about the looming issues that is dogging our society and the future of the youth. This will also bring out the creative skills among the students and allow them to showcase their talent.
7. BUDDY / BIG BROTHER SYSTEM
- a. Purpose: Include and involve the less fortunate children making them feel wanted and cared for as well as use the opportunity to share knowledge among school students.
- b. Method: Students have to go to nearby schools after procuring appropriate permissions to teach a particular topic on either technical or non technical domains. Each student can choose to adopt 5 students from the class to be their mentor over a period of 1 year by staying in touch with them and helping them resolve their issues on academic or other matters.
- c. Outcome: Appreciation and respect towards the responsibility of teaching. They will learn to be accountable as social contributors and bring about some change in the lives of the young students they mentor as Buddies or Big Brother.

Term Work Assessment Guidelines

Students must submit the report of all conducted activities conducted during Tutorial (Outside Classroom) of at least 04 activities (out of 07 activities) from group (of 02-03) students.

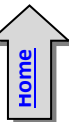
The brief guidelines for report preparations are as follows:

1. One activity report must be of maximum 3 pages;
2. Combined Report of all activities with cover pages, table of contents and certificate (signed by instructor) is to be submitted in soft copy (pdf) format only.
3. The report must contain:
 - General information about the activity;
 - Define the purpose of the activity;
 - Detail out the activities carried out during the visit in chronological order;
 - Summarize the operations / process (methods) during the activities;
 - Describe what you learned (outcomes) during the activities as a student;
 - Add photos of the activity;(optional)
 - Add a title page to the beginning of your report;
 - Write in clear and objective language; and
 - Get well presented, timely and complete report submitted.

Recommended Assessment and Weightage Parameters:

(Attendance 30%, Assignments/Activities-Active participation and proactive learning 50% and report 20%)

Learning Resources



Books:

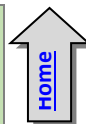
1. A. Alavudeen, M. Jayakumaran, and R Kalil Rahman, "Professional Ethics and Human Values"
2. Ram Ahuja, "Social Problems in India" (third edition)
3. Shastry, T. S. N., "India and Human rights: Reflections", Concept Publishing Company India Pvt. Ltd., 2005.
4. Nirmal, C.J., "Human Rights in India: Historical, Social and Political Perspectives (Law in India)", Oxford India
5. Rangarajan, "Environmental Issues in India", Pearson Education.
6. University of Delhi, The Individual and Society, Pearson Education.
7. Wikipedia.org / wiki /social studies.
8. M. N. Srinivas, "Social change in modern India", 1991, Orient Longman.
9. David Mandelbaum, Society in India, 1990, Popular.
10. Dr. Abha Singh, "Behavioral Science: Achieving Behavioral Excellence for Success", Wiley.

e-Books:

- <https://www.moteoo.org/en/products/social-science-and-humanities-student-book-english>
- <https://www.springeropen.com/books>
(SpringerOpen open access books; download them free of charge from SpringerLink)
- <https://muse.jhu.edu/article/541846/pdf>
(This content has been declared *free* to read by the publisher during the COVID-19)

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	2	2	2	-	-	-
CO2	-	-	-	-	-	-	2	-	-	-	-	-
CO3	-	-	-	-	-	-	-	2	2	-	-	1
CO4	-	-	-	-	-	-	2	2	2	-	-	-
CO5	-	-	-	-	-	-	-	2	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-



Savitribai Phule Pune University
Second Year of Computer Engineering (2019 Course)

210258: Project Based Learning II

Teaching Scheme Practical: 04 Hours/Week	Credit Scheme 02	Examination Scheme and Marks Term Work: 50 Marks
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Course Objectives:

- To develop critical thinking and problem solving ability by exploring and proposing solutions to realistic/social problem.
- To Evaluate alternative approaches, and justify the use of selected tools and methods.
- To emphasizes learning activities that are long-term, inter-disciplinary and student-centric.
- To engages students in rich and authentic learning experiences.
- To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.
- To develop an ecosystem that promotes entrepreneurship and research culture among the students.

Course Outcomes:

CO1: Identify the real life problem from societal need point of view

CO2: Choose and compare alternative approaches to select most feasible one

CO3: Analyze and synthesize the identified problem from technological perspective

CO4: Design the reliable and scalable solution to meet challenges

CO5: Evaluate the solution based on the criteria specified

CO6: Inculcate long life learning attitude towards the societal problems

Course Contents

Preamble:

Project-based learning is an instructional approach designed to give students the opportunity to develop knowledge and skills through engaging projects set around challenges and problems they may face in the real world. PBL, is more than just projects. With PBL students "investigate and respond to an authentic, engaging, and complex problem, or challenge" with deep and sustained attention. PBL is "learning by doing." The truth is, many in education are recognizing we live in a modern world sustained and advanced through the successful completion of projects. In short, If students are prepared for success in life, we need to prepare them for a project-based world. It is a style of active learning and inquiry-based learning. (Reference: Wikipedia). Project based learning will also redefine the role of teacher as mentor in learning process. Along with communicating knowledge to students, often in a lecture setting, the teacher will also to act as an initiator and facilitator in the collaborative process of knowledge transfer and development. The PBL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It Brings what students should academically know, understand, and be able to do and requires students to present their problems, research process, methods, and results.[\[1\]](#)

Project based learning (PBL) requires regular mentoring by faculty throughout the semester for successful completion of the idea/project tasks selected by the students per batch. For the faculty involved in PBL , teaching workload of 4 Hrs/week/batch needs to be considered. The Batch should be divided into sub-groups of 4 to 5 students. Idea implementation /Real life problem/Complex assignments / activities / projects. under project based learning is to be carried throughout semester and Credit for PBL has to be awarded on the basis of internal continuous assessment and evaluation at the end of semester

Group Structure:

Working in supervisor/mentor monitored groups; the students plan, manage, and complete a task/project/activity which addresses the stated problem.

1. There should be team/group of 4-5 students
2. A supervisor/mentor teacher assigned to individual groups

Selection of Project/Problem:

The problem-based project oriented model for learning is recommended. The model begins with the identifying of a problem, often growing out of a question or “wondering”. This formulated problem then stands as the starting point for learning. Students design and analyze the problem/project within an articulated interdisciplinary or subject frame.

A problem can be theoretical, practical, social, technical, symbolic, cultural, and/or scientific and grows out of students’ wondering within different disciplines and professional environments. A chosen problem has to be exemplary. The problem may involve an interdisciplinary approach in both the analysis and solving phases.

By exemplarity, a problem needs to refer back to a particular practical, scientific, social and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry.

There are no commonly shared criteria for what constitutes an acceptable project. Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content, and structure of the activity.

A few hands-on activities that may or may not be multidisciplinary.

Use of technology in meaningful ways to help them investigate, collaborate, analyse, synthesize, and present their learning.

Activities may include- Solving real life problem, investigation, /study and Writing reports of in depth study, field work.

Assessment:

The institution/head/mentor is committed to assessing and evaluating both student performance and program effectiveness.

Progress of PBL is monitored regularly on weekly basis. Weekly review of the work is necessary. During process of monitoring and continuous assessment and evaluation of the individual and the team performance is to be measured. PBL is monitored and continuous assessment is done by supervisor /mentor and authorities.

Students must maintain an institutional culture of authentic collaboration, self-motivation, peer-learning and personal responsibility. The institution/department should support students in this regard through guidance/orientation programs and the provision of appropriate resources and services. Supervisor/mentor and Students must actively participate in assessment and evaluation processes.

Group may demonstrate their knowledge and skills by developing a public product and/or report and/or presentation.

1. Individual assessment for each student (Understanding individual capacity, role and involvement in the project)
2. Group assessment (roles defined, distribution of work, intra-team communication and togetherness)
3. Documentation and presentation

Evaluation and Continuous Assessment:

It is recommended that all activities should to be recorded regularly, regular assessment of work need to be done and proper documents need to be maintained at college end by both students as well as mentor (PBL work book).

Continuous Assessment Sheet (CAS) is to be maintained by all mentors/department and institutes.

Recommended parameters for assessment/evaluation and weightage:

1. Idea Inception and Awareness /Consideration of -Environment/ Social /Ethics/ Safety measures/Legal aspects (10%)
2. Outcomes of PBL/ Problem Solving Skills/ Solution provided/ Final product (Individual assessment and team assessment) (40%)
3. Documentation (Gathering requirements, design and modelling, implementation/execution, use of technology and final report, other documents) (15%)
4. Demonstration (Presentation, User Interface, Usability) (20%)

5. Contest Participation/ publication (15%)

PBL workbook will serve the purpose and facilitate the job of students, mentor and project coordinator. It will reflect accountability, punctuality, technical writing ability and work flow of the work undertaken.

Note :

- While planning for the assessment, choose a valid method based on your context. It should be able to understand by both the students as well as the faculty.
- The student group must follow the principles of Software Engineering (Scoping out the problem, the solution implementation and related documentation).
- Researching the problem and outlining various approaches is key here and should be emphasized by the tutor and the mentor.
- Aspects of design thinking (from the point of view of the person facing the problem) are very important. Students should not jump into the technology aspects first.
- The team can follow the principles of Agile Software Development. The weekly meetings could be used as a Scrum meeting.
- The tutor and mentor should actively help the students to scope the work and the approach. They must validate the technology choices.
- If the implementation code is well documented, the project can be continued by subsequent batch – which will help solve a bigger problem.

Text Books:

1. A new model of problem based learning. By Terry Barrett. All Ireland Society for higher education (AISHE). ISBN:978-0-9935254-6-9; 2017
2. Problem Based Learning. By Mahnazmoallem, woei hung and Nada Dabbagh, Wiley Publishers. 2019.
3. Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert Capraro, Mary Margaret Capraro

Reference Books:

1. De Graaff E, Kolmos A., red.: Management of change: Implementation of problem-based and project-based learning in engineering. Rotterdam: Sense Publishers. 2007.
2. Gopalan, " Project management core text book", 2 Indian Edition
3. James Shore and Shane Warden, " The Art of Agile Development"

Tutors Role in Project Based Learning

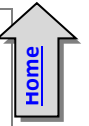
- The fundamentals of problem based learning, lies with the Tutors role.
- Tutors are not the source of solutions rather they act as the facilitator and mentor.
- The facilitator skills of the Tutors / Teacher are central to the success of PBL.

Change of Mindset

- Students are not used to the constructivist approach to learning, it is important that they are carefully told what to expect in PBL.
- Tutors need to explain the differences between PBL and traditional learning.
- Tutors need to explain the principals involved and role of the students in PBL learning.

Designing Problem

- Considering the prior knowledge of the students, their ability and creativity, problem statement should be designed.
- For 2nd year PBL students the tutor should place more emphasis on getting the students to perform higher-level tasks.
- It is important for tutors to design problems that are anchored in authentic contexts only
- Students should take ownership of the problem.
- Problems should not be over simplified or well defiled
- Learning should not be the sequencing of instructional events, but the application of principles for responding to the needs of the situation.
- The problems given to students in PBL should be realistic, complex, and should reflect, as



much as possible, the actual problems that students would encounter in real life.

Basic function of the tutor

- A good understanding of the overall curriculum the students have to study, the principles of problems solving, critical thinking and meta-cognitive skills.

Grouping

- Study the background and profile of each student.
- Make sure that students of different backgrounds and experience are assigned in a group
- It is useful to group students of different abilities, gender, and nationalities together.
- Tutors must have the commitment to devote the time to the tutorial process.
- A good tutor is always interested in helping students to learn better.
- Sufficient resources should be made available for students to take part the PBL tutorial.
- Time management is important.

Assessment of Learning

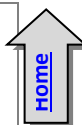
- It is important for tutors to make sure that assessment is consistent with learning objectives of the groups in PBL
- Assessment of students should not be focused only on the final leaning product.
- PBL tutors need to understand meaningful ways of assessing students' work to motivate learning.
- For assessment to be implemented properly there should be well designed and clearly defined goals and objectives and well thought out strategies, techniques, criteria, and marking schemes.

Student's Role in PBL

- Prepare students for PBL before starting the sessions.
- Students must have ability to initiate the task/idea .they should not be mere imitators.
- They must learn to think.
- Students working in PBL must be responsible for their own learning.
- Throughout the PBL process, students have to define and analyze the problem, generate learning issues and apply what they have learned to solve the problem and act for themselves and be free.
- Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
- Students in PBL are actively constructing their knowledge and understanding of the situation in groups.
- Students in PBL are expected to work in groups.
- They have to develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Inquiry Skills

- Students in PBL are expected to develop critical thinking abilities by constantly relating:
 - What they read to do?
 - What they want to do with that information?
 - They need to analyze information presented within the context of finding answers.
 - Modeling is required so that the students can observe and build a conceptual model of the required processes.
 - Formative and summative questions for evaluation:
 - How effective is?
 - How strong is the evidence for?
 - How clear is?
 - What are the justifications for thinking?
 - Why is the method chosen?
 - What is the evidence given to justify the solution?



Information Literacy

- Information literacy is an integral part of self- directed learning
- Information literacy involves the ability to:

- Know when there is a need for information
- Identify the information needed to solve a given problem or issue
- Be able to locate the needed information
- Use the information to solve the given problem effectively.
- Skills required by students in information literacy include:
 - How to prepare the search , How to carry out the research,
 - Sorting and assessing of information in general

Collaborative learning

- It is an educational approach to teaching and learning that involves
- groups of students working together to solve a problem or complete a project
- In collaborative learning, learners have the opportunity to talk with peers, exchange diverse beliefs present and defend ideas, as well as questioning other ideas.

Interpersonal Skills

- Interpersonal skills relating to group process are essential for effective problem solving and learning.
 - It is important that students are made aware of these inter personal skills.
 - Consensual decision making skills, Dialogue and discussion skills, Team maintenance skills
 - Conflict management skills and Team leadership skills.
- Students who have these skills have a better opportunity to learn than students who do not have these skills and Time Management

Resources

- Students need to have the ability to evaluate the resources used
- Students have to evaluate the source of the resources used by asking the following questions:

- How current is it?, Is there any reason to suspect bias in the source?
- How credible and accurate is it?

Meta-cognitive Skills

- Students need to reflect on the processes they are using during the learning process,
- Compare one strategy with another, and evaluate the effectiveness of the strategy used

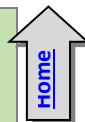
Reflection Skills

- Reflection helps students refine and strengthen their high-level thinking skills and abilities through self-assessment.
- Reflection gives students opportunities to think about how they answered a question, made a decision, or solved a problem.
- What strategies were successful or unsuccessful? ,What issues need to be remembered for next time? , What could or should be done differently in the future?

Follow the practices learned in Software Engineering course- Requirement Analysis, Designing and Modeling.

[@The CO-PO Mapping Matrix](#)

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-
CO4	-	-	-	-	2	-	-	-	-	-	-	-
CO5	-	-	-	-	-	3	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	2



Savitribai Phule Pune University Second Year of Engineering (2019 Course)

210251: Audit Course 3

In addition to credits, it is recommended that there should be audit course, in preferably in each semester starting from second year in order to supplement students' knowledge and skills. Student will be awarded the bachelor's degree if he/she earns specified total credit [1] and clears all the audit courses specified in the curriculum. The student will be awarded grade as AP on successful completion of audit course. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest in greater detail resulting in achieving the very objective of audit course's inclusion. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at institute level itself. Method of conduction and method of assessment for audit courses are suggested.

Criteria:

The student registered for audit course shall be awarded the grade AP (Audit Course Pass) and shall be included such AP grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at institute level itself [1]

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

- | | |
|---|---|
| <ul style="list-style-type: none"> • Lectures/ Guest Lectures • Visits (Social/Field) and reports • Demonstrations | <ul style="list-style-type: none"> • Surveys • Mini-Project • Hands on experience on focused topic |
|---|---|

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

- Written Test
- Demonstrations/ Practical Test
- Presentations, IPR/Publication and Report

Audit Course 3 Options

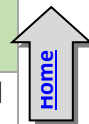
Audit Course Code	Audit Course Title
AC3-I	Green Construction and Design
AC3-II	Social Awareness and Governance Program
AC3-III	Environmental Studies
AC3-IV	Smart Cities
AC3-V	Foreign Language (one of Japanese/Spanish/French/German). Course contents for Japanese(Module 1) are provided. For other languages institute may design suitably.

Note: It is permitted to opt one of the audit courses listed at SPPU website too, if not opted earlier.

<http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202017/Forms/AllItems.aspx>

http://www.unipune.ac.in/university_files/syllabi.htm

AC3-IV: Smart Cities



We breathe in a world defined by urbanization and digital ubiquity, where mobile broadband connections outnumber fixed ones, machines dominate a new "internet of things," and more people live in cities than in the countryside. This course enables us to take a broad historical look at the forces that have shaped the planning and design of cities and information technologies from the rise of the great industrial cities of the nineteenth century to the present. This course considers the motivations, aspirations, and shortcomings of them all while offering a new civics to guide our efforts as we build the future together, one click at a time.

Course Objectives

- To identify urban problems
- To study Effective and feasible ways to coordinate urban technologies.
- To study models and methods for effective implementation of Smart Cities.
- To study new technologies for Communication and Dissemination.
- To study new forms of Urban Governance and Organization.

Course Outcomes

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

CO1: Understand the dynamic behavior of the urban system by going beyond the physical appearance and by focusing on representations, properties and impact factors

CO2: Explore the city as the most complex human-made organism with a metabolism that can be modeled in terms of stocks and flows

CO3: Knowledge about data-informed approaches for the development of the future city, based on crowd sourcing and sensing

CO4: Knowledge about the latest research results in for the development and management of future cities

CO5: Understand how citizens can benefit from data-informed design to develop smart and responsive cities

Course Contents

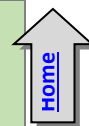
Urbanization and Ubiquity - The slow emergence of learning cities in an urbanizing world. Cities as collective learners, what do we know?- Framing a view -A gamut of learning types - Secrets of knowing and accelerating change - Why some cities learn and others do not.

References:

1. Anthony M. Townsend, W. W. Norton and Company "Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia", ISBN: 0393082873, 9780393082876.
2. Tim Campbell, Routledge, "Beyond Smart Cities: How Cities Network, Learn and Innovate", Routledge, ISBN: 9781849714266.
3. Stan Geertman, Joseph Ferreira, Jr. Robert Goodspeed, John Stillwell, "Planning Support Systems and Smart Cities", Lecture notes in Geo information and Cartography, Springer.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	2	-	-	2	2	1	-	-	-	-
CO2	1	2	1	-	-	1	1	-	-	-	-	-
CO3	2	1	3	3	2	-	1	-	1	1	1	
CO4	-	3	2	-	-	-	-	-	-	-	1	2



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
- To have an idea about the Collegiality and Loyalty, Collective Bargaining, Confidentiality, Occupational Crime, Professional, Employee, Intellectual Property Rights.

Course Outcomes:

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

CO1: Understand the basic perception of profession, professional ethics, various moral and social issues, industrial standards, code of ethics and role of professional ethics in engineering field.

CO2: Aware of professional rights and responsibilities of an engineer, responsibilities of an engineer for safety and risk benefit analysis.

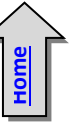
CO3: Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

CO4: Acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives.

Course Contents

The following are the certain guidelines as far as ethics and code of conduct are concerned to be clearly and elaborately explained to the students,

Fundamental norms Engineers, in the fulfillment of their professional duties, should include paying utmost attention to the safety, health, and welfare of the society. Along with that engineers should execute the services only in their areas of competence. Whenever there is a need to issue public statements then such statements should be expressed in objective and truthful manner. Engineer should extend high sense of integrity by acting for each employer or client as faithful agents or trustees. Whatever may be the working scope engineer should conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.



As far as ethical practices are concerned engineers should not reveal facts, data, or information without the prior consent of the client or employer except as authorized or required by law or Code. Engineers should not permit the use of their name or associate in business ventures with any person or firm that they believe is engaged in fraudulent or dishonest enterprise moreover he/she should not aid or abet the unlawful practice of engineering by a person or firm.

Engineers having knowledge of any alleged violation of the Code should report thereon to appropriate professional bodies and, when relevant, also to public authorities, and cooperate with the proper authorities in furnishing such information or assistance as may be required. Engineers should disclose all known or potential conflicts of interest that could influence or appear to influence their judgment or the quality of their services. Engineers should not accept compensation, financial or otherwise, from more than one party for services on the same project, or for services pertaining to the same project, unless the circumstances are fully disclosed and agreed to by all interested parties. Engineers should not solicit or accept financial or other valuable consideration, directly or indirectly, from outside agents in connection with the work for which they are responsible.

Engineers should never falsify their qualifications or permit misrepresentation of their or their associates' qualifications. They shall not misrepresent or exaggerate their responsibility in or for the subject matter of prior assignments. Brochures or other presentations incident to the solicitation of employment shall not misrepresent pertinent facts concerning employers, employees, associates, joint ventures, or past accomplishments.

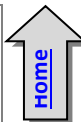
Engineers should not offer, give, solicit, or receive, either directly or indirectly, any contribution to influence the award of a contract by public authority, or which may be reasonably construed by the public as having the effect or intent of influencing the awarding of a contract. They should not offer any gift or other valuable consideration in order to secure work. They should not pay a commission, percentage, or brokerage fee in order to secure work, except to a bona fide employee or bona fide established commercial or marketing agencies retained by them.

There are certain obligations accompanied with engineering profession. Engineers should acknowledge their errors and should not distort or alter the facts. Candid advises in special cases are always welcome. Engineers should not accept outside employment to the detriment of their regular work or interest. Before accepting any outside engineering employment, they will notify their employers.

Engineers should not promote their own interest at the expense of the dignity and integrity of the profession furthermore they should treat all persons with dignity, respect, fairness, and without discrimination. Engineers should at all times strive to serve the public interest. Engineers are encouraged to participate in civic affairs; career guidance for youths; and work for the advancement of the safety, health, and well-being of their community. Engineers are encouraged to adhere to the principles of sustainable development in order to protect the environment for future generations. Engineers shall continue their professional development throughout their careers and should keep current in their specialty fields by engaging in professional practice, participating in continuing education courses, reading in the technical literature, and attending professional meetings and seminar.

Engineers should not, without consent, use equipment, supplies, laboratory, or office facilities of an employer to carry on outside private practice. They should not attempt to injure, maliciously or falsely, directly or indirectly, the professional reputation, prospects, practice, or employment of other engineers. Engineers who believe others are guilty of unethical or illegal practice shall present such information to the proper authority for action. "Sustainable development" is the challenge for the engineers meeting human needs for natural resources, industrial products, energy, food, transportation, shelter, and effective waste management while conserving and protecting environmental quality and the natural resource base essential for future development.

Following are contents to be covered in tutorial session-



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**

#Exemplar/Case Studies :

General Motors ignition switch recalls (2014), Space Shuttle Columbia disaster (2003), Space Shuttle Challenger disaster (1986), Therac-25 accidents (1985 to 1987), Chernobyl disaster (1986), Bhopal disaster (1984), Kansas City Hyatt Regency walkway collapse (1981)

Guidelines for Conduction:

The course will exemplify the budding engineers the Code of Conduct and ethics pertaining to their area and scope of their work. The Instructor/Teacher shall explain the students the importance and impact of the ethics and code of conduct.

Confined to various courses and project/mini-project development the possible vulnerabilities and threats need to be elaborated and the students' participation need to be encouraged in designing such document explicitly mentioning Code of Conduct and Disclaimers.

Suggested set of Activities

1. **Purpose**-Introduce the concept of Professional Code of Conduct
Method – Using Group Discussion as a platform, ask students to share one practice in their family / home that everyone has to follow. For ex. not wearing footwear in the house, taking a bath first thing in the morning, seeking blessings from elders, etc. Connect this Code of Conduct in their family to one that exists in the professional world
Outcome – Awareness of profession-specific code of conduct and importance of adherence of that code specified. Ability to express opinions verbally and be empathetic to diverse backgrounds and values
2. **Purpose**-Impress upon the students, the significance of morality
Method – Role play a professional situation where an engineer is not competent and is trying to copy the work of a colleague and claim credit for that work. Ask observing students to react to that situation. Alternatively, a short video that clearly shows unethical behavior can be played and ask viewers their opinion about the situation. Note to teachers – read about Kohlber's theory and Gilligan's theory to understand levels of moral behavior
Outcome – Incite students to contemplate their own immoral behavior in public space or academic environment (like copying homework or assignment). Will coax students to introspect their own values and encourage them to choose the right path
3. **Purpose**-Highlight the importance of professional ideals like conflict management, ambition, ethical manners and accountability
Method – Each student will have to write a 200 word essay on any of above mentioned virtues of being a good professional. On evaluation, the top 5 essays can be displayed on the college wall magazine and rewarded if deemed appropriate
Outcome – Learn to express one's ideas and identify and relate to good virtues. Build writing skills, improve language and gain knowledge about how to write an impactful essay



- 4. Purpose**–Make students aware of proper and globally accepted ethical way to handle work, colleagues and clients
Method – Teacher can form groups of 6 – 7 students and assign them different cases (these can be accessed online from copyright free websites of B-school content)
Outcome – Develop group communication skills. Learn to speak up one’s opinion in a forum. Cultivate the habit of presenting solution-driven analytical arguments making them contributors in any team.
- 5. Purpose** – Make students aware that technology can be harmful if not used wisely and ethically
Method – Conduct a quiz on various ethical dilemmas that are relevant in today’s world pertaining to privacy right, stalking, plagiarism, hacking, weaponizing technology, AI, electronic garbage creating environmental hazard etc
Outcome – Make students aware of various adverse consequences of technology development and allow them to introspect on how to use technology responsibly.
- 6. Purpose** – Expose students to professional situations where engineers must use their skills ethically and for the betterment of society and nation
Method – Students in groups of 4 can be given an assignment in the earlier session to present in front of the class one specific case where they felt unethical treatment has been meted out to a person by an engineer – either as a witness, advisor, dishonesty, improper skills testimony etc. The group has to make a short presentation and also suggested plausible solutions to that situation. Q&A from other students must encouraged to allow healthy discussion
Outcome – Become aware of unethical code of conduct in the professional world and how to follow a moral compass especially when one reaches positions of power.
- 7. Purpose** – Provide an insight into rights and ethical behavior.
Method – Movies like The Social Network can be played and students can be asked to discuss their opinion about collegiality, intellectual property, friendship and professional relationships
Outcome – help them look at success stories from an ethical point of view. Develop critical thinking and evaluation of circumstances.
- 8. Purpose** – Make students contemplate about ideal and safe professional environment and decide on making right decisions based on codes of conduct
Method – Students can be asked to write down 5 most important codes of conduct that they feel that every computer engineer should follow. After evaluation by teacher / experts, the collection of codes can be converted into a handbook to be given to every student as a memoir to help them in their professional life.
Outcome – Introspection and think about how to shape the professional environment. Also, when they carry back with them their own codes of conduct, they could feel bound to adhere to these ethics.

Term Work Assessment Guidelines

Students must submit the report of all conducted activities. The brief guidelines for report preparations are as follows:

1. One activity report must be of maximum 3 pages;
2. Combined Report of all activities with cover pages, table of contents and certificate (signed by instructor) is to be submitted in soft copy (pdf) format only.
3. The report must contain:
 - General information about the activity;
 - Define the purpose of the activity;
 - Detail out the activities carried out during the visit in chronological order;
 - Summarize the operations / process (methods) during the activities;
 - Describe what you learned (outcomes) during the activities as a student;
 - Add photos of the activity;(optional)
 - Add a title page to the beginning of your report;
 - Write in clear and objective language; and
 - Get well presented, timely and complete report submitted.

Recommended Assessment and Weightage Parameters:

(Attendance 30%, Assignments/Activities- Active participation and proactive learning 50% and report 20%)

Term Work Assessment Guidelines

Students must submit the report of all conducted activities conducted during Tutorial (Outside Classroom) of at least 04 activities (out of 07 activities) from group (of 02-03) students.

The brief guidelines for report preparations are as follows:

1. One activity report must be of maximum 3 pages;
2. Combined Report of all activities with cover pages, table of contents and certificate (signed by instructor) is to be submitted in soft copy (pdf) format only.
3. The report must contain:
 - General information about the activity;
 - Define the purpose of the activity;
 - Detail out the activities carried out during the visit in chronological order;
 - Summarize the operations / process (methods) during the activities;
 - Describe what you learned (outcomes) during the activities as a student;
 - Add photos of the activity;(optional)
 - Add a title page to the beginning of your report;
 - Write in clear and objective language; and
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Recommended Assessment and Weightage Parameters:

(Attendance 30%, Active participation and proactive learning 50% and report 20%)

Web Links:

- <https://www.ieee.org/about/compliance.html>
- <https://www.cs.cmu.edu/~bmclaren/ethics/caseframes/91-7.html>
- <https://www.nspe.org/>
- http://www.ewh.ieee.org/soc/pes/switchgear/presentations/tp_files/2017-1_Thurs_Shiffbauer_Singer_Engineering_Ethics.pdf

MOOC/ Video lectures available at:

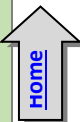
- https://swayam.gov.in/nd1_noc20_mg44/preview

@The CO-PO Mapping Matrix

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CO2	-	-	-	-	-	-	2	2	-	-	-	-
CO3	-	-	-	-	-	-	3	2	-	-	-	-
CO4	-	-	-	-	-	-	2	3	-	-	-	-

Savitribai Phule Pune University
Second Year of Engineering (2019 Course)

210260: Audit Course 4



In addition to credits, it is recommended that there should be audit course in preferably in each semester starting from second year in order to supplement student's knowledge and skills. Student will be awarded the bachelor's degree if he/she earns specified total credits [1] and clears all the audit courses specified in the syllabus. The student will be awarded grade as AP on successful completion of audit course. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest in greater detail resulting in achieving the very objective of audit course's inclusion. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at institute level itself. Method of conduction and method of assessment for audit courses are suggested.

Criteria:

The student registered for audit course shall be awarded the grade AP (Audit Course Pass) and shall be included such AP grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at institute level itself. [1]

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

- | | |
|---|---|
| <ul style="list-style-type: none"> • Lectures/ Guest Lectures • Visits (Social/Field) and reports • Demonstrations | <ul style="list-style-type: none"> • Surveys • Mini-Project • Hands on experience on focused topic |
|---|---|

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

- Written Test
- Demonstrations/ Practical Test
- Presentations, IPR/Publication and Report

Audit Course 4 Options

Audit Course Code	Audit Course Title
AC4-I	Water Management
AC4-II	Intellectual Property Rights and Patents
AC4-III	The Science of Happiness
AC4-IV	Stress Relief: Yoga and Meditation
AC4-V	Foreign Language (one of Japanese/Spanish/French/German) Course contents for Japanese(Module 2) are provided. For other languages institute may design suitably.

Note: It is permitted to opt one of the audit courses listed at SPPU website too, if not opted earlier. [1]

<http://collegirculars.unipune.ac.in/sites/documents/Syllabus%202017/Forms/AllItems.aspx>

http://www.unipune.ac.in/university_files/syllabi.htm

AC4-V: Foreign Language (Japanese) Module 2

With changing times, the competitiveness has gotten into the nerves and 'Being the Best' at all times is only the proof of it. Nonetheless, 'being the best' differs significantly from 'Communicating the best'! The best can merely be communicated whilst using the best... suited Language!!

Course Objectives:

- To meet the needs of ever growing industry with respect to language support.
- To get introduced to Japanese society and culture through language.

Course Outcomes:

On completion of the course learner will-

1. have ability of basic communication.
2. have the knowledge of Japanese script.
3. get introduced to reading , writing and listening skills
4. develop interest to pursue professional Japanese Language course

Course Contents

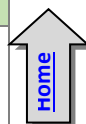
1. Katakana basic Script, Denoting things (nominal and pre nominal demonstratives), Purchasing at the Market / in a shop / mall (asking and stating price)
2. Katakana : Modified kana, double consonant, letters with ya, yu, yo, Long vowels, Describing time, describing starting and finishing time (kara ~ made), Point in time (denoting the time when any action or the movement occurs)
3. Means of transport (Vehicles), Places, Countries, Stating Birth date, Indicating movement to a certain place by a vehicle.

References:

1. Minna No Nihongo, "Japanese for Everyone", (Indian Edition), Goyal Publishers and Distributors Pvt. Ltd.
2. <http://www.tcs.com> (http://www.tcs.com/news_events/press_releases/Pages/TCS-Inaugurates-Japan-centric-Delivery-Center-Pune.aspx)

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	1	3	1	1
CO2	-	-	-	-	1	-	-	-	-	3	1	1
CO3	-	-	-	-	1	-	-	-	-	3	2	2
CO4	-	-	-	-	-	-	-	-	-	1	-	1



Savitribai Phule Pune University														
Third Year of Computer Engineering (2019 Course)														
(With effect from Academic Year 2021-22)														
Semester V														
Course Code	Course Name	Teaching Scheme (Hours/week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
310241	Database Management Systems	03	-	-	30	70	-	-	-	100	03	-	-	03
310242	Theory of Computation	03	-	-	30	70	-	-	-	100	03	-	-	03
310243	Systems Programming and Operating System	03	-	-	30	70	-	-	-	100	03	-	-	03
310244	Computer Networks and Security	03	-	-	30	70	-	-	-	100	03	-	-	03
310245	Elective I	03	-	-	30	70	-	-	-	100	03	-	-	03
310246	Database Management Systems Laboratory	-	04	-	-	-	25	25	-	50	-	02	-	02
310247	Computer Networks and Security Laboratory	-	02	-	-	-	25	-	25	50	-	01	-	01
310248	Laboratory Practice I	-	04	-	-	-	25	25	-	50	-	02	-	02
310249	Seminar and Technical Communication	-	01	-	-	-	50	-	-	50	-	01	-	01
Total		15	11	-	150	350	125	50	25	700	15	06	-	21
310250	Audit Course 5											Grade		
Total Credit											15	06	-	21
Elective I					Audit Course 5									
<ul style="list-style-type: none"> • Internet of Things and Embedded Systems • Human Computer Interface • Distributed Systems • Software Project Management 					<ul style="list-style-type: none"> • Cyber Security • Professional Ethics and Etiquettes • MOOC- Learn New Skills • Engineering Economics • Foreign Language 									
Laboratory Practice I														
Assignments from Systems Programming and Operating System and Elective I														

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
 (With effect from Academic Year 2021-22)

Semester VI

Course Code	Course Name	Teaching Scheme (Hours/week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral	Total	Lecture	Practical	Tutorial	Total
310251	Data Science and Big Data Analytics	03	-	-	30	70	-	-	-	100	03	-	-	03
310252	Web Technology	03	-	-	30	70	-	-	-	100	03	-	-	03
310253	Artificial Intelligence	03	-	-	30	70	-	-	-	100	03	-	-	03
310254	Elective II	03	-	-	30	70	-	-	-	100	03	-	-	03
310255	Internship**	-	**	-	-	-	100**	-	-	100	-	04**	-	04
310256	Data Science and Big Data Analytics Laboratory	-	04	-	-	-	50	25	-	75	-	02	-	02
310257	Web Technology Laboratory	-	02	-	-	-	25	-	25	50	-	01	-	01
310258	Laboratory Practice II	-	04	-	-	-	50	25	-	75	-	02	-	02
Total											12	09	-	21
Total		12	10	-	120	280	225	50	25	700	12	05	-	21
310259	Audit Course 6												Grade	
Elective II					Audit Course 6									
<ul style="list-style-type: none"> • Information Security • Augmented and Virtual Reality • Cloud Computing • Software Modeling and Architectures 					<ul style="list-style-type: none"> • Digital and Social Media Marketing • Sustainable Energy Systems • Leadership and Personality Development • Foreign Language • MOOC- Learn New Skills 									
Laboratory Practice II:														
Assignments from Artificial Intelligence and Elective II .														
** Internship:														
Internship guidelines are provided in course curriculum sheet.														

Savitribai Phule Pune University

Third Year of Computer Engineering (2019 Course)

Elective I

310245(A): Internet of Things and Embedded Systems


 Home

Teaching Scheme: TH: 03 Hours/Week	Credit: 03	Examination Scheme: Mid-Sem (TH) : 30 Marks End-Sem (TH): 70 Marks
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Prerequisites Courses: Computer Networks and Security (310244)

Companion Course: Laboratory Practice I (310248)

Course Objectives:

- To understand fundamentals of Internet of Things (IoT) and Embedded Systems
- To learn advances in Embedded Systems and IoT
- To learn methodologies for IoT application development
- To learn the IoT protocols, cloud platforms and security issues in IoT
- To learn real world application scenarios of IoT along with its societal and economic impact using case studies and real time examples

Course Outcomes:

On completion of the course, learners should be able to

- CO1:** Understand the fundamentals and need of Embedded Systems for the Internet of Things
- CO2:** Apply IoT enabling technologies for developing IoT systems
- CO3:** Apply design methodology for designing and implementing IoT applications
- CO4:** Analyze IoT protocols for making IoT devices communication
- CO5:** Design cloud based IoT systems
- CO6:** Design and Develop secured IoT applications

Course Contents

Unit I	Introduction to Embedded Systems	07 Hours
Definition, Characteristics of Embedded System, Real time systems, Real time tasks. Processor basics: General Processors in Computer Vs Embedded Processors, Microcontrollers, Microcontroller Properties, Components of Microcontrollers, System-On-Chip and its examples, Components of Embedded Systems, Introduction to embedded processor.		
#Exemplar/Case Studies	Installation of Real Time Operating System	
*Mapping of Course Outcomes for Unit I	CO1,CO2	
Unit II	Internet of Things : Concepts	07 Hours
Introduction to Internet of Things (IoT): Definition, Characteristics of IoT, Vision, Trends in Adoption of IoT, IoT Devices, IoT Devices Vs Computers, Societal Benefits of IoT, Technical Building Blocks. Physical Design of IoT: Things in IoT, Interoperability of IoT Devices, Sensors and Actuators, Need of Analog / Digital Conversion. Logical Design of IoT: IoT functional blocks, IoT enabling technologies, IoT levels and deployment templates, Applications in IoT.		
#Exemplar/Case Studies	Exemplary device: Raspberry Pi / Arduino: Programming: Arduino IDE/ Python, Interfacing. Other IoT Devices.	
*Mapping of Course Outcomes for Unit II	CO1,CO2	

Unit III	IoT: Design Methodology	07 Hours
IoT Design Methodology: Steps, Basics of IoT Networking, Networking Components, Internet Structure, Connectivity Technologies, IoT Communication Models and IoT Communication APIs, Sensor Networks, Four pillars of IoT: M2M, SCADA, WSN, RFID.		
#Exemplar/Case Studies	Home Automation using IoT communication models and IoT Communication APIs.	
*Mapping of Course Outcomes for Unit III	CO3,CO4	
Unit IV	IoT Protocols	07 Hours
Protocol Standardization for IoT, M2M and WSN Protocols, RFID Protocol, Modbus Protocol, Zigbee Architecture. IP based Protocols: MQTT (Secure), 6LoWPAN, LoRa.		
#Exemplar/Case Studies	LoRa based Smart Irrigation System.	
*Mapping of Course Outcomes for Unit IV	CO4,CO5	
Unit V	Cloud Platforms for IoT	07 Hours
Software Defined Networking, Introduction to Cloud Storage Models, Communication API. WAMP: AutoBahn for IoT, Xively Cloud for IoT. Python Web Application Framework: Django Architecture and application development with Django, Amazon Web Services for IoT, SkyNet IoT Messaging Platform, RESTful Web Service, GRPC,SOAP.		
#Exemplar/Case Studies	Smart parking, Forest Fire Detection	
*Mapping of Course Outcomes for Unit V	CO4, CO5	
Unit VI	Security in IoT	07 Hours
Introduction, Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, Threat Modeling. Key elements of IoT Security: Identity establishment, Access control, Data and message security, Non-repudiation and availability, Security model for IoT, Challenges in designing IOT applications, lightweight cryptography.		
#Exemplar/Case Studies	Home Intrusion Detection	
*Mapping of Course Outcomes for Unit VI	CO2, CO6	
Learning Resources		
Text Books:		
<ol style="list-style-type: none"> 1. Arshdeep Bahga, Vijay Madiseti, “Internet of Things – A hands-on approach”, Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515 2. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things: Key Applications and Protocols”, 2nd Edition, Wiley Publication, ISBN: 978-1-119-99435-0 		
Reference Books:		
<ol style="list-style-type: none"> 1. Dawoud Shenouda Dawoud, Peter Dawoud, “Microcontroller and Smart Home Networks”, ISBN: 9788770221566, e-ISBN: 9788770221559 2. Charles Crowell, “IoT-Internet of Things for Beginners: An Easy-to-Understand Introduction to IoT”, ISBN-13 : 979-8613100194 3. David Hanes, Gonzalo Salgueiro, Robert Barton, Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, Cisco Press, ISBN-13: 978-1-58714-456-1 ISBN-10: 1-58714-456-5 		

4. David Etter, “IoT Security: Practical guide book”, amazon kindle Page numbers, source ISBN : 1540335011.
5. Brian Russell, Drew Van Duren, “Practical Internet of Things Security”, Second Edition, Packt Publishing, ISBN: 9781788625821

e-Books :

- <https://www.iotforall.com/ebooks/an-introduction-to-iot>
- <https://www.qorvo.com/design-hub/ebooks/internet-of-things-for-dummies>

MOOCs Courses link

- <https://nptel.ac.in/courses/106/105/106105166/>
- <https://www.udemy.com/course/a-complete-course-on-an-iot-system-design-and-development/>
- <https://www.coursera.org/learn/iot>
- <https://nptel.ac.in/courses/108/108/108108098/>

@The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	2	-	-	-	-	1	-	1	-
CO2	3	2	1	2	1	-	-	-	-	-	-	-
CO3	2	3	3	3	2	3	-	-	2	-	1	-
CO4	1	2	2	2	3	3	-	-	2	1	2	2
CO5	2	2	2	3	3	3	-	-	2	1	2	2
CO6	2	2	1	2	2	2	-	1	1	-	1	1

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)
310249: Seminar and Technical Communication



Teaching Scheme Practical: 01 Hours/Week	Credit Scheme 01	Examination Scheme and Marks Term Work: 50 Marks
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Course Objectives:

- To explore the basic principles of communication (verbal and non-verbal) and active, empathetic listening, speaking and writing techniques
- To explore the latest technologies
- To enhance the communication skills
- To develop problem analysis skills

Course Outcomes:

On completion of the course, learners will be able to

CO1: Analyze a latest topic of professional interest

CO2: Enhance technical writing skills

CO3: Identify an engineering problem, analyze it and propose a work plan to solve it

CO4: Communicate with professional technical presentation skills

Guidelines

- Each student will select a topic in the area of Computer Engineering and Technology preferably keeping track with recent technological trends and development beyond scope of syllabus avoiding repetition in consecutive years.
- The topic must be selected in consultation with the Institute guide.
- Each student will make a seminar presentation using audio/visual aids for a duration of 20-25 minutes and submit the seminar report prepared in Latex only.
- Active participation at classmate seminars is essential.
- BoS has circulated the Seminar Log book and it is recommended to use it.

Guidelines for Assessment

Panel of staff members along with a guide would be assessing the seminar work based on these parameters-Topic, Contents and Presentation, regularity, Punctuality and Timely Completion, Question and Answers, Report, Paper presentation/Publication, Attendance and Active Participation.

Recommended Format of the Seminar Report

- Title Page with Title of the topic, Name of the candidate with Exam Seat Number / Roll Number, Name of the Guide, Name of the Department, Institution and Year and University
- Seminar Approval Sheet/Certificate
- Abstract and Keywords
- Acknowledgements
- Table of Contents, List of Figures, List of Tables and Nomenclature
- Chapters Covering topic of discussion- Introduction with section including organization of the report, Literature Survey/Details of design/technology/Analytical and/or experimental work, if any/,Discussions and Conclusions ,Bibliography/References
- Plagiarism Check report
- Report Documentation page

Reference Books :

1. Rebecca Stott, Cordelia Bryan, Tory Young, "Speaking Your Mind: Oral Presentation and Seminar Skills (Speak-Write Series)", Longman, ISBN-13: 978-0582382435

Savitribai Phule Pune University
Third Year of Engineering (2019 Course)
310250: Audit Course 5



In addition to credits, it is recommended that there should be audit course, in preferably in each semester starting from second year in order to supplement students' knowledge and skills. Student will be awarded the bachelor's degree if he/she earns specified total credit [1] and clears all the audit courses specified in the curriculum. The student will be awarded grade as AP on successful completion of audit course. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest in greater detail resulting in achieving the very objective of audit course's inclusion. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at Institute level itself. Method of conduction and method of assessment for audit courses are suggested.

Criteria

The student registered for audit course shall be awarded the grade AP (Audit Course Pass) and shall be included such AP grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at Institute level itself [1]

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

- | | |
|--|---|
| <ul style="list-style-type: none"> • Lectures/ Guest Lectures • Visits (Social/Field) and reports • Demonstrations or presentations | <ul style="list-style-type: none"> • Surveys • Mini-Project • Hands on experience on focused topic |
|--|---|

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

- Written Test
- Demonstrations/ Practical Test
- Presentation or Report

Audit Course 5 Options

Audit Course Code	Audit Course Title
AC5-I	Cyber Security
AC5-II	Professional Ethics and Etiquette
AC5-III	MOOC- Learn New Skills
AC5-IV	Engineering Economics
AC5-V	Foreign Language (one of Japanese/ Spanish/ French/ German). Course contents for Japanese (Module 3) are provided. For other languages institute may design suitably.

Note: It is permitted to opt one of the audit courses listed at SPPU website too, if not opted earlier.
<http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202017/Forms/AllItems.aspx>
http://www.unipune.ac.in/university_files/syllabi.htm

AC5-I: Cyber Security**Prerequisites:** Computer Network and Security (310244)**Course Objectives:**

- To motivate students for understanding the various scenarios of cybercrimes
- To increase awareness about the cybercrimes and ways to be more secure in online activities
- To learn about various methods and tools used in cybercrimes
- To analyze the system for various vulnerabilities

Course Outcomes : On completion of the course, learners will be able to**CO 1:** Understand and classify various cybercrimes**CO 2:** Understand how criminals plan for the cybercrimes**CO 3:** Apply tools and methods used in cybercrime**CO 4:** Analyze the examples of few case studies of cybercrimes**Course Contents**

- 1. Introduction to Cybercrime:** Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective.
- 2. Cyber offenses: How Criminals Plan Them:** Introduction, How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.
- 3. Tools and Methods Used in Cybercrime :** Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks (**Expected to cover the introduction to all these terms**).
- 4. Cybercrime: Illustrations, Examples and Mini-Cases:** Introduction, Real-Life Examples, Mini-Cases, Illustrations of Financial Frauds in Cyber Domain, Digital Signature-Related Crime Scenarios, Digital Forensics Case Illustrations, Online Scams.

Text Books :

1. Nina Godbole, Sunit Belapure , “Cyber Security- Understanding Cyber Crimes”, Computer Forensics and Legal Perspectives, Wiley India Pvt.Ltd, ISBN- 978-81-265-2179-1
2. William Stallings, “Computer Security: Principles and Practices”, Pearson 6th Ed, ISBN 978-0-13-335469-0

Reference Books :

1. Berouz Forouzan, “Cryptography and Network Security”, TMH, 2 edition, ISBN -978-00-707-0208-0. 5.
2. Mark Merkow, “Information Security-Principles and Practices”, Pearson Ed., ISBN- 978-81-317-1288-7
3. CK Shyamala et al., “Cryptography and Security”, Wiley India Pvt. Ltd, ISBN-978-81-265-2285-9

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	1	1	1	1	2	1	-	3	-	1	-	2
CO2	1	1	1	1	1	1	-	3	-	1	-	2
CO3	1	1	1	1	1	1	-	3	-	1	-	2
CO4	1	1	1	1	1	1	-	3	-	1	-	2

Savitribai Phule Pune University
Third Year of Computer Engineering (2019 Course)



Elective II

310254(A): Information Security

Teaching Scheme: TH: 03 Hours/Week	Credit: 03	Examination Scheme: Mid-Sem (TH) : 30 Marks End-Sem (TH): 70 Marks
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Prerequisites Courses: -- Computer Networks and Security (310244)

Companion Course: -- Laboratory Practice II (310258)

Course Objectives:

- To understand the fundamental approaches, principles and apply these concepts in Information Security
- To acquire the knowledge of mathematics for cryptography, understand the concepts of basic cryptography
- To learn standard algorithms and protocols employed to provide confidentiality, integrity and authenticity
- To acquire the knowledge of security protocol deployed in web security
- To study Information Security tools

Course Outcomes:

On completion of the course, learners should be able to

CO1: Model the cyber security threats and apply formal procedures to defend the attacks

CO2: Apply appropriate cryptographic techniques by learning symmetric and asymmetric key cryptography

CO3: Design and analyze web security solutions by deploying various cryptographic techniques along with data integrity algorithms

CO4: Identify and Evaluate Information Security threats and vulnerabilities in Information systems and apply security measures to real time scenarios

CO5: Demonstrate the use of standards and cyber laws to enhance Information Security in the development process and infrastructure protection

Course Contents

Unit I	Introduction to Information Security	05 Hours
Foundations of Security, Computer Security Concepts, The OSI Security Architecture, Security attacks, Security services, Security mechanism, A Model for Network Security.		
#Exemplar/Case Studies	Open Source/ Free/ Trial Tools: ClamAV antivirus engine, Anti Phishing, Anti Spyware, Wireshark	
*Mapping of Course Outcomes for Unit I	CO1	
Unit II	Symmetric Key Cryptography	07 Hours
Classical Encryption Techniques: Stream Ciphers, Substitution Techniques: Caesar Cipher, Monoalphabetic Ciphers, Playfair Cipher, Hill Cipher, Polyalphabetic Ciphers, Transposition Techniques, Block Ciphers and Data Encryption standards, 3DES, Advanced Encryption standard		
#Exemplar/Case Studies	Open Source/ Free/ Trial Tools: crypt tool	
*Mapping of Course Outcomes for Unit II	CO2	

Unit III	Asymmetric Key Cryptography	07 Hours
<p>Number theory: Prime number, Fermat and Euler theorems , Testing for primality, Chinese remainder theorem, discrete logarithm, Public Key Cryptography and RSA, Diffie-Hellman key exchange, ElGamal algorithm, Elliptic Curve Cryptography</p>		
#Exemplar/Case Studies	Open Source/ Free/ Trial Tools: crypt tool	
*Mapping of Course Outcomes for Unit III	CO2	
Unit IV	Data Integrity Algorithms And Web Security	09 Hours
<p>Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3, MD4, MD5. Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MACs. Digital Signatures: Digital Signatures, Schemes, Digital Signature standard, X.509 Certificate.</p> <p>Web Security issues, HTTPS, SSH, Email security: PGP, S/MIME, IP Security : IPSec</p>		
#Exemplar/Case Studies	Open Source/ Free/ Trial Tools: OpenSSL, Hash Calculator Tool : MD5, SHA1, SHA256, SHA 512	
*Mapping of Course Outcomes for Unit IV	CO3	
Unit V	Network and System Security	07 Hours
<p>The OSI Security architecture, Access Control, Flooding attacks, DOS, Distributed DOS attacks Intrusion detection, Host based and network based Honeypot, Firewall and Intrusion prevention system, Need of firewall, Firewall characteristics and access policy, Types of Firewall, DMZ networks, Intrusion prevention system: Host based, Network based, Hybrid.</p> <p>Operating system Security, Application Security, Security maintenance, Multilevel Security, Multilevel Security for role based access control, Concepts of trusted system, Trusted computing.</p>		
#Exemplar/Case Studies	Open Source/ Free/ Trial Tools: DOS Attacks, DDOS attacks, Wireshark, Cain and Abel, iptables/ Windows Firewall, Suricata, fail2ban, Snort.	
*Mapping of Course Outcomes for Unit V	CO4	
Unit VI	Cyber Security and Tools	07 Hours
<p>Introduction, Cybercrime and Information Security, Classification of Cybercrimes, The legal perspectives-Indian perspective, Global perspective, Categories of Cybercrime, Social Engineering, Cyber stalking, Proxy servers and Anonymizers, Phishing, Password Cracking, Key-loggers and Spywares, The Indian IT Act-Challenges, Amendments, Challenges to Indian Law and Cybercrime Scenario in India, Indian IT Act.</p>		
#Exemplar/Case Studies	Study of any two network security scanners: Nmap, Metasploit, OpenVAS, Aircrack, Nikito, Samurai, Safe 3 etc.	
*Mapping of Course Outcomes for Unit VI	CO5	
Learning Resources		
<p>Text Books :</p> <ol style="list-style-type: none"> 1. William Stallings, Lawrie Brown, “Computer Security Principles and Practice”, 3rd_Edition, Pearson , ISBN : 978-0-13-3777392-7 2. William Stallings, “Cryptography and Network Security Principals and Practice”, Seventh edition, Pearson , ISBN : 978-1-292-15858 		

3. Nina Godbole, Sumit Belapure, “Cyber Security”, Wiley, ISBN: 978-81-265-2179-1

Reference Books :

1. Atul Kahate, “Cryptography and Network Security”, 3e, McGraw Hill Education
2. V.K. Pachghare, “Cryptography and Information Security”, PHI Learning
3. Bernard Menezes, “Network Security and Cryptography”, Cengage Learning India, 2014, ISBN No.: 8131513491
4. Joseph Kizza, “Computer Network Security and Cyber Ethics”, McFarland & Company, Inc., Publishers, Fourth Edition
5. Michael Whitman and Herbert Matford, “Principles of Information Security”, Course Technology Ink, 7th edition

e-Books :

- Introduction to Cyber Security, “<http://www.uou.ac.in/sites/default/files/slm/FCS.pdf>“, by Dr. Jeetendra Pande | Uttarakhand Open University, Haldwani
- “Information Security, The complete reference”, Second Edition, Mark Rhodes-Ousley, McGrawHill

MOOCs Courses link

- Introduction to cyber security, “https://swayam.gov.in/nd2_nou19_cs08/preview” by Dr. Jeetendra Pande | Uttarakhand Open University, Haldwani
- NPTEL course on <https://nptel.ac.in/courses/106/106/106106129/> (IIT Madras, Prof. V.Kamakoti)

@The CO-PO Mapping Matrix

CO/ PO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	2	-	1	-	-	-	1
CO2	3	3	2	3	-	2	-	-	-	-	-	-
CO3	3	3	2	3	-	2	-	-	-	1	-	-
CO4	3	3	2	2	-	-	1	-	-	-	-	-
CO5	3	2	1	2	-	2	1	2	-	1	1	1

Savitribai Phule Pune University

Third Year of Computer Engineering (2019 Course)

310255: Internship**


 Home

Teaching Scheme:

Credit: 04

Examination Scheme:

**

Term work: 100 Marks

Course Objectives:

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

- To encourage and provide opportunities for students to get professional/personal experience through internships.
- To learn and understand real life/industrial situations.
- To get familiar with various tools and technologies used in industries and their applications.
- To nurture professional and societal ethics.
- 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: To demonstrate professional competence through industry internship.

CO2: To apply knowledge gained through internships to complete academic activities in a professional manner.

CO3: To choose appropriate technology and tools to solve given problem.

CO4: To demonstrate abilities of a responsible professional and use ethical practices in day to day life.

CO5: Creating network and social circle, and developing relationships with industry people.

CO6: To analyze various career opportunities and decide carrier 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.

Duration:

Internship is to be completed after semester 5 and before commencement of semester 6 of at least 4 to 6 weeks; and it is to be assessed and evaluated in semester 6.

Internship work Identification:

Student may choose to undergo Internship at Industry/Govt. Organizations/NGO/MSME/Rural Internship/ Innovation/IPR/Entrepreneurship. Student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with

industry/NGO's/Government organizations/Micro/Small/ Medium enterprises to make themselves ready for the industry [1].

Students must register at Internshala [2]. Students must get Internship proposals sanctioned from college authority well in advance. Internship work identification process should be initiated in the Vth semester in coordination with training and placement cell/ industry institute cell/ internship cell. This will help students to start their internship work on time. Also, it will allow students to work in vacation period after their Vth semester examination and before academic schedule of semester VI. Student can take internship work in the form of the following but not limited to:

Working for consultancy/ research project,

Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council/ startups cells of institute /

Learning at Departmental Lab/Tinkering Lab/ Institutional workshop,

Development of new product/ Business Plan/ registration of start-up,

Industry / Government Organization Internship,

Internship through Internshala,

In-house product development, intercollegiate, inter department research internship under research lab/group, micro/small/medium enterprise/online internship,

Research internship under professors, IISC, IIT's, Research organizations,

NGOs or Social Internships, rural internship,

Participate in open source development.

Internship Diary/ Internship Workbook:

Students must maintain Internship Diary/ Internship Workbook. The main purpose of maintaining diary/workbook is to cultivate the habit of documenting. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. The training diary/workbook should be signed every day by the supervisor. Internship Diary/workbook and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training.

Internship Work Evaluation:

Every student is required to prepare a maintain documentary proofs of the activities done by him as internship diary or as workbook. The evaluation of these activities will be done by Programme Head/Cell In-charge/ Project Head/ faculty mentor or Industry Supervisor based on- Overall compilation of internship activities, sub-activities, the level of achievement expected, evidence needed to assign the points and the duration for certain activities.

Assessment and Evaluation is to be done in consultation with internship supervisor (Internal and External – a supervisor from place of internship).

Recommended evaluation parameters-Post Internship Internal Evaluation -50 Marks + Internship Diary/Workbook and Internship Report - 50 Marks

Evaluation through Seminar Presentation/Viva-Voce at the Institute-

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

Depth of knowledge and skills: Communication and Presentation Skills

Team Work

Creativity

Planning and Organizational skills

Adaptability

Analytical Skills

Attitude and Behavior at work

Societal Understanding

Ethics

Regularity and punctuality

Attendance record

Diary/Work book

Student's Feedback from External Internship Supervisor

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period.

Internship Diary/workbook may be evaluated on the basis of the following criteria:

Proper and timely documented entries

Adequacy & quality of information recorded

Data recorded

Thought process and recording techniques used

Organization of the information

The report shall be presented covering following recommended fields but limited to,

Title/Cover Page

Internship completion certificate

Internship Place Details- Company background-organization and activities/Scope and object of the study / Supervisor details

Index/Table of Contents

Introduction

Title/Problem statement/objectives

Motivation/Scope and rationale of the study

Methodological details

Results / Analysis /inferences and conclusion

Suggestions / Recommendations for improvement to industry, if any

Attendance Record

Acknowledgement

List of reference (Library books, magazines and other sources)

Feedback from internship supervisor(External and Internal)

Post internship, faculty coordinator should collect feedback about student with following recommended parameters-

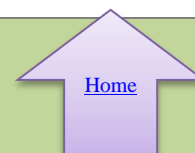
Technical knowledge, Discipline, Punctuality, Commitment, Willingness to do the work, Communication skill, individual work, Team work, Leadership.....

Reference:

[1] <https://www.aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf>

[2] <https://internship.aicte-india.org/>

Savitribai Phule Pune University
Third Year of Engineering (2019 Course)
310259: Audit Course 6



In addition to credits, it is recommended that there should be audit course, in preferably in each semester starting from second year in order to supplement students' knowledge and skills. Student will be awarded the bachelor's degree if he/she earns specified total credit [1] and clears all the audit courses specified in the curriculum. The student will be awarded grade as AP on successful completion of audit course. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest in greater detail resulting in achieving the very objective of audit course's inclusion. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at institute level itself. Method of conduction and method of assessment for audit courses are suggested.

Criteria

The student registered for audit course shall be awarded the grade AP (Audit Course Pass) and shall be included such AP grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at institute level itself [1]

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

- | | |
|---|---|
| <ul style="list-style-type: none"> • Lectures/ Guest Lectures • Visits (Social/Field) and reports • Demonstrations | <ul style="list-style-type: none"> • Surveys • Mini-Project • Hands on experience on focused topic |
|---|---|

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

- Written Test
- Demonstrations/ Practical Test
- Presentations, IPR/Publication and Report

Audit Course 6 Options

Audit Course Code	Audit Course Title
AC6-I	Digital and Social Media Marketing
AC6-II	Sustainable Energy Systems
AC6-III	Leadership and Personality Development
AC6-IV	Foreign Language (one of Japanese/Spanish/French/German). Course contents for Japanese (Module 4) are provided. For other languages institute may design suitably.
AC6-V	MOOC- Learn New Skills

Note: It is permitted to opt one of the audit courses listed at SPPU website too, if not opted earlier.
<http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202017/Forms/AllItems.aspx>
http://www.unipune.ac.in/university_files/syllabi.htm

AC6-III Leadership and Personality Development**Prerequisites:** General awareness of communication and relationship.**Course Objectives:**

- To understand the importance of communication
- To create awareness about teamwork and people skills
- To know thyself
- To recognize current and possible future of new-age thinking

Course Outcomes:

On completion of the course, learners will be able to

CO1: Express effectively through communication and improve listening skills**CO3:** Develop effective team leadership abilities.**CO4:** Explore self-motivation and practicing creative/new age thinking.**CO5:** Operate effectively in heterogeneous teams through the knowledge of team work, people skills and leadership qualities.**Course Contents****1. Communication :**

Listening Skills, Communication - 7 C's, Vision and Charisma, Planning and Organizing - Complex Tasks and Ideas --> Actionable Tasks, Presentation Skills.

2. Teamwork and People Skills :

Talent Picking skills, Strong networking and Employee engagement, Coach and Mentor the team, Influencing, Delegate and Empower, Generous, open communicator, Patience and Clarity of Mind, Inspire and Motivate, Ensure Team Cohesion, Empathy, Trust and Reliability.

3. New-age Thinking :

Strategic Thinking, Critical and Lateral Thinking, Problem Solving Skills, Flexibility, Change Management – VUCA.

4. Self-Awareness :

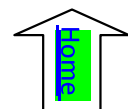
What is Self? – Real, Ideal and Social Self, Concepts related to Self - Self Concept, Self-Presentation, Self-Regulation and Impression Management, Definition and Causes of Prejudice, Relationship between Prejudice, Discrimination and Exclusion, Application – Attitudinal Change and Reducing Prejudices, Self Esteem and Self Awareness, SWOT – JOHARI, Self Esteem Quiz, Introduce Your Partner, Self Introduction - How to sell yourself?- appearance, voice modulation, verbal(simple language), Motivation and Optimism, Positive Emotions and Success.

Reference Books :

1. Paul Sloane, “The Leader's Guide to Lateral Thinking Skills Unlocking the Creativity and Innovation in You and Your Team”, 2006
2. Ronald Bennett, Elaine Millam, “Leadership for engineers : the magic of mindset”
3. Urmila Rai and S.M. Rai, “Business Communication”, Himalay Publication House
4. Baron R, Byrne D, Branscombe N, BharadwajG (2009), “Social Psychology, Indian adaptation” , Pearson , New Delhi
5. Baumgartner S.R, Crothers M.K. (2009) “Positive Psychology”, Pearson Education.

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	2	-	1	1	3	-	2



BE Computer Engineering 2019 Course tentative Curriculum structure:

Savitribai Phule Pune University Fourth Year of Computer Engineering (2019 Course) (With effect from Academic Year 2022-23)														
Semester VII														
Course Code	Course Name	Teaching Scheme (Hours/week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral\Pre	Total	Lecture	Practical	Tutorial	Total
410241	Design and Analysis of Algorithms	03	-	-	30	70	-	-	-	100	3	-	-	3
410242	Machine Learning	03	-	-	30	70	-	-	-	100	3	-	-	3
410243	Blockchain Technology	03	-	-	30	70	-	-	-	100	3	-	-	3
410244	Elective III	03	-	-	30	70	-	-	-	100	3	-	-	3
410245	Elective IV	03	-	-	30	70	-	-	-	100	3	-	-	3
410246	Laboratory Practice III	-	04	-	-	-	50	50	-	100	-	2	-	2
410247	Laboratory Practice IV	-	02	-	-	-	50	-	-	50	-	1	-	1
410248	Project Stage I	-	02	-	-	-	50	-	-	50	-	2	-	2
Total Credit											15	05	-	20
Total		15	08	-	150	350	150	50	-	700	15	05	-	20
410249	Audit Course 7										Grade			
Elective III					Elective IV									
410244(A) Pervasive Computing 410244(B) Multimedia Techniques 410244(C) Cyber Security and Digital Forensics 410244(D) Object Oriented Modeling and Design 410244(E) Digital Signal Processing					410245(A) Information Retrieval 410245(B) GPU Programming and Architecture 410245(C) Mobile Computing 410245(D) Software Testing and Quality Assurance 410245(E) Compilers									
Laboratory Practice III: Laboratory assignments Courses- 410241, 410242, 410243					Laboratory Practice IV: Laboratory assignments Courses- 410244, 410245									
Audit Course 7(AC7) Options:														
AC7- I MOOC- Learn New Skills														
AC7- II Entrepreneurship Development														
AC7- III Botnet of Things														
AC7- IV 3D Printing														
AC7- V Industrial Safety and Environment Consciousness														



Savitribai Phule Pune University														
Final Year of Computer Engineering (2019 Course)														
(With effect from Academic Year 2022-23)														
Semester VIII														
Course Code	Course Name	Teaching Scheme (Hours/week)			Examination Scheme and Marks						Credit Scheme			
		Lecture	Practical	Tutorial	Mid-Sem	End-Sem	Term work	Practical	Oral/Pre	Total	Lecture	Practical	Tutorial	Total
410250	High Performance Computing	03	-	-	30	70	-	-	-	100	03			03
410251	Deep Learning	03	-	-	30	70	-	-	-	100	03			03
410252	Elective V	03	-	-	30	70	-	-	-	100	03			03
410253	Elective VI	03	-	-	30	70	-	-	-	100	03			03
410254	Laboratory Practice V	-	02	-	-	-	50	50	-	100		01		01
410255	Laboratory Practice VI	-	02	-	-	-	50	-	-	50		01		01
410256	Project Stage II	-	06	-	-	-	100	-	50	150		06		06
Total Credit											12	08	-	20
Total		12	10	-	120	280	200	50	50	700	12	08	-	20
410257	Audit Course 8										Grade			
Elective V						Elective VI								
410252(A) Natural Language Processing 410252(B) Image Processing 410252(C) Software Defined Networks 410252(D) Advanced Digital Signal Processing 410252(E) Open Elective I						410253(A) Pattern Recognition 410253(B) Soft Computing 410253(C) Business Intelligence 410253(D) Quantum Computing 410253(E) Open Elective II								
Lab Practice V: Laboratory assignments Courses- 410250, 410251						Lab Practice VI: Laboratory assignments Courses- 410252, 410253								
Audit Course 8(AC8) Options: AC8- I Usability Engineering AC8- II Conversational Interfaces AC8- III Social Media and Analytics AC8- IV MOOC- Learn New Skills AC8- V Emotional Intelligence														



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)

410248: Project Work Stage I

Teaching Scheme: Practical:02Hours/Week	Credit 02	Examination Scheme: Presentation:50Marks
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Course Objectives:

- To Apply the knowledge for solving realistic problem
- To develop problem solving ability
- To Organize, sustain and report on a substantial piece of team work over a period of several months
- To Evaluate alternative approaches, and justify the use of selected tools and methods
- To Reflect upon the experience gained and lessons learned
- To Consider relevant social, ethical and legal issues
- To find information for yourself from appropriate sources such as manuals, books, research journals and from other sources, and in turn increase analytical skills.
- To Work in Team and learn professionalism

Course Outcomes:

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

- Solve real life problems by applying knowledge.
- Analyze alternative approaches, apply and use most appropriate one for feasible solution.
- Write precise reports and technical documents in a nutshell.
- Participate effectively in multi-disciplinary and heterogeneous teams exhibiting team work
- Inter-personal relationships, conflict management and leadership quality.

Guidelines

Project work Stage – I is an integral part of the Project work. In this, the student shall complete the partial work of the **Project which will consist of problem statement, literature review, SRS, Model and Design**. The student is expected to complete the project at least up to the design phase. As a part of the progress report of project work Stage-I, the candidate shall deliver a presentation on the advancement in Technology pertaining to the selected project topic. The student shall submit the duly certified progress report of Project work Stage-I in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute. The examinee will be assessed by a panel of examiners of which one is necessarily an external examiner. The assessment will be broadly based on work undergone, content delivery, presentation skills, documentation, question-answers and report.

Follow guidelines and formats as mentioned in Project Workbook recommended by Board of Studies



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

Teaching Scheme: TH: 06 Hours/Week	Credit 06	Examination Scheme: Term work: 100 Marks Presentation: 50Marks
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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 right perspective.
- CO4: Link techniques and results from literature as well as actual research and future research lines with the research.
- CO5: Appreciate practical implications and constraints of the specialist subject

Guidelines

In Project Work Stage–II, the student shall complete the remaining project work which consists of Selection of Technology and Tools, Installations, UML implementations, testing, Results, performance discussions using data tables per parameter considered for the improvement with existing/known algorithms/systems and comparative analysis and validation of results and conclusions. The student shall prepare and submit the report of Project work in standard format for satisfactory completion of the work that is duly certified by the concerned guide and head of the Department/Institute

Follow guidelines and formats as mentioned in Project Workbook recommended by Board of Studies



Savitribai Phule Pune University, Pune
Fourth Year of Computer Engineering (2019 Course)
410249: Audit Course 7

AC7 – V: Industrial Safety and Environment Consciousness

This course aims to provide knowledge of industrial safety performance planning and accident prevention.

Course Objectives:

- To understand Industrial hazards and Safety requirements with norms
- To learn the basics of Safety performance planning
- To know the means of accident prevention
- To understand the impact of industrialization on environment
- To know the diversified industrial requirements of safety and security

Course Outcomes:

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

- CO1: Develop the plan for Safety performance
- CO2: Demonstrate the action plan for accidents and hazards
- CO3: Apply the safety and security norms in the industry
- CO4: Evaluate the environmental issues of Industrialization

Course Contents

1. Introduction: Elements of safety programming, safety management, Upgrading developmental programmers: safety procedures and performance measures, education, training and development in safety.

2. Safety Performance Planning

Safety Performance: An overview of an accident, It is an accident, injury or incident, The safety professional, Occupational health and industrial hygiene. Understanding the risk: Emergency preparedness and response, prevention of accidents involving hazardous substances.

3. Accident Prevention

What is accident prevention?, Maintenance and Inspection, Monitoring Techniques, General Accident Prevention, Safety Education and Training.

4. Organization Safety

Basic Elements of Organized Safety, Duties of Safety Officer, Safe work Practices, Safety Sampling and Inspection, Job Safety Analysis(JSA), Safety Survey, On- site and Off-site Emergency Plan, Reporting of Accidents and Dangerous Occurrences.

5. Industrial Pollution

Introduction, Work Environment, Remedy, pollution of Marine Environment and Prevention, Basic Environmental Protection Procedures, Protection of Environment in Global Scenario, Greenhouse Gases, Climate Change Impacts, GHG Mitigation Options, Sinks and Barriers,

6. Industrial Security(Industry wise)

General security Systems in Factories, Activation Security, Computer Security, Banking Security, V.I.P. Security, Women Security, Event Security, Security in Open Environments.

Books :

1. Basudev Panda, “Industrial Safety, Health Environment and Security”, Laxmi Publications, ISBN-10: 9381159432, 13: 978-9381159439
2. L.M. Deshmukh, “Industrial Safety Management”, TMH, ISBN: 9780070617681

Savitribai Phule Pune University

Syllabus: Second Year (SE) Electrical Engineering (2019 Course)

w.e.f. AY:2020-2021

SEMESTER-I

Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks						Credits			
		TH	PR	TUT	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
207006	Engineering Mathematics-III	03	--	--	30	70	--	--	--	100	03	--	--	03
203141	Power Generation Technologies	03	--	--	30	70	--	--	--	100	03	--	--	03
203142	Material Science	03	04#	--	30	70	25	--	25	150	03	02	--	05
203143	Analog and Digital Electronics	03	02	--	30	70	--	50	--	150	03	01	--	04
203144	Electrical Measurement & Instrumentation	03	04#	--	30	70	25	25	--	150	03	02	--	05
203150	Applications of Mathematics in Electrical Engineering	--	02*	--	--	--	25	--	--	25	--	01	--	01
203151	Soft Skill	--	02	--	--	--	25	--	--	25	--	01	--	01
203152	Audit Course-III	--	--	--	--	--	--	--	--	--	Grade: PP/NP			
Total		15	14	--	150	350	100	75	25	700	15	07	--	22

SEMESTER-II

Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks						Credits			
		TH	PR	TUT	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
203145	Power System-I	03	--	--	30	70	--	--	--	100	03	--	--	03
203146	Electrical Machines-I	03	02	--	30	70	--	50	--	150	03	01	--	04
203147	Network Analysis	03	02	--	30	70	25	--	--	125	03	01	--	04
203148	Numerical Methods & Computer Programming	03	02	--	30	70	--	25	--	125	03	01	--	04
203149	Fundamental of Microcontroller and Applications	03	04\$	--	30	70	25	--	25	150	03	02	--	05
203152	Project Based Learning	--	04	--	--	--	50	--	--	--	--	02	--	--
203153	Audit Course-IV	--	--	--	--	--	--	--	--	--	Grade: PP/NP			
Total		15	14	--	150	350	100	75	25	700	15	07	--	22

* - Lab sessions on application of Mathematics in Electrical Engineering using professional software.

- Practical section will comprises of two Part : a) PART A : 2 hours per week : Regular curriculum listed practical total 12 numbers out of which conduction of 8 numbers will be mandatory b) PART B : 2 Hours a week :Practical/case studies/assignments to enable active learning based on advances related to subject to bridge gap between curriculum and enhance practical knowledge required in field .

\$ - Practical section will comprises of two Part : a) PART A : 2 hours per week : Regular curriculum listed practical total 12 numbers out of which conduction of 8 numbers will be mandatory b) PART B : 2 Hours a week : IOT application in Electrical Engineering using microcontroller and GSM module to bridge gap between curriculum and enhance application knowledge.

Abbreviation: TH: Theory, PR: Practical, TUT:Tutorial, ISE: Insem Exam, ESE: End Sem Exam, TW: Term Work, OR: Oral

203151: Soft Skill		
Teaching Scheme Practical : 02 Hrs/ Week	Credits Pr:01	Examination Scheme [Marks] Term Work: 25 Marks
<p>Course Objective: The course aims to:- □</p> <ul style="list-style-type: none"> ● 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. □ <p>Course Outcome: Students will be able to :- □</p> <p>CO1: DoSWOC analysis. □</p> <p>CO2: Develop presentation and take part in group discussion. □</p> <p>CO3: Understand and implement etiquette in workplace and in society at large. □</p> <p>CO4: Work in team with team spirit. □</p> <p>CO5: Utilize the techniques for time management and stress management. □</p>		
<p>Unit 01 : Self-Awareness & self-Development: (4Hrs)</p> <p>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,</p> <p>B) Career Planning, Personal success factors, Handling failure, Depression and Habit, relating SWOT analysis & goal setting and prioritization.</p>		
<p>Unit 02 : Communication Skill: (6 Hrs)</p> <p>A) Importance of communication, types, barriers of communication, effective communication.</p> <p>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.</p> <p>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</p> <p>D) Group Discussion:Characteristics, subject knowledge, oral and leadership skills, team management, strategies and individual contribution and consistency.</p> <p>E) Presentation skills:Planning, preparation, organization, delivery.</p> <p>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.</p>		
<p>Unit 03 : Corporate / Business Etiquette: (2 Hrs)</p> <p>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.</p>		
<p>Unit 04 : Interpersonal relationship: (4 Hrs)</p> <p>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.</p> <p>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</p>		
<p>Unit 05 : Leadership skills: (2 Hrs)</p>		

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

Term Work/Assignments: Term work will consist the record of any 8 assignments of following exercises

1. SWOT analysis
2. Personal & Career Goal setting – Short term & Long term
3. Presentation Skill
4. Letter/Application writing
5. Report writing
6. Listening skills
7. Group discussion
8. Resume writing
9. Public Speaking
10. Stress management
11. Team Activity-- Use of Language laboratory

Teaching Methodology:

Each class should be divided into three batches of 20-25 students each. The sessions should be activity based and should give students adequate opportunity to participate actively in each activity. Teachers and students must communicate only in English during the session. Specific details about the teaching methodology have been explained in every activity given below.

Practical Assignments (Term work)

Minimum 8 assignments are compulsory and teachers must complete them during the practical sessions within the semester. The teacher should explain the topics mentioned in the syllabus during the practical sessions followed by the actual demonstration of the exercises. Students will submit report of their exercise (minimum 8) assignments as their term work at the end of the semester but it should be noted that the teacher should assess their assignment as soon as an activity is conducted. The continual assessment process should be followed.

1. **SWOT analysis:** The students should be made aware of their goals, strengths and weaknesses, attitude, moral values, self-confidence, etiquettes, non-verbal skills, achievements etc. through this activity. The teacher should explain to them on how to set goals, SWOT Analysis, Confidence improvement, values, positive attitude, positive thinking and self-esteem. The teacher should prepare a questionnaire which evaluate students in all the above areas and make them aware about these aspects.

2. **Personal & Career Goal setting** – Short term & Long term

3. **Presentation Skills:** Students should make a presentation on any informative topic of their choice. The topic may be technical or non-technical. The teacher should guide them on effective presentation skills. Each student should make a presentation for at least 10 minutes.

4. **Letter/Application writing:** Each student will write one formal letter, and one application. The teacher should teach the students how to write the letter and application. The teacher should give proper format and layouts.

5. **Report writing:** The teacher should teach the students how to write report. The teacher should give proper format and layouts. Each student will write one report based on visit / project /

business proposal etc.

6. **Listening skills:** The batch can be divided into pairs. Each pair will be given an article (any topic) by the teacher. Each pair would come on the stage and read aloud the article one by one. After reading by each pair, the other students will be asked questions on the article by the readers. Students will get marks for correct answers and also for their reading skills. This will evaluate their reading and listening skills. The teacher should give them guidelines on improving their reading and listening skills. The teacher should also give passages on various topics to students for evaluating their reading comprehension.

7. **Group discussion:** Each batch is divided into two groups of 12 to 14 students each. Two rounds of a GD for each group should be conducted and teacher should give them feedback.

8. **Resume writing:** Each student will write one formal letter, and one application. The teacher should teach the students how to write the letter and application. The teacher should give proper format and layouts.

9. **Public Speaking:** Any one of the following activities may be conducted : A) Prepared speech (topics are given in advance, students get 10 minutes to prepare the speech and 5 minutes to deliver. B) Extempore speech (students deliver speeches spontaneously for 5 minutes each on a given topic) C) Story telling (Each student narrates a fictional or real life story for 5 minute search) D) Oral review(Each student orally presents a review on a story or a book read by them)

10. **Team Activity**-- Use of Language laboratory

Text Books:

[T1] Sanjay Kumar and PushpaLata, "Communication Skills", Oxford University Press.

[T2] Krishna Mohan, MeeraBanerji, "Developing Communication Skill", McMillan India Ltd.

[T3] Simon Sweeney, "English for Business Communication", Cambridge University Press

Reference Books:

[R1] Accenture, Convergys, Dell et.al, "NASSCOM-Global Business Foundation Skills, Foundation Books, Cambridge University Press.

[R2] E. H. McGraw, "Basic Managerial Skills for all", Eastern Economy Edition, Prentice hall

[R3] Barun K. Mitra, "Personality Development and Group Discussions", Oxford University Press.

[R4] PriyadarshiPatnaik, "Group Discussions and Interview Skills: Foundation Books", Cambridge University Press.

[R5] Napoleon Hill, "Thinks and Grow Rich", Ebury Publishing, ISBN 9781407029252.

[R6] Tony Robbins, "Awaken the Giant Within", Harper Collins Publishers, ISBN139780743409384. S.E. Electrical Engineering (2015 course) – Savitribai Phule Pune University 25

[R7] Wayne Dyer, "Change Your Thoughts, Change Your Life", Hay House India, ISBN-139788189988050.

[R8] Stephen Covey, "Habits of Highly Effective People", Pocket Books, ISBN139781416502494.

[R9] Dr. Joseph Murphy, "The Power of Your Subconscious Mind", MaanuGraphics, ISBN-13 9789381529560.

[R10] Daniel Coleman, "The new Leaders", Sphere Books Ltd, ISBN-139780751533811.

[R11] Richard Koch, "The 80/20 Principal", Nicholas Brealey Publishing , ISBN-13 9781857883992.

[R12] Julie Morgenstern, "Time management from inside out", Owl Books (NY), ISBN-13 9780805075908.

[R13] Shiv Khera, "You can win", Macmillan, ISBN-139789350591932.

[R14] Gopalaswamy Ramesh, Mahadevan Ramesh, "The Ace of Soft Skills: Attitude, Communication and Etiquette for Success"

203152 : Audit Course-III

List of three audit course is provided. Students can choose any one from 203152(A)
203152(B) and 203152(C)

203152 (A) : Solar Thermal System

Teaching Scheme Lectures: 2hrs/week	Credits No credit	Examination Scheme [Marks] Grade: PP/NP Quiz and term paper
<p>Description: The course will introduce the basics of: solar energy, availability, applications, heat transfer as applied to solar thermal systems, various types of solar thermal systems, introduction to manufacturing of the systems, characterization, quality assurance, standards, certification and economics. The following topics may be broadly covered in the classroom. The field visits will be designed for first-hand experience and basic understanding of the system elements.</p> <p>Course Objective:</p> <ul style="list-style-type: none"> • To understand basics and types of solar thermal systems. • To get knowledge of various types of concentrators. • To make students aware of different Standards and certification for Concentrator Solar Power. <p>Course Outcome: Student will be able to</p> <p>CO1: Differentiate between types of solar Concentrators</p> <p>CO2: Apply software tool for solar concentrators</p> <p>CO3: Design different types of Solar collectors and balance of plant</p>		
<p>Course Contents:</p> <ul style="list-style-type: none"> • Sun, Earth and seasons • Solar Radiation • Basics of heat transfer • Absorption, reflection and transmission of radiation • Types of Solar thermal systems • Basic design of different types of systems • Applications of solar thermal systems and their economics • Need for solar concentration • Various types of solar concentrators • Movement of Sun and tracking • Control systems for solar tracking • Concentrating solar thermal (CSP) • Concentrating solar PV (CPV) • Balance of plant for CSP • Critical points in concentrating solar system installation • Operation and maintenance of CSP • Typical financial analysis of CSP • Software tools for concentrating solar power • Environmental impact assessment • Standards and certification for CSP • Basics of solar thermal (STH) systems • Elements of various STH systems • Design, materials and manufacturing of <ul style="list-style-type: none"> ➤ Flat plate solar collector ➤ Evacuated tube solar collector ➤ Parabolic trough collector ➤ Dish type solar concentrators ➤ Concentrating PV systems ➤ Balance of plant • Manufacturing standards 		

- Quality assurance and standards
- Certification
- Special purpose machines and Automation in manufacturing
- Site assembly and fabrication
- Typical shop layouts
- Inventory management
- **Economics of manufacturing**

Assignment

- **Design of solar thermal system for residential/ commercial building.**

References:

1. Trainers Textbook Solar Thermal Systems Module, Ministry of New and Renewable Energy, Government of India
2. Students Workbook for Solar Thermal Systems Module, Ministry of New and Renewable Energy, Government of India

203152: Project Based Learning		
Teaching Scheme Practical : 04 Hrs/ Week	Credits PR:02	Examination Scheme [Marks] Term Work: 50 Marks
<p>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.</p>		
<p>Course Objectives: Objectives of this course are to</p> <ol style="list-style-type: none"> 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 		
<p>Course Outcomes: At the end of this project-based learning, students will be able to</p> <p>CO1: Identify, formulate, and analyze the simple project problem.</p> <p>CO2: Apply knowledge of mathematics, basic sciences, and electrical engineering fundamentals to develop solutions for the project.</p> <p>CO3: Learn to work in teams, and to plan and carry out different tasks that are required during a project.</p> <p>CO4: Understand their own and their team-mate's strengths and skills.</p> <p>CO5: Draw information from a variety of sources and be able to filter and summarize the relevant points.</p> <p>CO6: Communicate to different audiences in oral, visual, and written forms.</p>		
<p>Procedure: A group of 4-5 students will be assigned to a faculty member called a mentor. Based on the engineering knowledge of a group and societal and industry problems, the mentor has to guide a group to identify project problems and plan the work schedule. Here, the expected outcomes of the project must be noted. The complete work-plan should be divided in the form of the individual tasks to be accomplished with targets. Weekly review of the completed task should be taken and further guidelines are to be given to a group. The final activity will be presenting the work completed and submitting the report. A group should be promoted to participate in a competition or write a paper.</p> <p>A problem needs to refer back to a particularly practical, scientific, social, and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry. There are no commonly shared criteria for what constitutes an acceptable project. Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content, and the structure of the activity. It may have</p> <ul style="list-style-type: none"> ✓ A few hands-on activities that may or may not be multidisciplinary. ✓ Use of technology in meaningful ways to help them investigate, collaborate, analyze, synthesize, and present their learning. ✓ Activities on solving real-life problems, investigation /study, and writing reports of in-depth study, fieldwork. 		
<p>Assessment: The department/mentor is committed to assess and evaluate both students’ performance and course effectiveness. The progress of PBL is monitored regularly every week. During the process</p>		

of monitoring, continuous assessment and evaluation the individual and team performances are to be measured by supervisor /mentor and authorities.

Students must maintain an institutional culture of authentic collaboration, self-motivation, peer-learning, and personal responsibility. The institution/department should support students in this regard through guidance/orientation programs and the provision of appropriate resources and services. Supervisor/mentor and students must actively participate in the assessment and evaluation processes. Groups may demonstrate their knowledge and skills by developing a solution to the problem, public product, and/or report and/or presentation.

- ✓ Individual assessment for each student (Understanding individual capacity, role, and involvement in the project)
- ✓ Group assessment (roles defined, distribution of work, intra-team communication and togetherness)
- ✓ Documentation and presentation

Evaluation and Continuous Assessment:

It is recommended that all activities are to be recorded in a PBL workbook regularly, regular assessment of work to be done and proper documents are to be maintained at the department level by both students as well as a mentor. Continuous Assessment Sheet (CAS) is to be maintained by all mentors/department. Recommended parameters for assessment, evaluation, and weightage are as follows.

- ✓ Idea Inception **(5%)**
- ✓ Outcomes of PBL/ Problem Solving Skills/ Solution provided/ Final product **(50%)**
(Individual assessment and team assessment)
- ✓ Documentation (Gathering requirements, design and modeling, implementation/execution, use of technology and final report, other documents) **(25%)**
- ✓ Demonstration (Presentation, User Interface, Usability, etc.) **(10%)**
- ✓ Contest Participation/ publication **(5%)**
- ✓ Awareness /Consideration of -Environment/ Social /Ethics/ Safety measures/Legal aspects **(5%)**
- ✓ PBL workbook will serve the purpose and facilitate the job of students, mentors, and project coordinator. This workbook will reflect accountability, punctuality, technical writing ability and work flow of the work undertaken

203153: Audit Course-IV

List of three audit course is provided. Students can choose any one from 203153(A) 203153(B) and 203153(C)

203153(A): Solar Photovoltaic Systems

Teaching Scheme Lectures: 2hrs/week	Credits No credit	Examination Scheme [Marks] Grade: PP/NP Quiz and term paper
<p>Prerequisite: Completion of FE or equivalent</p> <p>Description: The course will introduce the basics of: solar energy, availability, semiconductors as photovoltaic convertors and solar cells, applications of photovoltaic, various types of solar photovoltaic systems, and introduction to manufacturing of the systems, characterization, quality assurance, standards, certification and economics. The following topics may be broadly covered in the classroom. The practical will be designed for basic understanding of the system elements.</p> <p>Course Objective:</p> <ul style="list-style-type: none"> ● To learn Solar PV system and its appliances ● To get knowledge of balance of PV system, batteries, inverters etc. ● To understand grid tied SPV solar plants <p>Course Outcome: Students will be able to</p> <p>CO1: design of Solar PV system for small and large installations</p> <p>CO2: handle software tools for Solar PV systems</p>		
<p>Course Contents:</p> <ul style="list-style-type: none"> ● Physics of photovoltaic (PV) electricity ● Photodiode and solar cell ● Solar radiation spectrum for PV • ● Types of solar cell and comparison ● Introduction to various types of solar module manufacturing ● Basic system design and economics ● Types of systems ● Common applications of solar PV ● Introduction to solar PV (SPV) systems ● SPV appliances ● Small capacity SPV power plants ● Grid tied SPV power plants ● Large scale SPV power plants ● Balance of system ● Solar inverters ● Batteries ● Financial modelling of SPV ● Operation and maintenance of SPV ● Software tools for SPV ● Environmental impact assessment ● Standards and certification for SPV ● Basics of SPV systems ● Elements of SPV appliances and power plants Procurement versus production ● Bought-outs, assemblies, sub-assemblies ● Manufacturing and assembly ● Manufacturing standards ● Quality assurance and standards ● Certification ● Special purpose machines and Automation in manufacturing ● Site assembly and fabrication 		

- Typical shop layouts
- Inventory management
- Economics of manufacturing

Practical:

- PV characterization
- Batteries and energy storage
- PV system design

Assignment

- Design of solar PV system for department / college.

References:

- [1] A.S.Kapur -A Practical Guide for Total Engineering of MW capacity Solar PV Power Project
- [2] Solanki C.S- Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers- PHI
- [3] Solanki C.S- SolarPhotovoltaics - Fundamentals, Technologies and Applications- PHI
- [4] S. Sukhatme -Solar Energy : Principles of Thermal Collection and Storage- McGraw Hill

Savitribai Phule Pune University, Pune																
Syllabus: Third Year (TE) Electrical Engineering (2019 course)																
(w.e.f 2021-22)																
SEMESTER-I																
Course code	Course Name	Teaching Scheme				Examination Scheme						Credit				
		Th	Pr	Tu	SEM /PW /IN	ISE	ESE	TW	PR	OR	Total	Th	Pr	Tu	SEM /PW /IN	Total
303141	Industrial and Technology Management	3	0	0	0	30	70	0	0	0	100	3	0	0	0	3
303142	Power Electronics	3	4#	0	0	30	70	0	50	0	150	3	2	0	0	5
303143	Electrical Machines-II	3	2	0	0	30	70	25	25	0	150	3	1	0	0	4
303144	Electrical Installation Design and Condition Based Maintenance	3	4#	0	0	30	70	25	0	25	150	3	2	0	0	5
303145	Elective-I	3	0	0	0	30	70	0	0	0	100	3	0	0	0	3
303146	Seminar	0	0	0	1	0	0	50	0	0	50	0	0	0	1	1
303147	Audit course-V	2*	0	0	0	0	0	0	0	0	0	GRADE: PP/NP				0
Total		15	10	0	1	150	350	100	75	25	700	15	5	0	1	21
303145: Elective-I								303147 : Audit Course-V								
303145A : <u>Advanced Microcontroller and Embedded System</u>								303147A : <u>Energy storage systems</u>								
303145B : <u>Digital Signal Processing</u>								303147B : <u>Start-up & Disruptive innovation</u>								
303145C : <u>Open Elective</u>																
SEMESTER-II																
Course code	Course Name	Teaching Scheme				Examination Scheme						Credit				
		Th	Pr	Tu	SEM /PW /IN	ISE	ESE	TW	PR	OR	Total	Th	Pr	Tu	SEM /PW /IN	Total
303148	Power System-II	3	2	1	0	30	70	25	50	0	175	3	1	1	0	5
303149	Computer Aided Design of Electrical Machines	3	4#	0	0	30	70	50	0	25	175	3	2	0	0	5
303150	Control System Engineering	3	2\$	1\$	0	30	70	25	0	25	150	3	1	0	0	4
303151	Elective-II	3	0	0	0	30	70	0	0	0	100	3	0	0	0	3
303152	Internship	0	0	0	4	0	0	100	0	0	100	0	0	0	4	4
303153	Audit Course VI	2*	0	0	0	0	0	0	0	0	0	GRADE: PP/NP				0
Total		12	8	2	4	120	280	200	50	50	700	12	4	1	4	21
303151: Elective-II								303153 : Audit Course-VI								
303151A : <u>IoT and its Applications in Electrical Engineering</u>								303153A: <u>Ethical Practices for Engineers</u>								
303151B : <u>Electrical Mobility</u>								303153B : <u>Project Management</u>								
303151C: <u>Cybernetic Engineering</u>																
303151D: <u>Energy Management</u>																
<p>#Practical consists of Part A & part B. PART A; Regular experiments & part B; to bridge the gap between theory & actual industrial practices. For subject 303144; there will be auto cad drawing on Electrical installation, Electrical wiring, cabling etc. For 303149, Part A, Regular drawing by hand & part B same drawing by AutoCAD.</p> <p>\$ tutorial credit merged with Practical.</p> <p>* Conduct over and above these lectures.</p>																

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						
<ul style="list-style-type: none"> • 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
<p>A) Management: Meaning, scope, function, and importance of management. Difference between administration and management.</p> <p>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.</p> <p>C) Business Organizations: Line organization, Staff organization and Functional Organization, (Project, Matrix, Committee Organization.)</p> <p>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).</p>						
Unit 02	Technology Management					05 hrs
<p>A) Technology Management: Definition of technology Management and its relation with society, development, application and its scope.</p> <p>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.</p>						
Unit 03	Intellectual Property Rights (IPR) & Human Resource Management (HRM)					06 hrs
<p>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).</p> <p>B) Human Resource Management: Introduction, importance, scope, HR planning, Recruitment, selection, training and development, Performance management.</p>						

Unit 04	Quality Management	06 hrs
<p>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.</p> <p>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.</p>		
Unit 05	Marketing and Financial Management	06 hrs
<p>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).</p> <p>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.</p>		
Unit 06	Motivational Theory and Entrepreneurship	06 hrs
<p>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</p> <p>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.</p> <p>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.</p>		
Test Books:		
[T1]	O. P. Khanna, industrial engineering and management, Dhanpat Rai and sons, New Delhi.	
[T2]	E. H. McGraw, S. J. Basic managerial skill for all.	
[T3]	Tarek Khalil, Management of Technology Tata McGraw Hill Publication Pvt. Ltd.	
[T4]	Prabuddha Ganguli Intellectual Property rights Tata McGraw Hill Publication Company	
[T5]	Management Accounting and financial management by M. Y.Khan and P.K. Jain, Tata McGraw Hill-Tata-ISBN.	
Reference Books:		
[R1]	C. B. Mamoria and V. S. P. Rao- Personnel Management , Himalaya Publishing House, 30 th Edition 2014.	
[R2]	Harold Koonlz and OD'onnel-Management. Tata McGraw Hill Publication 1980.	
[R3]	Philip Kotler-Marketing Management. Pearson Edition 2008.	
[R4]	Robert Heller, Managing Teams, Dorling Kindersley, London.	
[R5]	Kelly John M, Total Quality Management, InfoTech Standard, Delhi.	
[R6]	Joseph M. Juran, Juran's Quality Handbook TATA McGraw-Hill.	
[R7]	Dale H. Bester field and Carol Bester field Total Quality Management Prentice Hall of India Pvt. Ltd.	
[R8]	Shiv Sahai Singh [Editor] The Law of Intellectual Property rights.	
[R9]	N. R. Subbaram, What Everyone Should Know About Patents, Pharma Book Syndicate, Hyderabad.	
[R10]	Principles and Practices of Management –Dr. P.C. Shejwalkar, Dr. Anjali Ghanekar, Deepak	

303144: Electrical Installation, Design and Condition Based Maintenance						
Teaching Scheme			Credits		Examination Scheme	
Theory	03	Hr/Week	TH	03	ISE	30 Marks
Practical	04	Hr/Week/batch	PR	02	ESE	70 Marks
					OR	25 Marks
					TW	25 Marks
Prerequisite:						
Basic Electrical Engg, Power System 1, Electrical Machines I and Electrical Machines II.						
Course Objectives: The course aims: -						
<ol style="list-style-type: none"> To classify different types of distribution supply system and determine economics of distribution system. To compare and classify various substations, bus-bars and Earthing systems. To demonstrate the importance and necessity of maintenance. To analyze and test different condition monitoring methods. To carry out estimation and costing of internal wiring for residential and commercial installations. To apply electrical safety procedures. 						
Course Outcomes: At the end of this course, student will be able to						
CO1	Classify different types of distribution supply system and determine economics of distribution system. compare and classify various substations, bus-bars and Earthing systems.					
CO2	Demonstrate the importance and necessity of maintenance.					
CO3	Analyse and test different condition monitoring methods.					
CO4	Carry out estimation and costing of internal wiring for residential and commercial installations.					
CO5	Apply electrical safety procedures.					
Unit 01	Economics of Distribution Systems:					06 hrs
Classification of supply systems (State Only) (i) DC, 2-wire system, (ii) Single phase two wire ac system, (iii) Three phase three wire ac supply system, iv) Three phase four wire ac supply system. Comparison between overhead and underground systems (For above mentioned systems) on the basis of volume requirement for conductor. AC Distribution System: Types of primary and secondary distribution systems, calculation of voltage drops in ac distributors (Uniform and Non Uniform Loading) (Numerical). Economics of power transmission: Economic choice of conductor (Kelvin's law) (Derivation and Numerical). Distribution Feeders: Design considerations of distribution feeders; radial and ring types of primary feeder's voltage levels, energy losses in feeders.						
Unit 02	Substation and Earthing					06 hrs
Substation: Classification of substations, Various equipment used in substation with their specifications, Bus bar arrangements in the substation: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams. Earthing: Necessity of Earthing, Types of Earthing system (Equipment and Neutral), and Maintenance Free Earthing system. Methods of testing earth resistance, Different electrode configurations (Plate and Pipe electrode), Tolerable step and touch voltages, Steps involved in design of substation Earthing grid as per IEEE standard 80-2013.						
Unit 03	Maintenance and Condition Monitoring					08 hrs
Importance and necessity of maintenance, different maintenance strategies like breakdown maintenance, planned/preventive maintenance and condition based maintenance. Planned and preventive maintenance of transformer, Induction motor and Alternators. Insulation stressing factors,						

Insulation deterioration, polarization index, dielectric absorption ratio. Concept of condition monitoring of electrical equipment. Advance tools and techniques of condition monitoring, Thermography. Failure modes of transformer, Condition monitoring of oil as per the IS/IEC standards, Filtration/reconditioning of insulating oil, Condition monitoring of transformer bushings, on load tap changer, dissolved gas analysis, degree of polymerization. Induction motor fault diagnostic methods – Vibration Signature Analysis, Motor Current Signature Analysis. Hot Line Maintenance - Meaning and advantages, special types of non-conducting Materials used for tools for hot line maintenance.		
Unit 04	Basics of Estimation and Costing	04 hrs
Purpose of estimating and costing, qualities of good estimator, essential elements of estimating and costing, tender, guidelines for inviting tenders, quotation, price catalogue, labor rates, schedule of rates and estimating data (only theory),		
Unit 05	Installation and estimation of distribution system	06 hrs
Introduction cable sizing, Estimation and conductor size calculations of internal wiring for Residential and Commercial (Numerical) installations and estimate for underground LT service lines.		
Unit 06	Testing and Electrical Safety	06 hrs
Understanding CAT Ratings & Using CAT rated Instrument, Electrical Installation Testing Procedures- Insulation resistance test between installation and earth, Insulation resistance test between conductors (use of GUARD Terminal in IR test & Application) (methods used for IR Testing) Testing of polarity, Testing of earth continuity paths (Applications of PAT Tester “Portable Appliance Tester” in commercial like hotels, hospital & Industry also) and Earth resistance test (methods for earth testing 2-pole, 3-pole new methods clamp on type where we can performs test in Live) Contents of first aid box, treatment for cuts, burns and electrical shock. Procedures for first aid (e.g. removing casualty from contact with live wire and administering artificial respiration). Various statutory regulations (Electricity supply regulations, factory acts and Indian electricity rules of Central Electricity Authority (CEA), Classification of hazardous area. (<i>Introduction to OSHA</i>))		
Test Books:		
[T1]	B. R. Gupta- Power System Analysis and Design, 3 rd edition, Wheelers publication.	
[T2]	S. Rao, Testing Commissioning Operation and Maintenance of Electrical Equipment, Khanna publishers.	
[T3]	S. L. Uppal - Electrical Power - Khanna Publishers Delhi.	
[T4]	Hand book of condition monitoring by B. K. N. Rao, Elsevier Advance Tech., Oxford (UK).	
[T5]	S. K. Shastri – Preventive Maintenance of Electrical Apparatus – Katson Publication House.	
[T6]	B. V. S. Rao – Operation and Maintenance of Electrical Equipment – Asia Publication.	
[T7]	Hand book on Electrical Safety.	
Reference Books:		
[R1]	P.S. Pabla –Electric Power Distribution, 5 th edition, Tata McGraw Hill.	
[R2]	S. L. Uppal, Electrical Wiring and Costing Estimation, Khanna Publishers, New Delhi.	
[R3]	Surjit Singh, Electrical wiring, Estimation and Costing, Dhanpat Rai and company, New Delhi.	
[R4]	Raina K.B. and Bhattacharya S.K., Electrical Design, Estimating and Costing, Tata McGraw Hill, New Delhi	
[R5]	B.D. Arora-Electrical Wiring, Estimation and Costing, - New Heights, New Delhi.	
[R6]	M.V. Deshpande, Elements of Power Station design and practice, Wheelers Publication.	
[R7]	S. Sivanagaraju and S. Satyanarayana, Electric Power Transmission and Distribution, Pearson Publication .	
[R8]	Power Equipment Maintenance and Testing (Power Engineering Book 32) by Paul Gill	

Unit	Text Books	Reference Books
Unit 1	T1, T3	R1, R7
Unit 2	T1, T2, T3	R1, R4, R6
Unit 3	T2, T4, T5, T6	R6, R7, R8
Unit 4	--	R2, R3, R4, R5
Unit 5	T1, T3	R2, R3, R4, R5
Unit 6	T7	R8

List of Experiments

Part-A: (Any Eight of the following)

- 1) Measurement of Dielectric Absorption Ratio and Polarization Index of insulation.
- 2) Study of thermograph images and analysis based on these images.
- 3) Practice of Earthing and Measurement of Earth resistance of Campus premises by using 4 Pole, 3 Pole, new technology practicing in industry clamp on method.
- 4) Single Line diagram of 132 or 220 or 400 kV substation (based on actual field visit) Symbols, Plate or Pipe Earthing. (Drawing sheets 1 using AutoCAD or other CAD software)
- 5) Assignment on design of Earthing grid for 132/220 kV substation.
- 6) Design and estimation of light and power circuit of labs/industry.
- 7) Measurement of insulation resistance of motors and cables.
- 8) Precautions from Electric shock and method of shock treatment.
- 9) Using of Installation Multifunction Testers for RCD testing, Phase Sequence Indication, Insulation resistance measurement, Continuity testing.
- 10) Use REVIT / any BOQ (Bill of Quantity) estimation software for estimation and costing
- 11) Design and estimation of light and power circuit of residential wiring.

Part-B:(Any 4 out of these)

- 1) Estimation and costing for 11 kV feeders and substation. (voltage drop calculation, SLD, substation layout)
2. Study of troubleshooting of electrical equipment based on actual visit to repair workshop (**Any one**). i) Three phase induction motor ii) Transformer iii) Power Cable
3. Trouble shooting of household equipment – Construction, working and troubleshooting of any two household Electrical equipment's (Fan, Mixer, Electric Iron, Washing Machines, Electric Oven, Microwave - Limited to electrical faults) (Here we perform Practical by using PAT Testers)
- 4) Design, Estimation and costing of Earthing pit and Earthing connection for computer lab, Electrical Machines Lab.
- 5) Wiring installation and maintenance of pump motor.
- 6) Activity: Interview of Electrical maintenance personnel/Technician/Electrician.
- 7) Activity: Safety awareness for housing societies/schools/Junior colleges.
- 8) Activity: Preparation of Tender notice and studying the Tender notices published in newspapers.
- 9) Any innovative activity related to EIDCBM syllabus.

Industrial Visit (if any): Visit to substation/ installation sites.

303146: Seminar						
Teaching Scheme			Credits		Examination Scheme	
SEM	01	Hr/Week	SEM	01	TW	50 Marks
Course Objectives:						
<ol style="list-style-type: none"> 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.					
<p>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.</p> <p>Format of the Seminar report should be as follows:</p> <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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. <p>The assessment for the subject shall be based on:</p> <ol style="list-style-type: none"> 1. Content. 2. Presentation 3. Report 						

303147B: Start-up and Disruptive Innovations						
Teaching Scheme			Credits		Examination Scheme	
Theory	02	Hr/Week	TH	00	GRADE	PP/NP
Prerequisite:						
Course Objectives:						
To learn fundamentals related to Start-up and initiatives taken by government along with policies. To understand Disruptive technologies.						
Course Outcomes: At the end of this course, student will be able to						
CO1	Describe role of incubation for Startup and recent national policy.					
CO2	Identify various types of Startups.					
CO3	Explain impacts of disruptive innovation and Differentiate between disruptive innovation and disruptive technology					
Unit 01	Start-up					12 hrs
Startup Fundamentals						
Startup: Stages of startup life cycle, business model, business plan, Business incubation, Startup financing life cycle, Funding options for startup, Market, Market Segments. Entrepreneurship: Types of Entrepreneurship: Social , Rural, Women, Agri-preneurship. Factors affecting Entrepreneurship Growth						
Government Initiatives and Policies						
Initiatives taken by the government, Startup India Scheme, National Innovation and Startup Policy 2019, Approvals and other regulatory processes, Challenges faced by startups in India, Students Startup, Faculty Startup.						
Types of Startups and Case Studies						
Types of Startups: E-commerce Startups, EdTech Startups, FinTech Startups, Food and Beverages Startups, Health Care Startups, Block chain Startups etc. Case study : Airbnb, Paytm, Byju, Zomato, Red bus, Ola, Razorpay						
Unit 02	Disruptive Technologies					12 hrs
Disruptive Innovation Fundamental						
What is invention? What is innovation? Defining Disruptive Innovation, Sustaining Innovation, Disruptive Innovation Theory, Disruptive innovation model, Disruptive strategy, Impact of Disruptive Innovation, Requirements of Disruptive Innovation, Types of Disruptive Innovations. Inventor vs. Entrepreneur vs. Manager: Schumpeter's Trumpeters Schumpeter's "creative destruction" Maslow's Hierarchy of Needs Revisited , Disrupting Brands, Disrupting Religion.						
Disruptive Technologies						
Agricultural Revolution, Scientific Revolution, Industrial Revolution, Digital Revolution Disruptive Innovation Vs Disruptive Technology IoT, AI, Cloud Computing, Digital Twin, CRISPR, Block chain, 3D printing, Advanced Energy Storage, Hyperloop, Autonomous Vehicles, Nano technology, Industrial Automation (Industry 4.0)						
Reference Books:						
[R1]	The \$100 Startup : Reinvent the Way you Make a Living, Do What You Love and Create a New Future, Chris Guillebeau					
[R2]	Creating a Successful Business Plan, Entrepreneur Magazine					
[R3]	Thomas Kuhn and The Theory of Scientific Revolutions revisited, CRC Press					
[R4]	P. Armstrong. Disruptive Technologies: Understand, Evaluate, Respond Kogan Page Publishers. (2017)					
[R5]	Innovator's Solution: Creating and Sustaining Successful Growth – Clayton Christensen, 16 December 2013					
[R6]	Digital Disruption: Unleashing the Next Wave of Innovation – James McQuivey, 26					

303151D: Elective-II Energy Management						
Teaching Scheme			Credits		Examination Scheme	
Theory	03	Hr/Week	TH	03	ISE	30 Marks
					ESE	70 Marks
Prerequisite:						
Various electrical equipment and specifications, Construction and operation of different equipment/process like HVAC, Pumps, Compressors etc.						
Course Objectives: The course aims to:-						
<ol style="list-style-type: none"> 1. Understand importance of energy Conservation and energy security and impact of energy use on environment. 2. Follow format of energy management, energy policy. 3. Understand demand side management tools and impact of tariff on demand management. 4. Importance of Data Analytics in Energy audit and audit process. 5. Calculate energy consumption and saving options with economic feasibility. 6. Use of appropriate energy conservation measure in field applications or industry. 						
Course Outcomes: At the end of this course, student will be able to						
CO1	Describe BEE Energy policies, Energy ACT.					
CO2	List and apply demand side management measures for managing utility systems.					
CO3	Explore and use simple data analytic tools.					
CO4	Use various energy measurement and audit instruments.					
CO5	Evaluate economic feasibility of energy conservation projects.					
CO6	Identify appropriate energy conservations methods for electric and thermal utilities.					
Unit 01	Energy Scenario					06 hrs
Classification of Energy resources, Commercial and noncommercial sources, primary and secondary sources, commercial energy production, final energy consumption. Energy needs of growing economy, short terms and long terms policies, energy sector reforms, energy security, importance of energy conservation, energy and environmental impacts, introduction to CDM, UNFCCC, Paris treaty, emission check standard, salient features of Energy Conservation Act 2001 and Electricity Act 2003. Latest amendments in Electricity Act. Indian and Global energy scenario. Introduction to IE Rules. Study of Energy Conservation Building Code (ECBC).						
Unit 02	Energy Management					06 hrs
Definition and Objective of Energy Management, Principles of Energy management, Energy Management Strategy, Energy Manager Skills, key elements in energy management, force field analysis, energy policy, format and statement of energy policy, Organization setup and energy management. Responsibilities and duties of energy manager under the latest Act. Energy Efficiency Programs. Energy monitoring systems.						
Unit 03	Demand Management					06 hrs
Supply side management (SSM), Generation system up gradation, constraints on SSM. Demand side management (DSM), advantages and barriers, implementation of DSM. Use of demand side management in agricultural, domestic and commercial consumers. Demand management through tariffs (TOD). Power factor penalties and incentives in tariff for demand control. Apparent energy tariffs. Role of renewable energy sources in energy management, direct use (solar thermal, solar air conditioning, biomass) and indirect use (solar, wind etc.) Introduction to ISO 50001- Energy Management.						
Unit 04	Energy Audit					06 hrs
Definition, need of energy audits, types of audit, procedures to follow, data and information analysis, Introduction to Data Analytics, data quality processing, clustering techniques, pattern mining, regression and classification. Relevance of Data Analytics in Audit, energy audit instrumentation,						

energy consumption – production relationship, pie charts. Sankey diagram, Cusum technique, least square method and numerical based on it. Outcome of energy audit and energy saving potential, action plans for implementation of energy conservation options. Bench- marking energy performance of an industry. Energy Audit reporting format – Executive Summary , Detailing of report.																							
Unit 05	Financial Analysis	06 hrs																					
Financial appraisals; criteria, simple payback period, return on investment, net present value method, time value of money, break even analysis, sensitivity analysis and numerical based on it, cost of energy, cost of generation Energy Audits case studies – Sugar Industry, Steel Industry, Paper and Pulp industry.																							
Unit 06	Energy Conservation	06 hrs																					
a) Motive power (motor and drive system). b) Illumination c) Heating systems (boiler and steam systems) d) Ventilation(Fan, Blower and Compressors) and Air Conditioning systems e) Pumping System f) Cogeneration and waste heat recovery systems g) Utility industries (T and D Sector) and Performance Assessments.																							
Test Books:																							
[T1]	Guide books for National Certification Examination for Energy Managers/Energy Auditors Book 1, General Aspects (available on line)																						
[T2]	Guide books for National Certification Examination for Energy Managers/Energy Auditors Book 2 – Thermal Utilities (available on line)																						
[T3]	Guide books for National Certification Examination for Energy Managers/Energy Auditors Book 3- Electrical Utilities (available on line)																						
[T4]	Guide books for National Certification Examination for Energy Managers/Energy Auditors Book 4 (available on line)																						
Reference Books:																							
[R1]	Success stories of Energy Conservation by BEE (www. Bee-india.org)																						
[R2]	Utilization of electrical energy by S.C. Tripathi, Tata McGraw Hill.																						
[R3]	Energy Management by W.R. Murphy and Mackay, B.S. Publication.																						
[R4]	Generation and utilization of Electrical Energy by B.R. Gupta, S. Chand Publication																						
[R5]	Energy Auditing made simple by Balasubramanian, Bala Consultancy Services.																						
[R6]	A General Introduction to Data Analytics by Andre Carvalho and Tomáš Horváth Wiley Inc First Edition 2019.																						
Online Resources:																							
[O1]	www.energymanaertraining.com																						
[O2]	www.em-ea.org																						
[O3]	www.bee-india.org																						
[O4]	https://www.iso.org/iso-50001-energy-management.html																						
<table border="1"> <thead> <tr> <th>Unit</th> <th>Text Books</th> <th>Reference Books</th> </tr> </thead> <tbody> <tr> <td>Unit 1</td> <td>T1</td> <td>O1, O2</td> </tr> <tr> <td>Unit 2</td> <td>T1</td> <td>O1, O2</td> </tr> <tr> <td>Unit 3</td> <td>T1</td> <td>R4, O4</td> </tr> <tr> <td>Unit 4</td> <td>T1</td> <td>R4, R5 and O1 and O2, R6</td> </tr> <tr> <td>Unit 5</td> <td>T1 and T4</td> <td>R1, R2, R3, R5 O1 and O2</td> </tr> <tr> <td>Unit 6</td> <td>T2, T3 and T4</td> <td>R1, R5 and O1 and O2</td> </tr> </tbody> </table>			Unit	Text Books	Reference Books	Unit 1	T1	O1, O2	Unit 2	T1	O1, O2	Unit 3	T1	R4, O4	Unit 4	T1	R4, R5 and O1 and O2, R6	Unit 5	T1 and T4	R1, R2, R3, R5 O1 and O2	Unit 6	T2, T3 and T4	R1, R5 and O1 and O2
Unit	Text Books	Reference Books																					
Unit 1	T1	O1, O2																					
Unit 2	T1	O1, O2																					
Unit 3	T1	R4, O4																					
Unit 4	T1	R4, R5 and O1 and O2, R6																					
Unit 5	T1 and T4	R1, R2, R3, R5 O1 and O2																					
Unit 6	T2, T3 and T4	R1, R5 and O1 and O2																					

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:						
<ol style="list-style-type: none"> 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 handling 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.						
<ol style="list-style-type: none"> 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. 						
2. Internship Identification:						
A student may choose to undergo an Internship at Industries, Government organizations, NGOs, Micro-Small-Medium enterprises, startups, Innovation and Incubation Centers, Institutes of National interests, organizations working for rural development, organizations promoting IPR and Entrepreneurship, etc. Approaching various industries for Internships and finalizing the same should be initiated in the 5 th semester in consultation with Institute's Training and Placement Cell, Industry-Institute Cell, or Internship Cell. This will help students to start their internship work on time. Also, it will allow students to work in a vacation period after their 5 th -semester examination and before the start of the 6 th semester. Student can take internship work in the form of Online/Onsite work from any						

of the following but not limited to:

1. Working for consultancy or the funded research project of the institute/Department.
2. Contributing at Incubation, Innovation, Entrepreneurship Cell, Institutional Innovation Council, Start-up Cell of Institute where students will get learning opportunities on projects.
3. Learning at Departmental Lab leading to lab development and modernization, Tinkering Lab, Institutional workshop for prototyping and model development, etc.
4. Working at Industry or Government Organization on project or part of the project.
5. Internship through Internshala, AICTE, Government initiatives, etc.
6. In-house product or working model development, intercollegiate, inter-department research under research lab or research group, etc.
7. Working at micro-small-medium enterprises on solving their specific problems.
8. Research internship under professors at IISc, IIT's, NIT's, Research organizations, etc.
9. Working with NGOs or Social Internships, Rural Internship, etc.

Further, other internship opportunities should be discussed and finalized in consultation with Department/Institute constituted committees for Internship.

3. Internship Record Book:

Students must maintain an Internship record book. The main purpose of maintaining a record book is to nurture the habit of documenting and keeping records by students. The students should maintain the record of daily activities completed which may include, field visits, important discussions, observations, project work completed, suggestions received, etc. The record book should be signed every day by the supervisor or in-charge where the student is undergoing an internship. The internship record book and well-drafted Internship Report should be submitted by the students to the department faculty coordinator within a week after the completion of the internship.

4. Internship Evaluation:

The evaluation of activities recorded in the Internship Record Book will be done by Program Head, Cell In-charge, Project Head, faculty mentor, or Industry Supervisor based on the overall compilation of internship activities, sub-activities, the level of achievement expected, and the duration for certain activities. Assessment and Evaluation are to be done in consultation with the internship supervisors (Internal from the institute and External from industry).

5. Evaluation and Assessment of Internship:

Internship Record Book – 25 Marks + Internship Report - 25 Marks + Post Internship Internal Evaluation-50 Marks = Total 100 Marks

5.1 Internship Record Book: The attendance record of the student along with the evaluation sheet, duly signed and stamped by the industry should be submitted by the industry Supervisor or Mentor to the Institute/Department after the completion of the internship. The internship record book may be evaluated based on the following criteria:

- Proper and timely documented entries
- Adequacy and quality of information
- Data, observations, discussions recorded
- Thought process and recording techniques used
- Organization of the information

5.2 Internship Report: After completion of the Internship, the student should prepare a comprehensive report to indicate what he/she has observed and learned in the internship period. The report shall be presented covering the following recommended fields but not limited to:

- Title/Cover Page
- Internship certificate with details like company name, location, duration, supervisor, etc.
- Institute Certificate
- Declaration
- Abstract
- Index/Table of Contents
- List of Figures/Tables
- **Chapter 1:** Introduction: Brief about company, industry or organization, objectives, motivation, organization of the report
- **Chapter 2:** Problem Identification/Problem statement/objectives and scope/expected outcomes
- **Chapter 3:** Methodological details
- **Chapter 4:** Results / Analysis /inferences and conclusion
- **Chapter 5:** Suggestions/Recommendations for improvement to industry, if any
- Attendance Record
- Acknowledgement
- List of reference (Library books, magazines, and other sources)

5.3 Post Internship Internal Evaluation: The student will give a presentation based on his Internship report before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

1. Internship Identification and Selection
2. Problem Studied with objectives and expected outcomes
3. Consideration of Environment/ Social /Ethics/ Safety measures/Legal aspects.
4. Methodology/System/Procedure Q&A
5. Block-diagram, flow-chart, algorithm, system description Q&A
6. Final results, discussions, suggestions, comments, etc. Q&A
7. Presentation and Communication

6. Feedback from internship supervisor (External and Internal)

Post internship, the faculty Internship coordinator should collect feedback about the student on the following suggested parameters from Industry Supervisor.

- Technical knowledge,
- Discipline and Punctuality,
- Work Commitment,
- Willingness to do the work,
- Communication skills, etc.

303153B: Audit Course VI: Project Management						
Teaching Scheme			Credits		Examination Scheme	
Theory	02	Hr/Week	TH	00	GRADE	PP/NP
Prerequisite:						
Course Objectives: This course aims to						
1. Plan a successful project through project management.						
2. Select the right members of a team for a project.						
Course Outcomes: At the end of this course, student will be able to						
CO1	Elaborate importance of project management and its process.					
CO2	Learn about the role of high performance teams and leadership in project management.					
Unit 01	Basics of Project Management:					12 hrs
Introduction, Need for Project Management, Project Management Knowledge Areas and Processes, The Project Life Cycle, The Project Manager (PM), Phases of Project Management Life Cycle, Project Management Processes, Impact of Delays in Project Completions, Essentials of Project Management Philosophy, Project Management Principles						
Unit 02	Project Identification, Selection, planning:					12 hrs
Project Identification, Selection Introduction, Project Identification Process, Project Initiation, Pr-Feasibility Study, Feasibility Studies, Project Break-even point Project Planning: Introduction, Project Planning, Need of Project Planning, Project Life Cycle, Roles, Responsibility and Team Work, Project Planning Process, Work Breakdown Structure (WBS)						
Test Books:						
[T1]	Project Management: A Systems Approach to Planning, Scheduling, and Controlling by Harold Kerzner.					
[T2]	Guide to Project Management: Getting it right and achieving lasting benefits by Paul Roberts.					
Online Resources:						
[O1]	https://www.coursera.org/learn/project-planning?specialization=project-management					
[O2]	Project management for managers By Prof. Mukesh Kumar Barua, IIT Roorkee https://onlinecourses.nptel.ac.in/noc20_mg48/preview					

Savitribai Phule Pune University
FACULTY OF ENGINEERING

B.E. Electrical Engineering (2015 Course)
(w.e.f. 2018-2019)

SEMESTER-I													
Sr No	Subject Code	Subject Title	Teaching Scheme (Hrs/Week)			Examination Scheme (Marks)					Total Marks	Credit	
			TH	PR	TU	PP		TW	PR	OR		TH / TU	PR + OR
						In Sem	End Sem						
1	403141	Power System Operation and Control	03	02	--	30	70	25	--	25	150	03	01
2	403142	PLC and SCADA Applications	04	02	--	30	70	25	50	--	175	04	01
3	403143	Elective I	03	02	--	30	70	25	--	--	125	03	01
4	403144	Elective II	03	--	--	30	70	--	--	--	100	03	--
5	403145	Control System II	03	02	--	30	70	25	--	25	150	03	01
6	403146	Project I	--	--	02	--	--	--	--	50	50	02	--
	403152	Audit Course V											
TOTAL			16	08	02	150	350	100	50	100	750	18	04
SEMESTER-II													
Sr No	Subject Code	Subject Title	Teaching Scheme (Hrs/Week)			Examination Scheme (Marks)					Total Marks	Credit	
			TH	PR	TU	PP		TW	PR	OR		TH / TU	PR + OR
						In Sem	End Sem						
1	403147	Switchgear and Protection	03	02	--	30	70	50	--	25	175	03	01
2	403148	Power Electronic Controlled Drives	04	02	--	30	70	25	50	--	175	04	01
3	403149	Elective III	03	02	--	30	70	25	--	25	150	03	01
4	403150	Elective IV	03	--	--	30	70	--	--	--	100	03	--
5	403151	Project II	--	--	06	--	--	50	--	100	150	06	--
	403153	Audit Course VI											
TOTAL			13	06	06	120	280	150	50	150	750	19	03

403146 : Project I

Teaching Scheme	Credits	Examination Scheme [50 Marks]
Tutorial : 02 Hr/Week	02	Oral : 50 Marks

The student shall take up a project in the field closely related to Electrical Engineering. Preferably, group of 3/4 students should be formed for project work.

The project work should be based on the knowledge acquired by the student during the graduation and preferably it should meet and contribute towards the needs of the society. The project aims to provide an opportunity of designing and building complete system or subsystems based on area where the student likes to acquire specialized skills.

Project work in this semester is an integral part of the complete project. In this, the student shall complete the partial work of the project which will consists of problem statement, literature review, project overview and scheme of implementation. As a part of the progress report of project work, the candidate shall deliver a presentation on the advancement in Technology pertaining to the selected project topic.

Guidelines for VIIth Semester for Project work:

1. To identify the problems in industry and society.
2. Perform Literature survey on the specific chosen topic through research papers, Journals, books etc. and market survey if required.
3. To narrow down the area taking into consideration his/her strength and interest. The nature of project can be analytical, simulation, experimentation, design and validation.
4. Define problem, objectives, scope and its outcomes.
5. Design scheme of implementation of project.
6. Data collection, simulation, design, hardware if any, needs to be completed.
7. Presentation based on partially completed work.
8. Submission of report based on the work carried out.
9. Student should maintain Project Work Book.

403151: Project II

Teaching Scheme	Credits	Examination Scheme [150 Marks]
Tutorial : 06 Hrs./Week	06	Oral : 50 Marks Term work : 100 Marks

Course Objectives:

- To explore and to acquire specified skill in areas related to Electrical Engineering
- To develop skills for carrying literature survey and organize the material in proper manner.
- To provide opportunity of designing and building complete system/subsystem based on their knowledge acquired during graduation.
- To understand the needs of society and based on it to contribute towards its betterment and to learn to work in a team.
- To ensure the completion of given project such as fabrication, conducting experimentation, analysis, validation with optimized cost.
- Present the data and results in report form
- Communicate findings of the completed work systematically.

Course outcomes: Students will be able to

- Work in team and ensure satisfactory completion of project in all respect.
- Handle different tools to complete the given task and to acquire specified knowledge in area of interest.
- Provide solution to the current issues faced by the society.
- Practice moral and ethical value while completing the given task.
- Communicate effectively findings in verbal and written forms.

Guidelines :

The student shall complete the remaining part of the project which is an extension of the work carried out in VIIth Semester. For exceptional cases, change of topic has to be approved by Internal Assessment Committee consisting of Guide, Project Coordinator and Head of Department.

Student should incorporate suggestions given by examiner in project I.

The student shall complete the remaining part of the project which consists of design, simulation, fabrication of set up required for the project, analysis and validation of results and conclusions.

The student shall prepare duly certified final report of the project work in the standard format in MS Word / LaTeX.

Student should maintain Project Work Book.

Savitribai Phule Pune University

Board of Studies - Automobile and Mechanical Engineering

Undergraduate Program - Automobile Engineering & Mechanical Engineering (2019 pattern)

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit			
		TH	PR	TUT	ISE	ESE	TW	PR	OR	TOTAL	TH	PR	TUT	TOTAL
Semester-III														
202041	Solid Mechanics	4	2	-	30	70	-	50	-	150	4	1	-	5
202042	Solid Modeling and Drafting	3	2	-	30	70	-	50	-	150	3	1	-	4
202043	Engineering Thermodynamics	3	2	-	30	70	-	-	25	125	3	1	-	4
202044	Engineering Materials and Metallurgy	3	2	-	30	70	25	-	-	125	3	1	-	4
203156	Electrical and Electronics Engineering	3	2	-	30	70	25	-	-	125	3	1	-	4
202045	Geometric Dimensioning and Tolerancing Lab	-	2	-	-	-	25	-	-	25	-	1	-	1
202046	Audit Course - III	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		16	12	-	150	350	75	100	25	700	16	6	-	22
Semester-IV														
207002	Engineering Mathematics - III	3	-	1	30	70	25	-	-	125	3	-	1	4
202047	Kinematics of Machinery	3	2	-	30	70	-	-	25	125	3	1	-	4
202048	Applied Thermodynamics	3	2	-	30	70	-	-	25	125	3	1	-	4
202049	Fluid Mechanics	3	2	-	30	70	-	-	25	125	3	1	-	4
202050	Manufacturing Processes	3	-	-	30	70	-	-	-	100	3	-	-	3
202051	Machine Shop	-	2	-	-	-	50	-	-	50	-	1	-	1
202052	Project Based Learning - II	-	4	-	-	-	50	-	-	50	-	2	-	2
202053	Audit Course - IV	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		15	12	1	150	350	125	-	75	700	15	6	1	22
<p>Abbreviations: TH: Theory, PR: Practical, TUT: Tutorial, ISE: In-Semester Exam, ESE: End-Semester Exam, TW: Term Work, OR: Oral</p>														
<p>Note: Interested students of SE (Automobile Engineering and Mechanical Engineering) can opt for any one of the audit course from the list of audit courses prescribed by BoS (Automobile and Mechanical Engineering)</p>														
<p>Instructions</p> <ul style="list-style-type: none"> • Practical/Tutorial must be conducted in three batches per division only. • Minimum number of required Experiments/Assignments in PR/ Tutorial shall be carried out as mentioned in the syllabi of respective subjects. • Assessment of tutorial work has to be carried out as a term-work examination. Term-work Examination at second year of engineering course shall be internal continuous assessment only. • Project based learning (PBL) requires continuous mentoring by faculty throughout the semester for successful completion of the tasks selected by the students per batch. While assigning the teaching workload of 2 Hrs/week/batch needs to be considered for the faculty involved. The Batch needs to be divided into sub-groups of 5 to 6 students. Assignments / activities / models/ projects etc. under project based learning is carried throughout semester and Credit for PBL has to be awarded on the basis of internal continuous assessment and evaluation at the end of semester. • Audit course is mandatory but non-credit course. Examination has to be conducted at the end of Semesters for award of grade at institute level. Grade awarded for audit course shall not be calculated for grade point & CGPA. 														

202046 - Audit Course - III

Teaching Scheme	Credits	Examination Scheme
-	-	-

GUIDELINES FOR CONDUCTION OF AUDIT COURSE

Faculty mentor shall be allotted for individual courses and he/she shall monitor the progress for successful accomplishment of the course. Such monitoring is necessary for ensuring that the concept of self learning is being pursued by the students 'in true letter and spirit'.

- If any course through Swayam/ NPTEL/ virtual platform is selected the minimum duration shall be of 8 weeks.
- However if any of the course duration is less than the desired (8 weeks) the mentor shall ensure that other activities in form of assignments, quizzes, group discussion etc. (allied with the course) for the balance duration should be undertaken.

In addition to credits courses, it is mandatory that there should be an audit course (non-credit course) from second year of Engineering. The student will be awarded grade as AP on successful completion of the audit course. The student may opt for any one of the audit courses in each semester. Such audit courses can help the student to get awareness of different issues which make an 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. Students can choose one of the audit courses from the list of courses mentioned. Evaluation of the audit course will be done at institute level.

The student registered for audit course shall be awarded the grade AP and shall be included such grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not considered in the calculation of the performance indices SGPA and CGPA. Evaluation of the audit course will be done at institute level itself.

Selecting an Audit Course

List of Courses to be opted (Any one) under Audit Course III

- Technical English For Engineers
- Entrepreneurship Development
- Developing soft skills and personality
- **Design Thinking**
- Foreign Language (preferably German/ Japanese)
- Science, Technology and Society

The titles indicated above are subject to change in time to come and such an alteration (if any) should be brought to the notice of the BoS.

Using NPTEL Platform: (preferable)

NPTEL is an initiative by MHRD to enhance learning effectiveness in the field of technical education by developing curriculum based video courses and web based e-courses. The details of NPTEL courses are available on its official website www.nptel.ac.in

- Students can select any one of the courses mentioned above and has to register for the corresponding online course available on the NPTEL platform as an Audit course.
- Once the course is completed the student can appear for the examination as per the guidelines on the NPTEL portal.
- After clearing the examination successfully; student will be awarded with a certificate.

Assessment of an Audit Course

- The assessment of the course will be done at the institute level. The institute has to maintain the record of the various audit courses opted by the students. The audit course opted by the students could be interdisciplinary.
- During the course students will be submitting the online assignments. A copy of the same can be submitted as a part of term work for the corresponding Audit course.
- On the satisfactory submission of assignments, the institute can mark as "Present" and the student will be awarded the grade AP on the marksheet.

202048 - Applied 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

Engineering Thermodynamics, Systems in Mechanical Engineering, Engineering Mathematics - I, Engineering Mathematics - II

Course Objectives

1. To determine COP of refrigeration cycle and study Psychrometric properties and processes.
2. To study working of engine, Actual, Fuel-Air and Air standard cycle and its Performance.
3. To understand Combustion in SI and CI engines and factors affecting performance parameters
4. To study emission from IC Engines and its controlling method, various emission norms.
5. To estimate performance parameters by conducting a test on I. C. Engines.
6. To determine performance parameters of Positive displacement compressor.

Course Outcomes

On completion of the course, learner will be able to

- CO1. DETERMINE COP of refrigeration system and ANALYZE psychrometric processes.
 CO2. DISCUSS basics of engine terminology, air standard, fuel air and actual cycles.
 CO3. IDENTIFY factors affecting the combustion performance of SI and CI engines.
 CO4. DETERMINE performance parameters of IC Engines and emission control.
 CO5. EXPLAIN working of various IC Engine systems and use of alternative fuels.
 CO6. CALCULATE performance of single and multi stage reciprocating compressors and DISCUSS rotary positive displacement compressors

Course Contents**Unit I Basics of Refrigeration and Psychrometry [07 Hr.]**

Refrigeration: Reversed Carnot Cycle, unit of refrigeration, Simple Vapour Compression Cycle (VCC), Refrigerating Effect, Compressor Power & COP. Simple Vapor Absorption Cycle (VAC), Comparison between VCC & VAC.

Psychrometry: Introduction, Psychrometry and Psychrometric Properties, Basic Terminologies & Psychrometric Relations, Psychrometric Processes, Psychrometric Chart.

Unit II Introduction to Internal Combustion (IC) Engine [06 Hr.]

IC Engine: Components and Construction details, Terminology, Classification, Applications, Intake and exhaust system, Valves actuating mechanisms, Valve timing diagram.

Fuel, Air and Actual Cycle: Air-standard cycles, fuel air cycles, and actual cycles, Effects of variables on performance, various losses, and Comparison of Air standard with Fuel and Actual cycle.

Unit III SI and CI Engines [09 Hr.]

SI Engines: Theory of Carburetion and Types of Carburetor, Working of Simple Carburetor, Electronic Fuel Injection System, Combustion stages in SI engines, Abnormal Combustion, Theory of Detonation and Parameters affecting detonations, Rating of fuels in SI engines, Combustion Chambers used in SI Engine.

CI Engines: Fuel Injection system, Construction and Working of Fuel Pump, Fuel Injector and Various types of Nozzle, Combustion stages in CI engines, Theory of knocking and Parameters affecting knocking, Rating of fuels in CI engines, Combustion Chambers used in CI Engines.

Unit IV IC Engine Testing and Emission [09 Hr.]

Engine Testing: Engine Testing Procedure, Measurement of indicated power, Brake power, fuel consumption, Air Consumption, Measurement of friction power by Willan's Line Method and Morse Test, calculation of mean effective pressure, various efficiencies, specific fuel consumption, heat balance sheet of IC Engines and performance Characteristic curves.

Emission & Control: Introduction to Indian Driving Cycle (IDC), European Driving Cycle (EDC), SI and CI Engines Emission and controlling methods, Methods to measure emission such as (Non Dispersive Infrared Red (NDIR), Flame Ionization Detector (FID), Chemiluminescent Analyzer, Smoke meter), Euro Norms and Bharat Stage Norms.

Unit V Engine Systems and Alternative Fuels [07 Hr.]

Cooling system: Air Cooling, Liquid cooling, **Lubrication system:** Objectives of lubrication system, properties of lubricant, Methods of lubrication system, **Ignition system:** battery coil ignition system, magneto ignition system, Electronics Ignition (CDI, TCI), Maximum Brake Torque (MBT) & spark advance. Supercharging and Turbo-charging.

Alternative Fuels: Bio-diesel, Ethanol, LPG, CNG and Hydrogen.

Unit VI Compressor [07 Hr.]

Reciprocating Compressor: Applications of compressed air, single stage compressor (without clearance and with clearance volume), volumetric efficiency, isothermal efficiency, effect of clearance volume, free air delivery (FAD), actual indicator diagram for air compressor, Multi staging of compressor, optimum intermediate pressure, intercooler, after cooler, Capacity control of compressors.

Rotary Compressors: Roots blower, Vane type, Screw compressor and Scroll compressor.

Books & Other Resources

Text Books

1. Arora C. P., "Refrigeration and Air Conditioning", Tata McGraw-Hill
2. V. Ganesan, "Internal Combustion Engines", Tata McGraw-Hill
3. M. L. Mathur and R.P. Sharma, "A course in Internal combustion engines", Dhanpat Rai & Co.
4. H.N. Gupta, "Fundamentals of Internal Combustion Engines", PHI Learning Pvt. Ltd.

Reference Books

1. Dossat Ray J, "Principles of refrigeration, S.I. version", Willey Eastern Ltd, 2000
2. Heywood, "Internal Combustion Engine Fundamentals", Tata McGraw-Hill
3. Domkundwar & Domkundwar, "Internal Combustion Engine", Dhanpat Rai & Co.
4. R. Yadav, "Internal Combustion Engine", Central Book Depot, Ahmedabad.
5. S.Domkundwar,C.P. Kothandaraman,A.Domkundwar,"Thermal Engineering",DhanpatRai & Co.

Guidelines for Laboratory Conduction

The student shall complete the following activity as a Term Work

Total 10 of the following list must be performed. During Oral, the Student shall be evaluated based on the completion of Practical, Assignments, Presentations and Detailed Industrial Visit Report.

Practical (Minimum 6 Practical must be performed)

1. Trial on Vapour Compression System
2. Trial on Vapour Absorption System
3. Trial on Air-Conditioning Test Rig.
4. Morse Test on Petrol engine.
5. Trial on Diesel engine.
6. Trial on Petrol engine.
7. Trial on variable compression ratio engine.
8. Trial on Positive Displacement Air Compressor.
9. Demonstration on Exhaust Gas Analyser and Smoke meter.

Survey (Minimum one)

1. Practical Survey of various fuel supply systems.
2. Practical Survey of supercharged and turbocharged engines.

Activity: Presentation based

Compulsory study of following topics must be done by students during semester to gain awareness and further understanding of the course and a presentation of the same should be included in the TW:

1. **Engines:**(any one) Homogeneous charge compression ignition (HCCI)/ Stratified charge

engine/Variable valve timing (VVT)/Variable geometry turbocharger (VGT), etc.

2. **Automotive Field:** (any one) Hydrogen CNG vehicles/Adaptive cruise control system/On-board diagnostic system (OBD) / Electric Battery classification/Fuel Cell vehicle/Rear driving emission (RDE) system

Industrial Visit

A Compulsory industrial visit must be arranged to automobile manufacturing or servicing.

Students must submit properly documented Detailed Industrial Visit Report in his/her own words.

202051 - Machine Shop

Teaching Scheme	Credits	Examination Scheme
Practical : 02 Hr./Week	01 Practical : 01	In-Semester : 30 Marks End-Semester : 70 Marks Term Work : 50 Marks

Prerequisite Courses

Workshop Practice

Course Objectives

1. To understand the basic procedures, types of equipment, tooling used for sand casting and metal forming processes through demonstrations and/(or) Industry visits..
2. To understand TIG/ MIG/ Resistance/Gas welding techniques.
3. To acquire skills to handle grinding and milling machine and to produce gear by milling.
4. To acquire skills to produce a composite part by manual process.

Course Outcomes

On completion of the course, learner will be able to

- CO1. PERFORM welding using TIG/ MIG/ Resistance/Gas welding technique
 CO2. MAKE Fibre-reinforced Composites by hand lay-up process or spray lay-up techniques
 CO3. PERFORM cylindrical/surface grinding operation and CALCULATE its machining time
 CO4. DETERMINE number of indexing movements required and acquire skills to PRODUCE a spur gear on a horizontal milling machine
 CO5. PREPARE industry visit report
 CO6. UNDERSTAND procedure of plastic processing

Guidelines for Laboratory Conduction

The student shall complete the following activity as a Term Work

Practical (*Select any One Practical from Practical # 1 & 2; Select any Five Practical from Practical # 3 to 8; Perform Total Six Practicals*)

1. To study and observe various stages of casting through demonstration of sand casting process from pattern making, sand mould preparation and melting and pouring of metal.
2. Visit to any foundry/ permanent mould casting industry to demonstrate various stages of casting and make a report on it.
3. A compulsory visit to any one metal forming industry out of: Rolling mill, Forging plant, Wire/Tube drawing unit and prepare a report on it.
4. A demonstration of any one welding technique out of TIG/ MIG/Resistance/Gas welding. A job drawing to be prepared by an individual institute with details of welding process parameters with weld joint design such as edge preparation, type and size of electrode used, welding current, voltage etc.
5. Manufacturing of Fibre-reinforced Composites by hand lay-up process or spray lay-up techniques.
6. Demonstration on any one plastic component like bottle, bottle caps, machine handles etc. by injection moulding process/ by additive manufacturing process.
7. Demonstration on cylindrical grinding/surface grinding operations, measurement of surface roughness produced and estimation of machining time.
8. Demonstration on indexing mechanism. Calculation of index crank and index plate movement by simple/compound/differential indexing and manufacture of spur gear on a milling machine using indexing head.

Instructions for Laboratory Conduction

Please note following instructions regarding Laboratory Conduction:

1. Industrial Visits to be conducted by the Teaching **Faculty** (subject Teacher).
2. Demonstration of Welding machines, Surface/Cylindrical Grinding, Milling machine, Indexing head and calculation of indexing to be taught by a **subject Teacher in Practical slot**.

202053 - Audit Course - IV

Teaching Scheme	Credits	Examination Scheme
-	-	-

GUIDELINES FOR CONDUCTION OF AUDIT COURSE

Faculty mentor shall be allotted for individual courses and he/she shall monitor the progress for successful accomplishment of the course. Such monitoring is necessary for ensuring that the concept of self learning is being pursued by the students ‘in true letter and spirit’.

- If any course through Swayam/ NPTEL/ virtual platform is selected the minimum duration shall be of 8 weeks.
- However if any of the course duration is less than the desired (8 weeks) the mentor shall ensure that other activities in form of assignments, quizzes, group discussion etc. (allied with the course) for the balance duration should be undertaken.

In addition to credits courses, it is mandatory that there should be an audit course (non-credit course) from second year of Engineering. The student will be awarded grade as AP on successful completion of the audit course. The student may opt for any one of the audit courses in each semester. Such audit courses can help the student to get awareness of different issues which make an 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. Students can choose one of the audit courses from the list of courses mentioned. Evaluation of the audit course will be done at institute level.

The student registered for audit course shall be awarded the grade AP and shall be included such grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not considered in the calculation of the performance indices SGPA and CGPA. Evaluation of the audit course will be done at institute level itself.

Selecting an Audit Course

List of Courses to be opted (Any one) under Audit Course IV

- Language & Mind Emotional Intelligence
 - Advanced Foreign Language (preferably German/ Japanese)
 - Human Behaviour
 - Speaking Effectively
 - **Business Ethics**
 - Technical writing/ Research writing
- # The titles indicated above are subject to change in time to come and such an alteration (if any) should be brought to the notice of the BoS.

Using NPTEL Platform: (preferable)

NPTEL is an initiative by MHRD to enhance learning effectiveness in the field of technical education by developing curriculum based video courses and web based e-courses. The details of NPTEL courses are available on its official website www.nptel.ac.in

- Students can select any one of the courses mentioned above and has to register for the corresponding online course available on the NPTEL platform as an Audit course.
- Once the course is completed the student can appear for the examination as per the guidelines on the NPTEL portal.
- After clearing the examination successfully; student will be awarded with a certificate.

Assessment of an Audit Course

- The assessment of the course will be done at the institute level. The institute has to maintain the record of the various audit courses opted by the students. The audit course opted by the students could be interdisciplinary.
- During the course students will be submitting the online assignments. A copy of the same can be submitted as a part of term work for the corresponding Audit course.
- On the satisfactory submission of assignments, the institute can mark as “Present” and the student will be awarded the grade AP on the mark sheet.

Savitribai Phule Pune University
Board of Studies - Automobile and Mechanical Engineering
Undergraduate Program - Mechanical Engineering (2019 pattern)

Course Code	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks						Credit			
		TH	PR	TUT	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
Semester-V														
302041	Numerical & Statistical Methods	3	-	1	30	70	25	-	-	125	3	-	1	4
302042	Heat & Mass Transfer	3	2	-	30	70	-	50	-	150	3	1	-	4
302043	Design of Machine Elements	3	2	-	30	70	-	-	25	125	3	1	-	4
302044	Mechatronics	3	2	-	30	70	-	-	25	125	3	1	-	4
302045	Elective I	3	-	-	30	70	-	-	-	100	3	-	-	3
302046	Digital Manufacturing Laboratory	-	2	-	-	-	50	-	-	50	-	1	-	1
302047	Skill Development	-	2	-	-	-	25	-	-	25	-	1	-	1
302048	Audit course - V ^s	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		15	10	1	150	350	100	50	50	700	15	5	1	21
Semester-VI														
302049	Artificial Intelligence & Machine Learning	3	2	-	30	70	-	-	25	125	3	1	-	4
302050	Computer Aided Engineering	3	2	-	30	70	-	50	-	150	3	1	-	4
302051	Design of Transmission Systems	3	2	-	30	70	-	-	25	125	3	1	-	4
302052	Elective II	3	-	-	30	70	-	-	-	100	3	-	-	3
302053	Measurement Laboratory	-	2	-	-	-	50	-	-	50	-	1	-	1
302054	Fluid Power & Control Laboratory	-	2	-	-	-	50	-	-	50	-	1	-	1
302055	Internship/Mini project *	-	4	-	-	-	100	-	-	100	-	4	-	4
302056	Audit course - VI ^s	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		12	14	-	120	280	200	50	50	700	12	9	-	21
Elective-I						Elective-II								
302045-A	Advanced Forming & Joining Processes				302052-A	Composite Materials								
302045-B	Machining Science & Technology				302052-B	Surface Engineering								
Abbreviations: TH: Theory, PR: Practical, TUT: Tutorial, ISE: In-Semester Exam, ESE: End-Semester Exam, TW: Term Work, OR: Oral														
Note: Interested students of TE (Automobile Engineering and Mechanical Engineering) can opt for any one of the audit course from the list of audit courses prescribed by BOS (Automobile and Mechanical Engineering)														
Instructions:														
<ul style="list-style-type: none"> Practical/Tutorial must be conducted in FOUR batches per division only. Minimum number of Experiments/Assignments in PR/Tutorial shall be carried out as mentioned in the syllabi of respective courses. Assessment of tutorial work has to be carried out similar to term-work. The Grade cum marks for Tutorial and Term-work shall be awarded on the basis of continuous evaluation. ^sAudit course is mandatory but non-credit course. Examination has to be conducted at the end of Semesters for award of grade at institute level. Grade awarded for audit course shall not be calculated for grade point & CGPA. 														

302047: Skill Development					
Teaching Scheme		Credits		Examination Scheme	
Practical	2 Hrs./Week	Practical	1	TW	25 Marks
<p>Prerequisites: Students should have knowledge of Construction and working of IC engine / compressor / gear box / centrifugal pump/tail stock. Working principles of any type of mechanism / power plants. Working of electric and hydraulic systems of 4 wheeler vehicle. Working of machine tools, engine and transmission of different automotive and home appliances. Advanced manufacturing processes. Solid mechanics and design of machine elements.</p>					
<p>Course Objectives:</p> <ol style="list-style-type: none"> INTRODUCE the skills required in an industry such as design, development, assembly & disassembly. DEVELOP the skills required for fault diagnose of engine and transmission of different automotive and various home appliances. ESTABLISH the skills required for maintenance of any machine tool. CREATE awareness about industrial environment. 					
<p>Course Outcomes:</p> <p>On completion of the course, learner will be able to</p> <p>CO1.APPLY & DEMONSTRATE procedure of assembly & disassembly of various machines.</p> <p>CO2.DESIGN & DEVELOP a working/model of machine parts or any new product.</p> <p>CO3.EVALUATE fault with diagnosis on the machines, machine tools and home appliances.</p> <p>CO4.IDENTIFY & DEMONSTRATE the various activities performed in an industry such as maintenance, design of components, material selection.</p>					
Course Contents					
<ol style="list-style-type: none"> Assembly and Disassembly of any of the following mechanical systems/ subsystems: bicycle (geared), e-Bikes, e-Motor Cycles, Drones, Flying devices, gear box, IC engines, centrifugal pump etc. Assembly- Disassembly/ Fault diagnosis of home appliances such as mixer, grinder, washing machine, fan, ovens, gas geyser, chopping machine, kneading machine, exercise machines, etc. Development and demonstration of working/animation model of any mechanism. Design a circuit of electric and hydraulic system of 4 wheelers and its verification. <p style="text-align: center;">OR</p> <p>Circuit design /PCB design using software for control of BLDC electric motors used in e-Vehicles.</p> <ol style="list-style-type: none"> Undertake total preventive maintenance for any machine tool or mechanical system. Visit to an industry for awareness about preventive maintenance. Use of ergonomic principles for the design of hand tools, control in automobile dashboards, human operated mobile devices. 					

8. Use of alternative materials in the construction of daily activity machine and tool components
9. Interpretation of Drawings; Exercises in identifying the type of production, extracting important functional dimensions, checking the number of parts in an assembly. Checking and listing missing dimensions.
10. Exercises in -preparation of detailed production drawings as per BIS standard of simple machine parts having relevant notes and indications (limits/tolerances, surface finish, the process of production, relevant tools, materials, measuring instruments).

The documentation activity as a part of the Term work shall not be restricted to merely generation of 2D/3D CAD Drawings with dimensions (as applicable), Exploded View, Flowchart of Maintenance Work etc. but can be beyond.

Skill Development Documentation Diary must be maintained by every student.

302048: Audit Course V		
Teaching Scheme	Credits	Examination Scheme
	Non-Credit	
GUIDELINES FOR CONDUCTION OF AUDIT COURSE		
<p>Faculty mentor shall be allotted for individual courses and he/she shall monitor the progress for successful accomplishment of the course. Such monitoring is necessary for ensuring that the concept of self-learning is being pursued by the students ‘in true letter and spirit’.</p> <ul style="list-style-type: none"> • If any course through Swayam/ NPTEL/ virtual platform is selected the minimum duration shall be of 8 weeks. • However if any of the course duration is less than the desired (8 weeks) the mentor shall ensure that other activities in form of assignments, quizzes, group discussion etc. (allied with the course) for the balance duration should be undertaken. <p>In addition to credits courses, it is mandatory that there should be an audit course (non-credit course) from third year of Engineering. The student will be awarded grade as AP on successful completion of the audit course. The student may opt for any one of the audit courses in each semester. Such audit courses can help the student to get awareness of different issues which make an 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. Students can choose one of the audit courses from the list of courses mentioned. Evaluation of the audit course will be done at institute level.</p> <p>The student registered for audit course shall be awarded the grade AP and shall be included such grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not considered in the calculation of the performance indices SGPA and CGPA. Evaluation of the audit course will be done at institute level itself.</p>		
Selecting an Audit Course		
List of Courses to be opted (Any one) under Audit Course V		
<ul style="list-style-type: none"> • Entrepreneurship and IP strategy • Engineering Economics • Mangment of Inventory Systems <p># The titles indicated above are subject to change in time to come and such an alteration (if any) should be brought to the notice of the BOS.</p>		
Using NPTEL Platform: (preferable)		
<p>NPTEL is an initiative by MHRD to enhance learning effectiveness in the field of technical education by developing curriculum based video courses and web based e-courses. The details of NPTEL courses are available on its official website www.nptel.ac.in</p> <ul style="list-style-type: none"> • Students can select any one of the courses mentioned above and has to register for the 		

corresponding online course available on the NPTEL platform as an Audit course.

- Once the course is completed the student can appear for the examination as per the guidelines on the NPTEL portal.
- After clearing the examination successfully; student will be awarded with a certificate.

Assessment of an Audit Course

- The assessment of the course will be done at the institute level. The institute has to maintain the record of the various audit courses opted by the students. The audit course opted by the students could be interdisciplinary.
- During the course students will be submitting the online assignments. A copy of the same can be submitted as a part of term work for the corresponding Audit course.
- On the satisfactory submission of assignments, the institute can mark as “Present” and the student will be awarded the grade AP on the mark-sheet.

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:				
<p>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.</p> <ol style="list-style-type: none"> 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:				
<p>On completion of the course, learners should be able to</p> <p>CO1. DEMONSTRATE professional competence through industry internship.</p> <p>CO2. APPLY knowledge gained through internships to complete academic activities in a professional manner.</p> <p>CO3. CHOOSE appropriate technology and tools to solve given problem.</p> <p>CO4. DEMONSTRATE abilities of a responsible professional and use ethical practices in day to day life.</p> <p>CO5. DEVELOP network and social circle, and DEVELOPING relationships with industry people.</p> <p>CO6. ANALYZE various career opportunities and DECIDE career goals.</p>				
**Guidelines:				
<p>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.</p> <p>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.</p> <p>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.</p>				

Duration:
Internship is to be completed after semester 5 and before commencement of semester 6 of at least 4 to 6 weeks; and it is to be assessed and evaluated in semester 6.
Internship work Identification:
<p>Student may choose to undergo Internship at Industry/Govt. Organizations/NGO/MSME/Rural Internship/ Innovation/IPR/Entrepreneurship. Student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO's/Government organizations/Micro/Small/ Medium enterprises to make themselves ready for the industry.</p> <p>Students must get Internship proposals sanctioned from college authority well in advance. Internship work identification process should be initiated in the Vth semester in coordination with training and placement cell/ industry institute cell/ internship cell. This will help students to start their internship work on time. Also, it will allow students to work in vacation period after their Vth semester examination and before academic schedule of semester VI.</p> <p>Student can take internship work in the form of the following but not limited to:</p> <ol style="list-style-type: none"> 1. Working for consultancy/ research project, 2. Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council/ startups cells of institute / 3. Learning at Departmental Lab/Tinkering Lab/ Institutional workshop, 4. Development of new product/ Business Plan/ registration of start-up, 5. Industry / Government Organization Internship, 6. Internship through Internshala, 7. In-house product development, intercollegiate, inter department research internship under research lab/group, micro/small/medium enterprise/online internship, 8. Research internship under professors, IISC, IIT's, Research organizations, 9. NGOs or Social Internships, rural internship, 10. Participate in open source development.
Internship Diary/ Internship Workbook:
<p>Students must maintain Internship Diary/ Internship Workbook. The main purpose of maintaining diary/workbook is to cultivate the habit of documenting. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. The training diary/workbook should be signed every day by the supervisor.</p> <p>Internship Diary/workbook and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training.</p>
Internship Work Evaluation:
<p>Every student is required to prepare and maintain documentary proofs of the activities done by him as internship diary or as workbook. The evaluation of these activities will be done by Program Head/Cell In-charge/ Project Head/ faculty mentor or Industry Supervisor based on- Overall compilation of internship activities, sub-activities, the level of achievement expected, evidence needed to assign the points and the duration for certain activities.</p> <p>Assessment and Evaluation is to be done in consultation with internship supervisor (Internal and External – a supervisor from place of internship).</p>

Recommended evaluation parameters-Post Internship Internal Evaluation -50 Marks + Internship Diary/Workbook and Internship Report - 50 Marks

Evaluation through Seminar Presentation/Viva-Voce at the Institute

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

- Depth of knowledge and skills
- Communication & Presentation Skills
- Team Work and Creativity
- Planning & Organizational skills
- Adaptability
- Analytical Skills
- Attitude & Behavior at work
- Societal Understanding
- Ethics
- Regularity and punctuality
- Attendance record
- Diary/Workbook
- Student's Feedback from External Internship Supervisor

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period.

Internship Diary/workbook may be evaluated on the basis of the following criteria:

- Proper and timely documented entries
- Adequacy & quality of information recorded
- Data recorded
- Thought process and recording techniques used
- Organization of the information

The report shall be presented covering following recommended fields but limited to,

- Title/Cover Page
- Internship completion certificate
- Internship Place Details- Company background-organization and activities/Scope and object of the study / Supervisor details
- Index/Table of Contents
- Introduction
- Title/Problem statement/objectives
- Motivation/Scope and rationale of the study
- Methodological details
- Results / Analysis /inferences and conclusion
- Suggestions / Recommendations for improvement to industry, if any
- Attendance Record
- Acknowledgement
- List of reference (Library books, magazines and other sources)

Feedback from internship supervisor(External and Internal)

Post internship, faculty coordinator should collect feedback about student with recommended parameters include as- Technical knowledge, Discipline, Punctuality, Commitment, Willingness to do the work, Communication skill, individual work, Team work, Leadership...

Reference:

1. <https://www.aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf>
2. <https://internship.aicte-india.org/>

IMPORTANT NOTE:

The student shall be encouraged to undertake the industrial internships however the Industry may provide opportunity to a limited few amongst the students available. In such scenario it becomes the moral responsibility of the faculty to create opportunity for such group of students (similar to the ones in Industry) by assigning them some real life problem as a part of the mini project and encouraging/mentoring them to attempt viable solutions. Hence the provision of Mini project is being done to accommodate such students and expose them with the Industrial practices in house. The students can be encouraged to consider analysis of the global patents available as a mini project,

Mini project					
Teaching Scheme		Credits		Examination Scheme	
Practical	4 Hrs./Week	Practical	4	Term work	100

Course Objectives:

Students shall UNDERTAKE and EXECUTE a Mini Project through a group of students to

1. **UNDERSTAND** the “Product Development Cycle”, through Mini Project.
2. **PLAN** for various activities of the project and distribute the work amongst team members.
3. **LEARN** budget planning for the project.
4. **INCULCATE** mechanical/interdisciplinary implementation skills.
5. **DEVELOP** students’ abilities to transmit technical information clearly and test the same by delivery of Seminar based on the Mini Project.
6. **UNDERSTAND** the importance of document design by compiling Technical Report on the Mini Project work carried out.

Course Outcomes:

On completion of the course, learner will be able to

- CO1. **EXPLAIN** plan and execute a Mini Project with team.
- CO2. **IMPLEMENT** hardware/software/analytical/numerical techniques, etc.
- CO3. **DEVELOP** a technical report based on the Mini project.
- CO4. **DELIVER** technical seminar based on the Mini Project work carried out.

Course Contents

Maximum Group Size: Minimum 2 and maximum 4 students can form a group for the mini project.

Project Type: (The selected mini project must be based on any of the following)

1. Development of a prototype mechanical system/product.
2. Investigate performance of mechanical systems using experimental method

3. Parametric analysis of components/systems/devices using suitable software
4. Investigation of optimum process/material for product development using market survey.
5. Solution for society/industry problems

The Assessment Scheme will be:

- a. **Continuous Assessment 50 marks** (*based on regular interaction, circuit development*)
- b. **End Semester 50 marks** (*based on poster presentation, demonstration / Seminar*)

Project domain may be from the following, but not limited to:

1. Thermal Systems
2. Robotics Mechanisms/design systems
3. Production/advance manufacturing
4. Materials: Composite/Nano
5. Automation and Control Systems
6. Mechatronic Systems
7. Agriculture system.
8. Smart systems using AI-ML

A project report with following contents shall be prepared:

1. Title
2. Objectives
3. Relevance and significance
4. Methodology
5. Analysis-Simulation/experimentation/survey/testing etc.
6. Result and Discussion
7. Conclusion

302056: Audit Course VI

Teaching Scheme	Credits	Examination Scheme
	Non-Credit	

GUIDELINES FOR CONDUCTION OF AUDIT COURSE

Faculty mentor shall be allotted for individual courses and he/she shall monitor the progress for successful accomplishment of the course. Such monitoring is necessary for ensuring that the concept of self-learning is being pursued by the students 'in true letter and spirit'.

- If any course through Swayam/ NPTEL/ virtual platform is selected the minimum duration shall be of 8 weeks.
- However if any of the course duration is less than the desired (8 weeks) the mentor shall ensure that other activities in form of assignments, quizzes, group discussion etc. (allied with the course) for the balance duration should be undertaken.

In addition to credits courses, it is mandatory that there should be an audit course (non-credit course) from third year of Engineering. The student will be awarded grade as AP on successful completion of the audit course. The student may opt for any one of the audit courses in each semester. Such audit courses can help the student to get awareness of different issues which make an 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. Students can choose one of the audit courses from the list of courses mentioned. Evaluation of the audit course will be done at institute level.

The student registered for audit course shall be awarded the grade AP and shall be included such grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not considered in the calculation of the performance indices SGPA and CGPA. Evaluation of the audit course will be done at institute level itself.

Selecting an Audit Course**List of Courses to be opted (Any one) under Audit Course VI**

- Business and Sustainable Development
- Management Information System
- **International Business**

The titles indicated above are subject to change in time to come and such an alteration (if any) should be brought to the notice of the BOS.

Using NPTEL Platform: (preferable)

NPTEL is an initiative by MHRD to enhance learning effectiveness in the field of technical education by developing curriculum based video courses and web based e-courses. The details of NPTEL courses are available on its official website www.nptel.ac.in

- Students can select any one of the courses mentioned above and has to register for the corresponding online course available on the NPTEL platform as an Audit course.
- Once the course is completed the student can appear for the examination as per the guidelines on the NPTEL portal.
- After clearing the examination successfully; student will be awarded with a certificate.

Assessment of an Audit Course

- The assessment of the course will be done at the institute level. The institute has to maintain the record of the various audit courses opted by the students. The audit course opted by the students could be interdisciplinary.
- During the course students will be submitting the online assignments. A copy of the same can be submitted as a part of term work for the corresponding Audit course.
- On the satisfactory submission of assignments, the institute can mark as “Present” and the student will be awarded the grade AP on the mark-sheet.

Savitribai Phule Pune University
Board of Studies - Mechanical and Automobile Engineering
Undergraduate Program – Final Year Mechanical Engineering (2019 pattern)

Course Code	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks							Credit			
		TH	PR	TUT	ISE	ESE	TW	PR	OR	TOTAL	TH	PR	TUT	TOTAL	
Semester-VII															
402041	Heating Ventilation Air-Conditioning and Refrigeration	3	2	-	30	70	-	-	25	125	3	1	-	4	
402042	Dynamics of Machinery	3	2	-	30	70	-	-	25	125	3	1	-	4	
402043	Turbomachinery*	2	2	-	-	50	25	-	25	100	2	1	-	3	
402044	Elective – III	3	-	-	30	70	-	-	-	100	3	-	-	3	
402045	Elective - IV	3	-	-	30	70	-	-	-	100	3	-	-	3	
402046	Data Analytics Laboratory	-	2	-	-	-	50	-	-	50	-	1	-	1	
402047	Project (Stage - I)	-	4	-	-	-	50	-	50	100	-	2	-	2	
402054	Audit Course VII ^S	-	-	-	-	-	-	-	-	-	-	-	-	NC	
Total		14	12	-	120	330	125	-	125	700	14	6	-	20	
Semester-VIII															
402048	Computer Integrated Manufacturing	3	2	-	30	70	25	-	25	150	3	1	-	4	
402049	Energy Engineering	3	2	-	30	70	25	-	25	150	3	1	-	4	
402050	Elective - V	3	-	-	30	70	-	-	-	100	3	-	-	3	
402051	Elective - VI	3	-	-	30	70	-	-	-	100	3	-	-	3	
402052	Mechanical Systems Analysis Laboratory	-	2	-	-	-	25	-	25	50	-	1	-	1	
402053	Project (Stage - II)	-	10	-	-	-	100	-	50	150	-	5	-	5	
402055	Audit Course VIII ^S	-	-	-	-	-	-	-	-	-	-	-	-	NC	
Total		12	16	-	120	280	175	-	125	700	12	8	-	20	
Elective-III						Elective-V									
402044A	Automobile Design					402050A	Quality and Reliability Engineering								
402044B	Design of Heat Transfer Equipments					402050B	Energy Audit and Management								
402044C	Modern Machining Processes					402050C	Manufacturing Systems and Simulation								
402044D	Industrial Engineering					402050D	Engineering Economics and Financial Management								
402044E	Internet of Things					402050E	Organizational Informatics								
402044F	Computational Fluid Dynamics					402050F	Computational Multi Body Dynamics								
Elective-IV						Elective-VI									
402045A	Product Design and Development					402051A	Process Equipment Design								
402045B	Experimental Methods in Thermal Engineering					402051B	Renewable Energy Technologies								
402045C	Additive Manufacturing					402051C	Automation and Robotics								
402045D	Operations Research					402051D	Industrial Psychology and Organizational Behavior								
402045E	Augmented Reality and Virtual Reality					402051E	Electrical and Hybrid Vehicle								
Audit Courses															
402054A	Yoga Practices					402054B	Stress Management								
402055A	Managing Innovation					402055B	Operations Management								

Abbreviations: TH: Theory, PR: Practical, TUT: Tutorial, ISE: In-Semester Exam, ESE: End-Semester Exam, TW: Term Work, OR: Oral

- Student can select any elective subjects from the list given as per his/her choice. However, it is advised to select the subjects from within a group identified for specialization.

Savitribai Phule Pune University
Board of Studies - Mechanical and Automobile Engineering
 Undergraduate Program – Final Year Mechanical Engineering (2019 pattern)

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:					
<ol style="list-style-type: none"> 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/Organisation 					
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.	
Books and other resources	
Text Books:	
1. Bureau of Energy Efficiency Study material for Energy Managers and Auditors Examination: Paper I to IV.	
References Books:	
1. Barney L. Capehart, Wayne C. Turner and William J. Kennedy, “Guide to Energy Management”, Seventh Edition, The Fairmont Press Inc., 2012.	
2. Craig B. Smith, “Energy Management Principles”, Pergamon Press, 2015.	
3. Hamies, “Energy Auditing and Conservation; Methods, Measurements, Management and Case Study”, Hemisphere Publishers, Washington, 1980.	
4. Albert Thumann P.E. CEM, William J. Younger CEM, “Handbook of Energy Audit”, The Fairmont Press Inc., 7th Edition.	
5. Wayne C. Turner, “Energy Management Handbook”, The Fairmont Press Inc., , Georgia.	
6. Abbi Y. A., Jain Shashank, “Handbook on Energy Audit and Environment management”,	

TERI, Press, New Delhi, 2006.

7. Anthony L Kohan, “Boiler Operator’s Guide”, Fourth Edition, McGraw Hill
8. Robert L. Loftness, “Energy Hand Book”, Second edition, Von Nostrand Reinhold Company
9. G. G. Rajan, “Optimizing Energy Efficiencies in Industry”, Tata McGraw Hill, 2001
10. Amlan Chakrabarti, “Energy Engineering and Management”, Prentice Hall, India 2011

Web References:

1. www.npcindia.gov.in
2. <http://www.bee-india.nic.in>
3. www.aipnpc.org (for entire course material along with case studies)
4. <https://beeindia.gov.in/sites/default/files/EC%20Guidelines-Final.pdf>

Savitribai Phule Pune University
Board of Studies - Mechanical and Automobile Engineering
 Undergraduate Program – Final Year Mechanical Engineering (2019 pattern)

402051E: Electric and Hybrid Vehicle					
Teaching Scheme		Credits		Examination Scheme	
Theory	3 Hrs./Week	Theory	3	In-Semester	30 Marks
				End-Semester	70 Marks
<p>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</p>					
<p>Course Objectives:</p> <ol style="list-style-type: none"> 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 					
<p>Course Outcomes:</p> <p>On completion of the course the learner will be able to;</p> <p>CO1. UNDERSTAND the basics related to e-vehicle</p> <p>CO2. CLASSIFY the different hybrid vehicles</p> <p>CO3. IDENTIFY and EVALUATE the Prime Movers, Energy Storage and Controllers</p> <p>CO4. DISCOVER and CATAGORIZE the Electric Vehicle Configuration with respect to Propulsion, Power distribution and Drive-Train Topologies</p> <p>CO5. DEVELOP body frame with appropriate suspension system and TESTING of for e-Vehicles</p> <p>CO6. CLASSIFY and EVALUATE Battery Charging techniques and management</p>					
Course Contents					
Unit 1	Introduction to Electric and Hybrid Vehicle				
<p>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,</p>					

Brief introduction to Autonomous and self-driving Vehicles	
Unit 2	Hybrid Electric Vehicle
<p>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</p> <p>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</p> <p>Control Strategy: Supervisory Control, Selection of Modes</p>	
Unit 3	Prime Movers, Energy Storage and Controllers
<p>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</p> <p>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</p> <p>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</p>	
Unit 4	Electric Vehicle Configuration and Mechanics of Vehicle Movement
<p>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</p> <p>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</p> <p>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</p>	

resistance, Acceleration resistance, Total driving resistance, Dynamic equation, Brake System	
Unit 5	Electric Vehicle Design, Manufacturing, Testing & Homologation
<p>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</p> <p>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</p>	
Unit 6	EV Charging Infrastructure Management
<p>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</p> <p>Battery Management Systems: Necessity of Battery Management Systems, Typical Structure of BMSs, Representative Products, Keypoints of BMSs in Future Generation, Hazard/Safety Management</p>	
Books and other resources	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Iqbal Hussein, (2021), “Electric and Hybrid Vehicles: Design Fundamentals,” CRC Press, ISBN: 9780367693930 2. Denton, Tom, (2020), “Electric and Hybrid Vehicles,” 2nd Ed., Routledge, ISBN:9780367273248 3. John Lowry, James Larminie, (2012), “Electric Vehicle Technology Explained,” Wiley, ISBN: 9781119942733 4. Knowles, Don, (2011), “Automotive Suspension & Steering Systems,” Cengage learning, ISBN: 9781435481152 5. Malen, Donald E., (2011), “Fundamentals of Automobile Body Structure Design,” SAE International, ISBN: 9780768021691 6. R. Krishnan, (2001), “Electric Motor Drives: Modeling, Analysis, and Control,” Pearson, ISBN: 9780130910141 7. Mohammad Saad Alam, Reji Kumar Pillai, N. Murugesan, (2021), “Developing Charging Infrastructure and Technologies for Electric Vehicles,” IGI Global/ Business Science Reference, ISBN: 9781799868583 	
<p>References Books:</p> <ol style="list-style-type: none"> 1. Mehrdad Ehsani, Yimi Gao, Sefano Longo, Kambiz Ebrahimi, (2019), “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design,” CRC Press, 	

ISBN: 9780367137465

2. Tariq Muneer, Mohan Kolhe, Aisling Doyle, (2017), “Electric Vehicles: Prospects and Challenges,” Electric Vehicles: Prospects and Challenges, ISBN: 9780128030219
3. Sandeep Dhameja, (2001), “Electric Vehicle Battery Systems,” Newnes, ISBN: 9780750699167
4. Bruno Scrosati, Jürgen Garche, Werner Tillmetz, (2015), “Advances in Battery Technologies for Electric Vehicles,” Woodhead Publishing, ISBN: 9781782423775
5. Shunli Wang, Carlos Fernandez, Yu Chunmei, Yongcun Fan, Cao Wen, Daniel-Ioan Stroe, Zonghai Chen, (2021), “Battery System Modeling,” Elsevier, ISBN: 9780323904728
6. Andrea, Davide, (2010), “Battery management systems for large lithium battery packs,” Artech House Publishers, ISBN: 9781608071043
7. Dixon, John C., (2009), “Suspension Analysis and Computational Geometry,” Wiley, ISBN: 9780470510216
8. Day, Andrew J., (2014), “Braking of Road Vehicles,” Butterworth Heinemann, ISBN: 9780123973146
9. Guiggiani, Massimo, (2018), "The Science of Vehicle Dynamics: Handling, Braking, and Ride of Road and Race Cars," Springer, ISBN: 978-3319732190
10. Chen, Yong, (2021), “Automotive Transmissions: Design, Theory and Applications,” Springer, ISBN: 9789811567025
11. Bentley Publishers, (2002), “Bosch Automotive Handbook,” Bentley Publishers, ISBN: 0837610974
12. Prasad, Priya and Belwafa, Jamel E., (2004), “Vehicle Crashworthiness and Occupant Protection,” American Iron and Steel Institute Southfield, Michigan, www.roadsafelle.com
13. Macey, Stuart and Wardle, Geoff, (2008), “H-Point: The Fundamentals of Car Design & Packaging,” designstudio Press, ISBN: 9781933492377
14. Sulabh Sachan, Sanjeevikumar Padmanaban, and Sanchari Deb, (2022), “Smart Charging Solutions for Hybrid and Electric Vehicles,” Scrivener Publishing, ISBN: 9781119768951

Web References:

- Majhi, S. and Kumar, P., (2019), “Introduction to Hybrid and Electric Vehicles,” IIT Guwahati, <http://nptel.ac.in/courses/108103009/>
- <https://evreporter.com/>

Savitribai Phule Pune University
Board of Studies - Mechanical and Automobile Engineering
 Undergraduate Program – Final Year Mechanical Engineering (2019 pattern)

402047: Project (Stage I)					
Teaching Scheme		Credits		Examination Scheme	
Practical	4 Hrs./Week	Practical	2	Term Work	50 Marks
				Oral	50 Marks
Prerequisites: Project Based Learning, Internship/Mini Project, Laboratory works, Skill Development, Audit Courses, Industrial Visits					
Course Objectives:					
<ol style="list-style-type: none"> 1. To provide an opportunity of designing and building complete system or subsystems based on areas where the student likes to acquire specialized skills. 2. To obtain hands-on experience in converting a small novel idea / technique into a working model / prototype involving multi-disciplinary skills. 3. To embed the skill in a group of students to work independently on a topic/ problem/ experimentation selected by them and encourage them to think independently on their own to bring out the conclusion under the given circumstances of the curriculum period in the budget provided with the guidance of the faculty. 4. To encourage creative thinking processes to help them to get confidence by planning and carrying out the work plan of the project and to successfully complete the same, through observations, discussions and decision making process. 					
Course Outcomes:					
On completion of the course the learner will be able to; <ol style="list-style-type: none"> CO1. IMPLEMENT systems approach. CO2. CONCEPTUALIZE a novel idea / technique into a product. CO3. THINK in terms of a multi-disciplinary environment. CO4. TAKE ON the challenges of teamwork, and DOCUMENT all aspects of design work. CO5. UNDERSTAND the management techniques of implementing a project. CO6. DEMONSTRATE the final product for Functionality, Designability, and Manufacturability. 					
Course Contents					
Project work in the seventh semester is an integral part of the Term Work. The project work shall be based on the knowledge acquired by the student during the graduation and preferably it should meet and contribute towards the needs of the society. <ol style="list-style-type: none"> 1. Fabrication of product/testing setup of an experimentation unit/small equipment, in a group. 2. Experimental verification of principles used in Mechanical Engineering Applications 					

<p>3. Projects having valid database, algorithm, and output reports, preferably software based.</p> <p>4. Study projects are strictly not allowed.</p>
Project Lab
<ol style="list-style-type: none"> 1. There has to be a Project Lab in the department. <ol style="list-style-type: none"> a. It consists of necessary tools required to do a project. b. Previous projects and their components. c. Common measuring instruments. d. Previous years' project reports. e. Project related books and Publications. f. Proper linkage with central workshop and various laboratories. g. Safety measures. 2. All the project activities must be handled with a digital platform which is developed in the department according to the policies laid down by the institution. Respective authority levels to be created to maintain the transparency and confidentiality of the process. (ERP)
Books and other resources
<p>Web References:</p> <ol style="list-style-type: none"> 1. SWAYAM-NPTEL Course. 2. MOOCs' Courses.
Guidelines for Project Execution
At the end of the VIth Semester
<ol style="list-style-type: none"> 1. A group of 3-4 students shall be formed according to their suitability. 2. Department faculty will float prospective Project Titles through Project Coordinator. 3. Department will take care of a list of titles at least two times of the groups. 4. Students will interact with guides for scope and outline of the project. 5. Maximum of two groups will be given to a guide. 6. Guide and Project groups will be finalized at the end of sixth semester so that project work can be started at the start of Seventh semester.
During the VIIth Semester
<ol style="list-style-type: none"> 1. Project work is expected to be done in the Project Lab. 2. Projects must be executed in association with industrial experts/facilities. 3. Progress of project work is monitored regularly on weekly project slots/project day. 4. Regular interval presentations are to be arranged to review and assess the work. 5. Project work is monitored and continuous assessment is done by guide and authorities.
Term Work
<ul style="list-style-type: none"> ● The student shall prepare the duly certified final report of project work in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute. ● Recommended performance measure parameters may Include-Problem definition and scope of the project, Literature Survey, Appropriate Engineering approach used, Exhaustive and

Rational Requirement Analysis.

- Comprehensive Implementation - Design, modeling, documentation, Usability, Optimization considerations (Time, Resources, Costing), Thorough Testing, Project Presentation and **Demonstration (ease of use and usability), Social and environment aspects.**
- The term work under project submitted by students shall include work Diary;
Work Diary to be maintained by a group and countersigned by the guide (weekly). The contents of work diary shall reflect the efforts taken by project group for;
 - a. Searching suitable project work
 - b. Brief report preferably on journals/research or conference papers/books or literature surveyed** to select and bring up the project.
 - c. Brief report of feasibility studies carried to implement the conclusion.
 - d. Rough Sketches/ Design Calculations
 - e. Synopsis
- The group should submit the synopsis in the following form.
 - i. Title of Project
 - ii. Names of Students
 - iii. Name of Guide
 - iv. Relevance
 - v. Present Theory and Practices
 - vi. Proposed work
 - vii. Expenditure
 - viii. References
- The synopsis shall be signed by each student in the group, approved by the guide (along with external guide in case of sponsored projects) and endorsed by the Head of the Department.
- Presentation: The group has to make a presentation in front of the faculty of department at the end of semester.

Examination Scheme

- During university examination Internal examiner (preferably the guide) and External examiners jointly, evaluate the project work.
- During the process of monitoring and continuous assessment & evaluation the individual and team performance is to be measured.
- The project term work shall be evaluated on the basis of reviews. In first semester two reviews are to be taken and evaluated for total 50 marks (25 marks each)
- Review 1 and 2 will be based on synopsis submission (team members, Title of the Project Work, Abstract, Problem Definition, work done earlier, Objectives of the Project, Methodology of the Project, Application / Significance of the Project, Duration of the Project, Individual Role of the Student, References, sponsored etc.)
- The final presentation shall be taken in front of external examiner and to be evaluated for 50 marks
 - 20 marks for presentation (Oral, Written)
 - 30 marks for quality of the project work

Project Report
<ul style="list-style-type: none">● Stage I report shall be in the booklet form● Plagiarism check is must, and certificate shall be attached in the report
References: <ul style="list-style-type: none">● References format MUST BE STANDARD – ASME, SAE or IEEE

Savitribai Phule Pune University
Board of Studies - Mechanical and Automobile Engineering
 Undergraduate Program – Final Year Mechanical Engineering (2019 pattern)

402053: Project (Stage II)					
Teaching Scheme		Credits		Examination Scheme	
Practical	10 Hrs./Week	Practical	5	Term Work	100 Marks
				Oral	50 Marks
Prerequisites: Project Based Learning, Internship/Mini Project, Laboratory works, Skill Development, Audit Courses, Industrial Visits, Project (Stage I)					
Project Stage II is the extension of Project Stage I.					
Course Objectives, Course Outcomes, Course Contents and Guidelines for Project Execution are same as that of Project Stage I					
Term Work Evaluation					
<ol style="list-style-type: none"> 1. In Project Stage II, two reviews shall be taken for total 100 marks (50 marks each) 2. Review III shall be based on the approximate end of fabrication / design validation etc. in front of an expert panel from the department. 3. Review IV shall be third party evaluation by Faculty/Student/Industry person/Alumni 4. Evaluation committee shall consist of Guide, One Industry person and One Faculty appointed by the Institution. 5. Students shall be encouraged to publish a research paper/patent/technical note. Their credential shall be considered while term work evaluation. 					
Examination Scheme					
<ol style="list-style-type: none"> 1. Examination committee shall consist of Internal Examiner and External Examiner appointed by University. (External Examiner shall be a competent Industry/Research/Laboratory person. A list shall be provided by Board of Studies) 2. Well in advance soft copies of the project shall be shared with examination committee. 					
Presentation of Project Work					
Presentation of work in the form of Project Report (s), Understanding individual capacity, Role & involvement in the project, Team Work (Distribution of work, intra-team communication and togetherness), Participation in various contests, Publications and IPR, Manuals (Project Report, Quick reference, System, Installation guide) among other parameters. Team members with guide information shall be added at the end of the report.					

Project Report

1. The report shall be both side print hard bound. A hardbound report shall be made after examination and examiner and guide's expected correction, before that report must be loosely bound.
2. **Plagiarism check is must, and certificate shall be attached in the report.**
3. A group activity shall be presented in report.
4. Report copies shall be submitted in the department, one for university and one for supervisor.
5. For standardization of the project reports the following format shall be strictly followed.
Page size: Trimmed A4
Top Margin: 1"
Bottom Margin: 1.32"
Left Margin: 1.5"
Right Margin: 1"
Para Text: Times New Roman 12-point font
Line Spacing: 1.15 Lines
Page Numbers: Right aligned at footer. Font 12 point Times New Roman
Headings: Times New Roman, 14 Points, Boldface 10.

Certificate

1. All students shall attach a standard format of Certificate as described by the department.
2. Certificates shall be awarded to project groups and not individual students of the group.
3. Certificates shall have signatures of Guide, External Examiner, HOD and Principal.

Index of Report

1. Title Sheet
2. Certificate (Institution)
3. Certificate (Company, if sponsored by company)
4. Acknowledgement
5. Abstract of the Project
6. List of Figures
7. List of Photographs / Plates
8. List of Tables
9. Table of Contents
10. Introduction
11. Literature Survey / Theory
12. Design / Experimentation / Fabrication / Production / Actual work carried out for the same
13. Observation Results
14. Discussion on Result and Conclusion
15. Student and Guide details. (A common photograph with project)

Savitribai Phule Pune University
Board of Studies - Mechanical and Automobile Engineering
 Undergraduate Program – Final Year Mechanical Engineering (2019 pattern)

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:					
<ol style="list-style-type: none"> 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; <ul style="list-style-type: none"> 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 beneficiation, 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
<p>Energy management and storage: energy management with storage systems, energy demand estimation, energy pricing, thermal energy storage methods.</p> <p>Power plant instrumentation: layout of electrical equipment, switch gear, circuit breaker, protective devices, measurement of high voltage, current and power.</p> <p>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</p>	
Unit 6	Renewable Energy Systems
<p>Solar thermal and photovoltaic energy: solar thermal plant based on flat plate collector; solar photovoltaic systems, applications, economics and technical feasibility.</p> <p>Wind Energy: wind availability, basic components of wind mills, performance operating characteristics, wind solar hybrid power plants, Cost economics and viability of wind farm.</p> <p>Geothermal Energy: typical geothermal field, superheated steam system, flash type, binary cycle plant, economics of geothermal energy.</p> <p>Tidal Energy: components, single basin, double basin systems</p> <p>Ocean Thermal Energy: working principle, Claude /Anderson /hybrid cycle</p> <p>Wave Energy: dolphin type wave machines</p> <p>MHD Power Generation: working principle, open/ close cycle MHD generator</p> <p>Fuel cell: main components, working Principle</p> <p>Biomass Energy: biomass gasifier</p> <p>Hydrogen Energy: principle of hydrogen production, hydrogen storage, applications.</p>	
Books and other resources	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Domkundwar & Arora, Power Plant Engineering, Dhanpat Rai & Sons, New Delhi 2. Domkundwar & Domkundwar- Solar Energy and Non Conventional Sources of Energy, Dhanpat Rai& Sons, New Delhi. 3. R.K.Rajput, Power Plant Engineering, Laxmi Publications New Delhi 	
<p>References Books:</p> <ol style="list-style-type: none"> 1. E.I.Wakil, Power Plant Engineering, McGraw Hill Publications New Delhi 2. P.K.Nag, Power Plant Engineering, McGraw Hill Publications New Delhi. 3. R.Yadav , Steam and Gas Turbines ,Central Publishing House, Allahabad. 4. G.D.Rai, Non-Conventional Energy Sources, Khanna Publishers, Delhi 5. S.P.Sukhatme, Solar Energy,Tata McGraw-Hill Publications, New Delhi 6. G R Nagpal, Power Plant Engineering , Khanna Publication 	
<p>Web References:</p> <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/112107291 	

2. <https://nptel.ac.in/courses/112103277>
3. <https://nptel.ac.in/courses/103103206>
4. <https://nptel.ac.in/courses/115103123>
5. <https://cea.nic.in/?lang=en>

Term Work

The student shall complete the following activity as a Term Work:

1. Trial on Steam Power Plant to determine
 - a) Plant Efficiency, Rankine Efficiency Vs Load
 - b) Specific Steam consumption Vs Load
 - c) Rate of Energy Input Vs Load
 - d) Heat Rate and Incremental heat Rate Vs Load
2. Trial on Diesel Power Plant to determine
 - a) Plant Efficiency Vs Load
 - b) Total fuel consumption Vs Load
 - c) Rate of Energy Input Vs Load
 - d) Heat Rate and Incremental heat Rate Vs Load
3. Analysis of HT/LT electricity bill and recommendations for energy saving opportunities.
4. Case study on different control systems in thermal power plant .
(Review of control principles, Combustion control, pulveriser control, control of air flow, Furnace pressure and feed water, steam temperature control, turbine control, Safety provisions / Interlocks)
5. Design and component selection for solar photovoltaic power plant with net metering.
6. Estimation of annual energy from wind data and component selection for wind mill.
7. Case study on cogeneration in Sugar mill/Paper mill/Cement kiln.
8. Design and performance analysis of steam surface condenser for steam thermal power plant.
9. Design and performance analysis of cooling tower system for steam thermal power plant.
10. Case study on biomass gasification and analysis of properties of syngas.
11. Case study on production of bio-diesel and evaluation of its properties and its use in diesel engine based power plant.
12. Design and performance analysis of Thermal energy storage system.
13. Case study on energy management in conventional/ renewable energy power plant
14. Visit to Thermal Energy Based plant /Co-generation Power plant.
15. Visit to GTPP/Combined Cycle/renewable energy plants.

IMP Notes for Term Work:

1. Eight experiments from No.1 to 15 from above list should be conducted.
2. Experiment No, 1 and 2 are compulsory.
3. Any six experiments can be performed 3 to 15.

Savitribai Phule Pune University
Board of Studies - Mechanical and Automobile Engineering
 Undergraduate Program – Final Year Mechanical Engineering (2019 pattern)

402044D: Industrial Engineering					
Teaching Scheme		Credits		Examination Scheme	
Theory	3 Hrs./Week	Theory	3	In-Semester	30 Marks
Tutorial		Tutorial		End-Semester	70 Marks
<p>Prerequisites: Basic concepts of Mathematics and Mechanical Engineering, Industrial Orientation, Quality Control, Human Psychology, Basic Finance, Passion for Continual Improvement.</p>					
<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To introduce the concepts, principles, and framework of Industrial Engineering and Productivity enhancement approaches. 2. To familiarize the students with different time study and work measurement techniques for productivity improvement. 3. To introduce various aspects of facility design. 4. To acquaint the students with various components and functions of Production Planning and Control. 5. To acquaint the student about inventory management and approaches to control. 6. To acquire the students with concepts of ergonomics, value engineering and job evaluation. 					
<p>Course Outcomes Learner will be able to:</p> <ul style="list-style-type: none"> CO1. EVALUATE the productivity and IMPLEMENT various productivity improvement techniques. CO2. APPLY work study techniques and UNDERSTANDS its importance for better productivity. CO3. DEMONSTRATE the ability to SELECT plant location, appropriate layout and material handling equipment. CO4. USE of Production planning and control tools for effective planning, scheduling and managing the shop floor control. CO5. PLAN inventory requirements and EXERCISE effective control on manufacturing requirements. CO6. APPLY Ergonomics and legislations for human comfort at work place and UNDERSTANDS the role of value engineering in improving productivity. 					
Course Contents					
Unit 1	Introduction to Industrial Engineering and Productivity				
Introduction to Industrial Engineering, Historical background and scope, Contribution of Taylor, Gilbreth, Gantt, Maynard, Ford, Deming and Ohno. Importance of Industrial engineering. Introduction to Work system design					
<p>Productivity: Definition of productivity, Measures of Productivity, Total Productivity Model, Need for Productivity Evaluation, Productivity measurement models, Productivity improvement</p>					

<p>approaches, Principles, Productivity Improvement techniques – Technology based, Material based, Employee based, Product based techniques. (Numerical on productivity measurement)</p>	
Unit 2	Work Study
<p>Method Study: Introduction and objectives, Areas of application of work study in industry, Selection and Basic procedure. Recording techniques, Operations Process Chart, Flow Process Chart (Man, Machine & Material) Multiple Activity Chart, Two Handed process chart, Flow Diagram, String Diagram and Travel Chart, Cycle and chronocycle graphs, SIMO chart, Therbligs, Micro motion and macro-motion study: Principles of motion economy, Normal work areas and work place design.</p> <p>Work Measurement: Techniques, time study, steps, work sampling, Determination of time standards. Observed time, basic time, normal time, rating factors – allowances, standard time, and standard time determination. (Numerical)</p> <p>Introduction to PMTS, MTM, and MOST</p>	
Unit 3	Production Facility Design
<p>Plant Location: Introduction, Factors affecting location decisions, Multi-facility location</p> <p>Plant Layout: Principles of Plant layout and Types, factors affecting layout, methods, factors governing flow pattern, travel chart for flow analysis, analytical tools of plant layout, layout of manufacturing shop floor, repair shop, services sectors, and process plant. Layout planning, Quantitative methods of Plant layout and relationship diagrams. Dynamic plant layout</p> <p>Material Handling: Objectives and benefits of Material handling, Relationship between layout and Material handling, Equipment selection</p>	
Unit 4	Production Planning and Control
<p>Types and methods of Production, and their Characteristics, functions and objectives of Production Planning and Control, Steps: Process planning, Loading, Scheduling, Dispatching and Expediting with illustrative examples, Capacity Planning, Aggregate production planning and Master production scheduling. Introduction to a line of balance, assembly line balancing, and progress control</p> <p>Forecasting Techniques: Causal and time series models, Moving average, Exponential smoothing, Trend and Seasonality. (Numerical)</p>	
Unit 5	Inventory and Inventory Control
<p>Materials: Profit Centre: Role of materials management techniques in material productivity improvement, cost reduction and value improvement.</p> <p>Purchase Management: Purchase management, incoming material control. Acceptance sampling and inspection. Vendor rating system.</p>	

Inventory: Functions, Costs, Classifications, Deterministic inventory models and Quantity discount

Inventory Control: EOQ (Numericals), concepts, type of Inventory models-deterministic and probabilistic, Selective inventory control, Fundamental of Material Requirement Planning (MRP-I), Manufacturing Resource Planning (MRP-II), Enterprise Resource Planning (ERP), Just-in-Time system (JIT) and Supply Chain Management (SCM)

Unit 6 Ergonomics, Value Engineering and Job Evaluation

Ergonomics: Introduction to ergonomics and human factors Engineering - **physiological basis of human performance, basic anatomy of human body and its functional systems;** principles of ergonomics, design of display and controls in relation to information processing by human being, Introduction to Rapid Upper Limb Assessment (RULA) and Rapid Entire Body Assessment (REBA)

Value Engineering: VE concepts, Principles, Methodologies and standards, methods of functional analysis.

Job Evaluation and Wage Plan: Objective, Methods of job evaluation, job evaluation procedure, merit rating (Performance appraisal), method of merit rating, wage and wage incentive plans, Performance appraisal, concept of KRA (Key Result Areas), Introduction to industrial legislation.

Books and other resources

Text Books:

1. O. P. Khanna, Industrial engineering and management, Dhanpat Rai publication
2. M Mahajan, Industrial Engineering and Production Management, Dhanpat Rai and Co.
3. Martend Telsang, Industrial Engineering, S. Chand Publication.
4. Banga and Sharma, Industrial Organization & Engineering Economics, Khanna publication.

References Books:

1. Askin, Design and Analysis of Lean Production System, Wiley, India
2. Introduction to Work Study by ILO, ISBN 978-81-204-1718-2, Oxford & IBH Publishing Company, New Delhi, Second Indian Adaptation, 2008.
3. H. B. Maynard, K Jell, Maynard's Industrial Engineering Hand Book, McGraw Hill Education.
4. Zandin K.B., Most Work Measurement Systems, ISBN 0824709535, CRC Press, 2002
5. Martin Murry, SAP ERP: Functionality and Technical Configuration, SAP Press.
6. Barnes, Motion and time Study design and Measurement of Work, Wiley India
7. Sumanth, D.J, "Productivity Engineering and Management", TMH, New Delhi, 1990.
8. Edosomwan, J.A, "Organizational Transformation and Process re- Engineering", British Cataloging in publications, 1996.
9. Prem Vrat, Sardana, G.D. and Sahay, B.S, "Productivity Management - A systems approach", Narosa Publications, New Delhi, 1998.
10. Francis, R.L., and White, J.A, "Facilities layout and Location", Prentice Hall of India, 2002.
11. James A. Tompkins, John A. White, "Facilities Planning", Wiley, 2013
12. Richard L. Francis, Leon F Mc Ginnes and John A. White, "Facility Layout and Location-

An Analytical Approach”, PHI, 1993

13. G. K. Agarawal, “Plant Layout and Material Handling”, Jain Brothers, 2007

Web References:

1. <https://archive.nptel.ac.in/courses/112/107/112107143/#>
2. <https://nptel.ac.in/courses/112107249>
3. https://onlinecourses.nptel.ac.in/noc22_me04/preview
4. <https://nptel.ac.in/courses/112107292>
5. <https://nptel.ac.in/courses/112107142>

Savitribai Phule Pune University
Board of Studies - Mechanical and Automobile Engineering
 Undergraduate Program – Final Year Mechanical Engineering (2019 pattern)

402054: Audit Course VII				
Teaching Scheme		Credits	Examination Scheme	
		Non- Credit		
GUIDELINES FOR CONDUCTION OF AUDIT COURSE				
<p>Faculty mentor shall be allotted for individual courses and he/she shall monitor the progress for successful accomplishment of the course. Such monitoring is necessary for ensuring that the concept of self-learning is being pursued by the students ‘in true letter and spirit’</p> <ul style="list-style-type: none"> If any of the following listed course is selected through Swayam/ NPTEL/ virtual platform, the minimum duration shall be of 8 weeks. However if any of the course duration is less than the desired (8 weeks) the mentor shall ensure that other activities in form of assignments, quizzes, group discussion etc. (allied with the course) for the balance duration should be undertaken. Students can join any online platform or can participate any online/offline workshop to complete the Audit course with prior-permission of mentor. <p>In addition to credits courses, it is mandatory that there should be an audit course (non-credit course) from Final year of Engineering. The student will be awarded grade as AP on successful completion of the audit course. The student may opt for any one of the audit courses in each semester. Such audit courses can help the student to get awareness of different issues which make an 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. Students can choose one of the audit courses from the list of courses mentioned. Evaluation of the audit course will be done at institute level. The student registered for audit course shall be awarded the grade AP and shall be included such grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not considered in the calculation of the performance indices SGPA and CGPA. Evaluation of the audit course will be done at institute level itself</p>				

List of Courses to be opted (Any one) under Audit Course

A. Yoga Practices

B. Stress Management

Note:-The title indicated above are subject to change in time to come and such an alteration (if any) should be brought to the notice of the BoS.

Using NPTEL Platform: (preferable)

NPTEL is an initiative by MHRD to enhance learning effectiveness in the field of technical education by developing curriculum based video courses and web based e-courses. The details of NPTEL courses are available on its official website www.nptel.ac.in

- Students can select any one of the courses mentioned above and has to register for the corresponding online course available on the NPTEL platform as an Audit course.
- Once the course is completed the student can appear for the examination as per the guidelines on the NPTEL portal.
- After clearing the examination successfully; student will be awarded with a certificate.

Assessment of an Audit Course

- The assessment of the course will be done at the institute level. The institute has to maintain the record of the various audit courses opted by the students. The audit course opted by the students could be interdisciplinary
- During the course students will be submitting the online assignments/report/course completion certificate etc. A copy of the same can be submitted as a part of term work for the corresponding Audit course.
- On the satisfactory submission of assignments/report/course completion certificate etc., the institute can mark as “Present” and the student will be awarded the grade AP on the mark-sheet.