Savitribai Phule Pune University, Pune
B. E. Civil (2019 Pattern) w. e. f. June 2022
401 005: Project Stage I

Teaching scheme	Credits	Examination scheme
Practical: 04 Hours/week	01	Term Work: 50 Marks
	02	Oral: 50 Marks

Pre-requisites
Fundamentals of Civil Engineering

Course objectives
01 Identify latest 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 Project Stage I 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. Project group must comprise of minimum two and maximum five students.

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

Oral Examination: The students must prepare presentation on Project Stage I and present in presence of pair of examiners through a viva-voce examination.

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Savitribai Phule Pune University, Pune
B. E. Civil (2019 Pattern) w. e. f. June 2022
401 015: Project Stage II

Teaching scheme	Credits	Examination scheme
Practical: 04 Hours/week	03	Term Work: 100 Marks
	02	Oral: 50 Marks

Pre-requisites

Fundamentals of Civil Engineering

Course objectives

01 Identify latest 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 Project Stage II report should contain the following. Internal guides may prepare a continuous evaluation sheet for each student and refer as continuous assessment for term work marks.

01 Introduction including aim and objective
02 Review of literature
03 Problem statement and methodology
03 Concepts associated with the project topic
04 Results and discussion
05 Validation of results
06 Conclusions and future scope of work
07 References
08 Students publication/achievements

In Project Work Stage II, the student shall complete the project and prepare the final report of project work in standard format duly certified for satisfactory completion of the project work by the concerned guide and Head of the Department/Institute. The final project report shall be submitted in hard bound copy as well as a soft copy. The term work of project stage II shall be assessed jointly by the pair of internal and external examiners, along with oral examination of the same. It is recommended that at least one publication on the project topic to be presented in a conference or published in a referred journal.

Oral Examination: The students must prepare presentation on Project Stage II 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
301016: Internship

Teaching scheme	Credit	Examination scheme
Tutorial: 04 Hours/week	04	Term Work: 100 Marks

Pre-requisites: Fundamentals of Civil Engineering covered in earlier courses

Course objectives

01 To encourage and provide opportunities for students to get professional/personal experience through internships.
02 To learn to apply the technical knowledge gained from academics /c1assroom learning in real life/industrial situations.
03 To get familiar with various tools and technologies used in industries and their applications.
04 To enable students to develop professional skills and expand their professional network with the development of employer-valued skills like teamwork, communication.
05 To apply the experience gained from industrial internship to the academic course completion project.
06 To nurture professional and societal ethics in students
07 Understand the social, economic and administrative considerations that influence the working environment of industrial organizations

Course outcomes

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

01 To develop professional competence through industry internship
02 To apply academic knowledge in a personal and professional environment
03 To build the professional network and expose students to future employees
04 Apply professional and societal ethics in their day to day life
05 To become a responsible professional having social, economic and administrative considerations
06 To make own career goals and personal aspirations

CO-PO Mapping Matrix

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

Guidelines of Internship

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 theoretical 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.

1. Duration: Internship to be completed after semester V and before commencement of semester VI of at least 4 to 6 weeks. It is to be assessed and evaluated in semester VI.

2. Internship work Identification: Student may choose to undergo Internship at Industry/Govt./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].

Contacting various companies for Internship and Internship work identification process should be initiated in the V^{th} 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 V^{th} semester examination.

Student can take internship work in the form of online/onsite work from any of the following but not limited to:

a. Working for consultancy/ research project
b. Participation at events (technical/business) in innovation related completions like Hackathon
c. Contribution in incubation/innovation/entrepreneurship cell/institutional innovation council/startups cells of institute
d. Learning at departmental lab/tinkering lab/institutional workshop
e. Development of new product/business plan/registration of start-up
f. Participation in IPR workshop/leadership talks/ideal design/innovation/business completion/technical expos
g. Industry/government organization internship
h. Internship through Internshala

i. In-house product development, intercollegiate, inter department research internship under research lab/group, micro/small/medium enterprise/online internship
j. Research internship under professors, IISC, IIT's, research organizations
k. NGOs or social internships, rural internship
l. Participate in open source development
m Development of Physical and/or numerical, mathematical, soft computing model
n Carrying out surveys related to society related but Engineering problems. For example, a survey of solid waste management in a particular area/town/village, survey of water supply network in a locality, town, village etc. , survey of air quality etc.

[1] https://www.aicte-india.org/sites/default/files/AICTE%20Internship%20Po1icy.pdf

3. 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 after every day by the supervisor/ in charge of the section where the student has been working.

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 diary/workbook may be evaluated on the basis of the following criteria.

i. Proper and timely documented entries
ii. Adequacy & quality of information recorded
iii. Data recorded
iv. Thought process and recording techniques used
v. Organization of the information

4. Internship Work Evaluation: 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 programme head/cell in-charge/project head/ faculty mentor or Industry Supervisor based on overall compilation of internship activities, sub-activities, 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) and a supervisor from place of internship.

Recommended evaluation parameters: Post internship internal evaluation 50 Marks and internship diary/workbook and internship report 50 Marks. Evaluation through Seminar Presentation/Viva-Voce at the Institute

The student will present 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, communication skills, presentation skills, team work, creativity, planning & organizational skills, adaptability, analytical skills, attitude and behavior at work, societal understanding, ethics, regularity and punctuality, attendance record, log 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. The student may contact industrial supervisor/faculty mentor/TPO for assigning special topics and problems and should prepare the final report on the student's presence physically, if the student is found absent without prior intimation to the department/institute/concern authority/T & P Cell, entire training can be cancelled.

The report shall be presented covering following recommended fields but not limited to:

- ✓ Title/cover Page
- ✓ Internship completion certificate
- ✓ Internship place details: Company background-organization and activities/scope and object of the study/personal observations
- ✓ 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 (books, magazines and other sources)

5. 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 and leadership

Savitribai Phule Pune University, Pune
Second Year of Civil Engineering– Sem I (2019 Course)
201004 Building Technology and Architectural Planning –Lab

Credits: 01

Teaching Scheme:	**Examination Scheme:**
Practical : 04 hrs/week	Term Work : 50 Marks

List of Laboratory Assignments

1. Students shall prepare drawings of types of masonry and Brick bonds (Quarter plate)
2. Prepare sheet showing details of at least two Doors, windows and Arches.(Quarter plate)
3. Draw the line plans of any one residential building and any two Public Buildings (Graph Paper)
4. Perspective drawing of a small building element (Total 2 problems - 1 based on one point and two point each)
5. Floor Plan/ Typical floor plan with construction notes, schedule of openings, of any type of building, Plan, Elevation and Section on separate sheet **(Full Imperial sheet)**
6. Developing typical floor plan drawing exercise completed in assignment number 5, using CAD and Printout of the same.
7. Layout/ Site plan indicating water supply and drainage line (with area statement, make max. four students in one group).
8. **Site Visit** : Any on-going Construction Site (visit report should contain: details of the project, stage of construction, sketches of components with cross section & dimensions, materials used and site plan, etc.)

OR

8. Site Visit : **Green Building**, Salient features like materials used/technology etc, benefits, planning concepts of Green Building (site selection, orientation, sun pathand wind diagram etc.),
9. Document collection: Different sanction forms and at least six brochures of building materials

Report file:

1. It shall consist of data given for the project, Planning considerations and line plans, Design calculations.
2. Terminology of Perspective drawing
3. Dimension standards of Residential building and Public building
4. Visit Report

Savitribai Phule Pune University, Pune
TE Civil (2019 Pattern) w. e. f. June 2021
301018: Design of Reinforced Concrete Structures Lab

Teaching scheme	Credit	Examination scheme
Practical: 04 Hours/week	02	Oral: 50 Marks

Term work

Term work consists of a journal containing the following design, drawing and site visit report. Oral examination based on term work.

01 Design Project: Design of G + 2 (residential/commercial/public) building covering all types of slabs, beams, columns, footings and staircase (first and intermediate flight) with following details.

i. Minimum plan area of each floor shall be more than 150 m^2
ii. Design of plinth and ground beams: for each type two simply supported and two continuous.
iii. Design of all slabs and beams of typical floor (first or second floor)
iv. Design of three types of columns: (a) axial load, (b) axial load with uniaxial bending,
(c) axial load with biaxial bending, from terrace level to footing along with detailed load calculations.
v. Design of two footing: (a) axial load, (b) axial load plus uniaxial bending.
vi. Design any one element by using spread sheet or use of analysis and design by suitable software.
vii. Four full imperial drawing sheets. Out of which only structural plan drawing sheet shall be drawn by using any drafting software. Schedule of slabs, beams, columns and footing can be prepared by using any drafting software.
viii. Detailing of reinforcement should be as per SP-34 & IS-13920.

02 Two assignments on design of combined footing along with reinforcement detailing

03 Reports of two site visits. (Building under construction)

Note: For term work, the group size should not be more than five students and each group should have different design data.

Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
410248: Project Work Stage I

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

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

Prerequisite Courses: Project Stage I(410248)

Course Objectives:

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

Course Outcomes:

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

CO1: Show evidence of independent investigation

CO2: Critically analyze the results and their interpretation.

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

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

CO5: Appreciate practical implications and constraints of the specialist subject

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 the 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

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Savitribai Phule Pune University
Second Year of Computer Engineering (2019 Course)
210258: Project Based Learning II

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

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

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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%)

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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

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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 them-selves 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?

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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?

@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
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/

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

110013: Project Based Learning

Teaching Scheme:	**Credits**	**Examination Scheme:**
PR: 04 Hrs/Week	**02**	**PR : 50 Marks**

Preamble:

For better learning experience, along with traditional classroom teaching and laboratory learning; project based learning has been introduced with an objective to motivate students to learn by working in group cooperatively to solve a problem.

Project-based learning (PBL) is a student-centric pedagogy that involves a dynamic classroom approach in which it is believed that students acquire a deeper knowledge through active exploration of real-world challenges and problems. Students learn about a subject by working for an extended period of time to investigate and respond to a complex question, challenge, or problem. It is a style of active learning and inquiry-based learning. (Reference: Wikipedia). Problem 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.

Course Objectives:

1. To emphasizes learning activities that are long-term, interdisciplinary and student-centric.
2. To inculcate independent learning by problem solving with social context.
3. To engages students in rich and authentic learning experiences.
4. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.

Course Outcomes: CO1: Project based learning will increase their capacity and learning through shared cognition. CO2: Students able to draw on lessons from several disciplines and apply them in practical way. CO3: Learning by doing approach in PBL will promote long-term retention of material and replicable skill, as well as improve teachers' and students' attitudes towards learning.

Group Structure:

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

- **There should be team/group of 5 -6 students**
- **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 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, analyze, 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 the individual and 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.
** 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**

Savitribai Phule Pune University Fourth Year of E & Tc Engineering (2019 Course) 404188: Project Phase - I		
Teaching Scheme:	**Credit :**	**Examination Scheme:**
Practical: 02 hrs. / week	01	**Term Work: 50 Marks**

Course Objectives:

• To understand the basic concepts & broad principles of projects.
• To understand the value of achieving perfection in project implementation & completion.
• To apply the theoretical concepts to solve real life problems with teamwork and Multidisciplinary approach.
• To demonstrate professionalism with ethics; present effective communication skills and relate engineering issues to broader societal context.

Course Outcomes:

CO1: Demonstrate a sound technical knowledge in field of E&TC in the form of project.
CO2: Undertake real life problem identification, formulation and solution.
CO3: Design engineering solutions to complex problems utilizing a systematic approach.
CO4: Demonstrate the knowledge, effective communication skills and attitudes as professional engineer.

Project phase 1 is an integral part of the project 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. The project aims to provide an opportunity of designing and building complete system or subsystems in the field of Electronics and communication where the student likes to acquire specialized skills. The student shall prepare the duly certified Fourth report of project work in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute.

Guidelines:

1. Group Size: The student shall carry the project work individually or by a group of students. Optimum group size shall be 3 students. However, if project complexity demands a maximum group size of 4 students, the project committee should be convinced about such complexity and scope of the work. Projects selected should meet and contribute towards the needs of the

society.
2. Selection and approval of topic: Topic should be related to real life application in the field of
Electronics and Telecommunication engineering.
3. The topic may be based on : Investigation of the latest development in a specific field of Electronics or Communication / The investigation of practical problem in manufacture and / or
testing of electronics or communication equipment/ Software based projects related to VHDL,
Communication, Instrumentation, Signal Processing agriculture Engineering etc. with the justification for techniques used / any topic in the field of E&TC may be allowed.
4. Interdisciplinary projects should be encouraged. The examination of Interdisciplinary projects
shall be conducted independently in respective departments.
5. The term work assessment of project phase 1 shall be based on Innovative Idea of selected project, literature survey, Depth of understanding, Applications, Individual contributions, presentation, project report, timely completion of work.
6. The department should prepare project planner and should follow accordingly
7. A log book of work carried out during the semester should be maintained with weekly review
remarks by the guide and committee.
8. A certified copy of report preferably using LATEX is required to be presented to external examiner at the time of Fourth examination.
9. The project report must undergo by plagiarism check and the similarity index must be less than
15%. The plagiarism report should be included in the project report

Savitribai Phule Pune University Fourth Year of E & Tc Engineering (2019 Course) 404197: Project Phase - II		
Teaching Scheme:	**Credit :**	**Examination Scheme:**
Practical: 10 hrs. / week	05	**Term Work: 100 Marks** **Oral: 50 Marks**

Project phase 2 is extension of Project phase 1 carried out in seventh semester. The student shall
prepare the duly certified Fourth report of project work in standard format preferably in LATEX for
satisfactory completion of the work by the concerned guide and head of the Department/Institute.

GUIDELINES

1. The project TW/OR assessment shall be based on Live Project Demonstration and presentation by the students. The assessment parameters shall be Innovative Idea of selected project, literature survey, Depth of understanding, Applications, Individual contributions, presentations, project report, timely completion of work (Project review presentations), participation in project competition, publication of research work in journal/conference, publication in the form of patent and copyright etc. The college can prepare the rubrics based on these parameters
2. Certified hard bound project report to be submitted by the students in prescribed format.
3. Students must preferably publish at least one technical paper on project work in the conference or peer reviewed Journals or publish patent or copyright or should participate into one of the project competition at university/State/National/International level.
4. A log book of work carried out during the semester should be maintained with weekly review
remarks by the guide and committee.
5. A certified copy of report preferably using LATEX is required to be presented to external examiner at the time of Fourth examination.
6. The project report must undergo by plagiarism check and the similarity index must be less than 10%. The plagiarism report should be included in the project report.

Savitribai Phule Pune University Third Year of E & Tc Engineering (2019 Course) 304200: Mini Project		
Teaching Scheme:	**Credit :**	**Examination Scheme:**
Practical: 04 hrs. / week	2	**Term Work: 25 Marks** **Oral: 50 Marks**

Course Objectives:

• To understand the ―Product Development Process‟ including budgeting through Mini Project.

• To plan for various activities of the project and distribute the work amongst team members.

• To inculcate electronic hardware implementation skills by -

• Learning PCB artwork design using an appropriate EDA tool.

• Imbibing good soldering and effective trouble-shooting practices.

• Following correct grounding and shielding practices.

• To develop student‘s abilities to transmit technical information clearly and test the same by delivery of Seminar based on the Mini Project.

• To understand the importance of document design by compiling Technical Report on the Mini Project work carried out.

Course Outcome:

On completion of the course, student will be able to

CO1: Understand, plan and execute a Mini Project with team.

CO2: Implement electronic hardware by learning PCB artwork design, soldering techniques, testing and
troubleshooting etc.

CO3: Prepare a technical report based on the Mini project.

CO 4: Deliver technical seminar based on the Mini Project work carried out.

Execution of mini Project:

- Project designs ideas can be necessarily adapted from recent issues of electronic design
- magazines Application notes from well known device manufacturers may also be referred.
- Use of Hardware devices/components is mandatory.
- Layout versus schematic verification is mandatory.
- Bare board test report shall be generated.
- Assembly of components and enclosure design is mandatory.

B: Selection: Domains for projects may be from the following, but not limited to: • Instrumentation and Control Systems
• Electronic Communication Systems

• Biomedical Electronics

• Power Electronics

• Audio , Video Systems

• Embedded Systems

• Mechatronic Systems

• Microcontroller based projects should preferably use Microchip PIC controllers / ATmega controller / AVR microcontrollers / Ardino / Rasberry Pi.

C. Monitoring: (for students and teachers both): Suggested Plan for various activities to be monitored by the teacher.
Week 1 & 2: Formation of groups, Finalization of Mini project & Distribution of work.

Week 3 & 4: PCB artwork design using an appropriate EDA tool, Simulation.

Week 5 to 8: PCB manufacturing through vendor/at lab, Hardware assembly, programming (if required) Testing, Enclosure Design, Fabrication etc

Week 9 & 10: Testing of final product, Preparation, Checking & Correcting of the Draft Copy of Report

Week 11 & 12: Demonstration and Group presentations.

Log book for all these activities shall be maintained and shall be produced at the time of examination.

D. Report writing: A project report with following contents shall be prepared:

➢ Title

➢ Specifications

➢ Block Diagram

➢ Circuit Diagram

➢ Selection of components, calculations

➢ Simulation Results

➢ PCB Art work

➢ Testing Procedures

➢ Enclosure Design

➢ Test Results & Conclusion

➢ References

Savitribai Phule Pune University Third Year of E & Tc Engineering (2019 Course) 304199: Internship		
Teaching Scheme:	**Credit**	**Examination Scheme:**
**	04	Term Work: 100 Marks

Course Objective:

• Will expose technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
• Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job.
• Exposure to the current technological developments relevant to the subject area of training.
• Experience gained from the 'Internship' will be used in classroom discussions.
• Create conditions conducive to quest for knowledge and its applicability on the job.
• Learn to apply the Technical knowledge in real industrial situations.
• Gain experience in writing Technical reports/projects.
• Expose students to the engineer's responsibilities and ethics.
• Familiarize with various materials, processes, products and their applications along with relevant aspects of quality control.
• Promote academic, professional and/or personal development.
• Expose the students to future employers.
• Understand the social, economic and administrative considerations that influence the working environment of industrial organizations.
• Understand the psychology of the workers and their habits, attitudes and approach to problem solving

Course Outcomes: On completion of the internship, learner will be able to –
CO1: To develop professional competence through internship.
CO2: To apply academic knowledge in a personal and professional environment.
CO3: To build the professional network and expose students to future employees.
CO4: Apply professional and societal ethics in their day to day life.
CO5: To become a responsible professional having social, economic and administrative considerations.
CO6: To make own career goals and personal aspirations.

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 theoretical 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.
A. Duration:

Internship 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.

B. Framework of Internship:

✓ Students are required to be involved in Inter/ Intra Institutional Activities viz; Training with higher Institutions.

✓ Soft skill training organized by Training and Placement Cell of the respective institutions; contribution at incubation/ innovation /entrepreneurship cell of the institute; participation in conferences/ workshops/ competitions etc.

✓ Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop.

✓ During the vacation after 5th semester, students are ready for industrial experience. Therefore, they may choose to undergo Internship / Innovation / Entrepreneurship related activities.

✓ Students 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.

✓ Every student is required to prepare a file containing documentary proofs of the activities done by him. The evaluation of these activities will be done by Programmed Head / Cell In-charge / Project Head / TPO / faculty mentor or Industry Supervisor.

C. Internship Guidelines:

a) Guidelines to the Institute:

Department will arrange internship for students in industries / organization after fifth semester or as per AICTE/ affiliating University guidelines & managing internships. The general procedure for arranging internship is given below:

Step 1: Request Letter/ Email should go to industry to allot various slots of 4-6 weeks as internship periods for the students. Students request letter /profile / interest areas may be submitted to industries for their willingness for providing the training.

Step 2: Industry will confirm the training slots and the number of seats allocated for internships via Confirmation Letter/ Email. In case the students arrange the training themselves the confirmation letter will be submitted by the students.

Step 3: Students on joining Training at the concerned Industry / Organization, submit the Joining Report/ Letters / Email.

Step 4: Students undergo industrial training at the concerned Industry / Organization. In-between Faculty Member(s) evaluate(s) the performance of students once/twice by visiting the Industry/Organization and Evaluation Report of the students is submitted in department.

Step 5: Students will submit training report after completion of internship.

Step 6: Training Certificate to be obtained from industry.

Step 7: List of students who have completed their internship successfully will be issued by Training and Placement Cell.

b) Guidelines to the students:

Any absenteeism by students during their internship should be informed immediately to the mentor/reporting manager and the internal guide. No special considerations will be accepted. Students cannot take leave for college work or fest activities. The leave permission for any college related activities will be solely approved by the HOD. The monthly attendance format should be duly submitted to the internal guide by the intern.

c) Internal reporting Guidelines:

Every intern should send weekly report to their internal guide without fail. It is mandatory for the intern to send weekly reports to their respective guide on regular basis. Interns should have at least

fortnightly verbal communication with the internal guide without fail. In cases where in the company wants to secure their confidential information in the project / internship report, the internal guide should duly co-ordinate with the respective mentor/reporting manager on the method of reporting to assure that no information will be leaked outside and is purely for academic purposes.

d) 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 account of the observations, impressions, information gathered and suggestions given, if any. The training diary/workbook should be signed after every day by the supervisor/ in charge of the section where the student has been working.

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 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.

e) Internship Work Evaluation:

Every student is required to prepare a maintain documentary proofs of the activities done by him / her 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).

f) 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

✓ Creativity

✓ Planning & Organizational skills

✓ Adaptability and Analytical Skills

✓ Attitude & behavior at work.

✓ Societal Understanding

✓ Ethics

✓ Regularity and punctuality

✓ Attendance record

✓ Log book

✓ Student's Feedback from External Internship Supervisor

g) Internship Report:
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 / personal observation.

➢ 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

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

h) 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

Savitribai Phule Pune University
Second Year of Electronics / E & Tc Engineering (2019 Course)
204200: Project Based Learning

Teaching Scheme:	Credit	Examination Scheme:
Practical: 04 hrs. / week	02	Term Work: 50 Marks

Preamble:
The main stream engineering education follows traditional classroom teaching, in which the major focus is mainly on the lecturer and the student has very little (if any) choice on the learning process. However rapid development in engineering and technology requires adopting a teaching approach that would assist students not only in developing a core set of industry relevant skills, but also enable them to adapt to changes in their professional career.
PBL is an approach to design Electronic Systems Curricula for making electronics more appealing to students. Since electronics is an important grounding for other disciplines (computer science, signal processing, and communications), this approach proposes the development of multidisciplinary projects using the PBL strategy for increasing the attractiveness of the curriculum. Promoting electronics as grounding for other disciplines can be done by defining a new curriculum that includes practical courses (laboratories) in which the students develop whole systems involving multidisciplinary knowledge.
Course Objectives: On completion of the course, learner will be able to -
 To emphasize projectbased learning activities that are long-term, interdisciplinary and student-centric.
 To inculcate independent and group learning by solving real world problem with the help of available resources.
 To be able to develop application based on the fundamentals of electronics and communication engineering by possibly the integration of previously acquired knowledge.
 To get practical experience in all steps in the life cycle of the development of electronic systems: specification, design, implementation, and testing.
 To be able to select and utilize appropriate hardware and software tools to design and analyze the proposed system.
 To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.

Course Outcomes: On completion of the course, learner will be able to -
CO1: Identify the real-world problem (possibly of interdisciplinary nature) through a rigorous literature survey
and formulate / set relevant aim and objectives.
CO2: Contribute to society through proposed solution by strictly following professional ethics and safety
measures.
CO3: Propose a suitable solution based on the fundamentals of electronics and communication engineering by
possibly the integration of previously acquired knowledge.
CO4: Analyze the results and arrive at valid conclusion.
CO5: Use of technology in proposed work and demonstrate learning in oral and written form.

CO6: Develop ability to work as an individual and as a team member.

Group Structure:
Working in supervisor/mentor –monitored groups. The students plan, manage and complete a task/project/activity which addresses the stated problem.
1. Create groups of 5 (five) to 6 (six) students in each class

2. A supervisor/mentor teacher assigned to 3-4 groups or one batch

Project Selection:
Survey through journals, patents or field visit (A problem can be theoretical, practical, social, technical, symbolic, cultural and/or scientific), check the physibility of solution, analyze the problem, design and find the values of components.
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.
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. 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. As stated in the preamble as electronics is an important grounding for other disciplines (computer science, signal processing, and communications), the project topic can be Interdisciplinary in nature. However the chosen problem must involve the application of electronics and communication engineering fundamentals. Out of the total developed system setup, the project must involve minimum 40% electronic components. Although in a genuine case 100% software based project topic may be allowed.

Ethical Practices, team work and project management:
Use IEEE standards for project manufacturing, respect the time of others, attend the reviews, poster presentation and model exhibitions, strictly follow the deadline of project completion, comply with all legislation requirements that govern workplace health and safety practices.
Effective Documentation:
In order to make our engineering graduates capable to prepare effective documentation, it is required for the students to learn the effective writing skills. The PBL final report is expected to consist of the Literature Survey, Problem Statement, Aim and Objectives, System Block Diagram, System Implementation Details, Discussion and Analysis of Results, Conclusion, System Limitations and Future Scope. Many freely available software tools (for instance Medley (Elsevier), Grammerly) are expected to be used during the preparation of PBL synopsis and final report. It is expected that the PBL guides/mentors shall teach students about utilizing valid sources of information (such as reference papers, books, magazines, etc) related to their PBL topic.
Evaluation & Continuous 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 the individual and 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.
It is recommended that the all activities are required to be recorded and regularly. A regular assessment of PBL work is required to be maintained at the department in PBL log book by students. It is expected that the PBL log book must include following:
1. Weekly monitoring by the PBL guide,

2. Assessment sheet for PBL work review by PBL guide and PBL Evaluation Committee (PEC).

The PEC structure shall consist of Head of the department, 1/2 senior faculties of the department and one industry expert (optional). Continuous Assessment Sheet (CAS) is to be maintained by the department.

Recommended parameters for assessment, evaluation and weightage:
1. Idea Inception (kind of survey). (10%)

2. Outcome (Participation/ publication, copyright, patent, product in market). (50%)

3. Documentation (Gathering requirements, design & modeling, implementation/execution, use of technology and final report, other documents). (15%)

4. Attended reviews, poster presentation and model exhibition. (10%)

5. Demonstration (Poster Presentation, Model Exhibition etc). (10%).

6. Awareness /Consideration of - Environment/ Social /Ethics/ Safety measures/Legal aspects. (5%)

Reference Books / Research Articles:
1. John Larmer, John R. Mergendoller, and Suzie Boss, “Setting the Standard for Project Based Learning”.
2. John Larmer and Suzie Boss, “Project Based Teaching: How to Create Rigorous and Engaging Learning Experiences”.
3. Erin M. Murphy and Ross Cooper, “Hacking Project Based Learning: 10 Easy Steps to PBL and Inquiry”. M. Krašna, "Project based learning (PBL) in the teachers' education,"39th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), Opatija, 2016, pp. 852-856, doi: 10.1109/MIPRO.2016.7522258.
4. J. Macias- Guarasa, J.M. Montero, R. San-Segundo, A. Araujo and O. Nieto-Taladriz, "A project based learning approach to design electronic systems curricula", IEEE transactions on Education, vol.49, no. 3, pp. 389-397, Aug. 2006, doi: 10.1109/TE.2006.879784

Web resources:
- Project-Based Learning, Edutopia, March 14, 2016.
- What is PBL? Buck Institute for Education.
- www.howstuffworks.com
- www.wikipedia.org

Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414448: Project Stage I

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Tutorial (TUT): 02 hrs/week	02 Credits	Term Work: 50 Marks

Prerequisite Courses, if any: PBL, Seminar, Basic Knowledge of Latest Technologies in IT.

Companion Course, if any: NOT APPLICABLE

Course Objectives:

1. To build up their practical experience with implementation and hence develops self-confidence.
2. To generate the opportunities to experience practically the facts learned in various fields together.
3. To improve overall communication skill, Teamwork and Leadership Qualities, professionalism.
4. To apply the knowledge for solving realistic problems.
5. To evaluate alternative approaches and justify the use of selected tools and methods.

Course Outcomes:

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

- **CO1.** To apply knowledge of mathematics, science, and engineering to formulate the Problem statement.
- **CO2.** To design and conduct experiments, as well as to analyze and interpret data.
- **CO3.** Understand the professional and ethical responsibility.
- **CO4.** To communicate effectively.
- **CO5.** Get broad education which is necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- **CO6.** Recognition of the need for, and an ability to engage in life-long learning.
- **CO7.** To use the techniques, skills, and modern engineering tools necessary for engineering practices.
- **CO8.** 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.

Introductory Information:

BE Project can be application oriented and/or will be based on some innovative work in recent technologies like IoT, Cloud Computing, Web Technologies, Bio-inspired Algorithms, Artificial Intelligence, Machine Learning, Natural Language Processing, Theoretical Computer Science fundamentals. In Project Phase-I the student will undertake project over the academic year, which will involve the analysis, design of a system or sub system in the area identified earlier in the field of Information Technology and Computer Science and Engineering. The project will be undertaken preferably by a group of 3-4 students who will jointly work and implement the project. The group will select a project based on their internship or Guide can suggest based on recent technologies / Industrial Applications.

Guidelines to Faculty and Students:

1) The Head of the department / Project coordinator shall constitute a review committee (preferably same committee needs to carry throughout the year) for project group; project guide would be one member of that committee by default.

2) For sponsored projects, an employee of the sponsoring organization may be one of the member of review committee.

3) There shall be **TWO** reviews in Project phase –I (in semester-I) by the review committee.

4) The Project Review committee will be responsible for evaluating the timely progress of the projects. It is suggested to evaluate the skills learned by the students in their PBL (in their previous years).

5) Student should identify project of enough complexity, which has at least 4-5 major functionalities.

6) Student should adopt skills learned in Software Engineering / Software Architecture to identify stakeholders, actors, Architectural Styles etc... and write detail problem statement for the system.

7) Review committee should finalize the scope of the project.

8) If change in project topic is unavoidable then the students should complete the process of Project approval by submitting synopsis along with the review of important papers which should be approved by review committee.

9) Every student of the project group shall make presentation on the progress made by them before the committee during each review. Each student/group is required to give presentation as part of review for 10 to 15 minutes followed by a detailed discussion and query session.

10) Students need to note down the queries raised during review(s) and comply the same in the next review session.

11) The record of the remarks/suggestions of the review committee (project dairy) should be properly maintained and should be made available at the time of university examination.

12) Project group needs to present / publish TWO papers (One in each semester, at least one paper should be in **UGC – Care journal**).

- **a)** Paper must be checked for Plagiarism by any open software.
- **b)** One paper during first semester which includes Literature Survey and Detailed design components of the Project Statement.
- **c)** One paper during second semester which includes Methodologies / Algorithms implemented, Results obtained, Analysis of results and conclusion.

13) Project report must also be checked for Plagiarism.

14) 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.

Review 1: Synopsis –

Points to be covered:

1) The precise problem statement/title based on literature survey and feasibility study.

2) Motivation, objectives, and scope of the project.

3) List of required hardware, software, or other equipment for executing the project, test Environment/tools, cost and software measurement/human efforts in hours.

4) System overview- proposed system and expected outcomes.

5) Architecture and initial phase of design (DFD).

Review 2: Requirement and Design Specification

Points to be covered:

1) User and System Requirements.
2) Functional and Non-functional Requirements.
3) SRS Document, Writing structures SRS as per Problem Statement.
4) Requirement Analysis / Models.
5) UML/ER Diagrams.
6) Detail architecture / System design/ Algorithms with analysis / Methods / Techniques.
7) Need to discuss Design models and Component level designs.
8) Detailed Design (DFD levels as per the problem statement).
9) At least 30-40% coding documentation with at least 3 to 4 working modules.
10) Identification of test to be essential and appropriate (to be implement later).
11) Project plan.

Evaluation Criteria:

Following criteria and weightage is suggested for evaluation of Project-Phase I Term Work.

1) Originality of Problem Statement: 10% (05 Marks)
2) Depth of Understanding the Problem Statement: 10% (05 Marks)
3) Concreate Literature Survey with identified gaps in all referred papers: 10% (05 Marks)
4) Design and Analysis of Algorithm / Model / Architecture / System: 40% (20 Marks)
5) Representation of results using suitable tools like tabulation, graph etc: 10% (05 Marks)
6) Presentation Skill: 10% (05 Marks)
7) Report preparation and Paper publication: 10% (05 Marks)

Project report contains the details as Follows:

Project report must have:

i. Certificate from the institute
ii. Certificate sponsoring organization (If any)
iii. Acknowledgement
iv. Abstract
v. Contents
vi. List of Abbreviations (As applicable)
vii. List of Figures (As applicable)
viii. List of Graphs (As applicable)
ix. List of Tables (As applicable)

1. Introduction and aims/motivation and objectives.
2. Literature Survey (with proper citation).
3. Problem Statement/definition.
4. Software Requirement Specification (In SRS Documentation only).
5. Flowchart
6. Project Requirement specification.
7. Proposed system Architecture.
8. High level design of the project (DFD,UML, ER Diagrams).
9. System implementation-code documentation: Algorithm style, Description of detailed methodologies, protocols used etc..as applicable.
10. Test cases.
11. Proposed GUI/Working modules/Experimental Results (Module wise if available) in suitable format.
12. Project Plan.
13. Conclusions.
14. Bibliography in IEEE format.

Appendices:

A. Plagiarism Report of Paper and Project report from any open-source tool.
B. Base Paper(s) [If any].
C. Tools used / Hardware Components specifications [If any].
D. Published Papers and Certificates.

Use appropriate plagiarism tools, reference managers, Latex for efficient and effective project writing.

Reference Books:

1. UML2 Bible by Tom Pender, Wiley India Pvt. Limited 2011
2. Applying UML and Patterns Second Edition by Craig Larman, Pearson Education
3. UML 2 and the Unified Process, Second Edition, JIM Arlow, Ila Neustadt, Pearson
4. Design Patterns: Elements of Reusable Object-Oriented Software, Erich Gamma, Pearson
5. Design Patterns in Java Second Edition by Steven John Metsker, Pearson

All the assignments should be conducted on Latest version of Open-Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading

Savitribai Phule Pune University, Pune Final Year Information Technology (2019 Course) 414456 : Project-II		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 10 hrs/week	**05 Credits**	**Term Work : 100 Marks** **Oral : 50 Marks**
Prerequisite Courses, if any: Project Phase-I (B.E. (IT) Final Year Semester-I)		
Companion Course, if any: NA		

Course Objectives:

1. To enable the student to extend further the investigative study taken up under Project stage-I, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory / Industry.
2. To build up exposure of implementation and hence develops analysis of results by considering performance measures.
3. To expose students to product development environment using industrial experience, use of state of art technologies.
4. To encourage and expose students with funding agency for sponsored projects.
5. To generate the opportunities to experience practically the facts learned in various fields together.
6. To improve overall communication skill, Teamwork and Leadership Qualities, professionalism.
7. Evaluate the various validation and verification methods.
8. Analyzing professional issues, including ethical, legal and security issues, related to computing projects.
9. To evaluate alternative approaches, and justify the results obtained.

Course Outcomes:

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

1. To apply engineering and mathematical knowledge to investigate / select proper technology / Algorithm suitable to solve the problem in hand.
2. To apply knowledge of statistics for analysis of results and express conclusion and justification for the same.
3. To design and conduct experiments, as well as to analyze and interpret data or develop prototype model of the application.
4. To communicate effectively.
5. Get broad education which is necessary to understand the impact of engineering solutions in a global, economic, environmental, ethically and societal context.
6. Recognition of the need for, and an ability to engage in life-long learning.

Introductory Information:

BE Project Phase-II is the continuation of Project Phase-I for implementation, and analysis of results to arrive a valid conclusion with justification.

Guidelines to Faculty and Students:

1. Preferably same review committee needs to continue for Project Phase-II.
2. There shall be **TWO** reviews in Project phase –II (in semester-II) by the review committee.
3. The Project Review committee will be responsible for evaluating the timely progress of the projects. It is suggested to evaluate the skills learned by the students in their PBL (in their previous years).
4. Student needs to justify the Algorithm / Model used for implementation.
5. Every student of the project group shall make presentation on the progress made by them before the committee during each reviews. Each student/group is required to give presentation as part of review for 10 to 15 minutes followed by a detailed discussion and query session.
6. Students need to note down the queries raised during review(s) and comply the same in the next review session.
7. The record of the remarks/suggestions of the review committee (project dairy) should be properly maintained in continuation of Project Phase-II and should be made available at the time of university examination.
8. Project group needs to present / publish **TWO** papers (One in each semester, at least one paper should be in **UGC – Care journal**).
    a. Paper must be checked for Plagiarism by any open software.
    b. One paper during second semester which includes Methodologies / Algorithms implemented, Results obtained, Analysis of results and conclusion.
9. Project report must also be checked for Plagiarism.
10. 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.

Review 3: Implementation –

Points to be covered:

1. Detailed study of Algorithm(s) / Model / Hardware specification (As applicable).
2. Confirmation of Data set used (As applicable)
3. Detailed ER Diagram / DFD diagrams.
4. Detailed UML Diagrams.
5. Sample results (module based).

Review 4: Testing and Result Analysis.

Points to be covered:

1. Appropriate test cases and results of test cases.
2. Representation of results with analysis.
3. Conclusion over performance parameters (as applicable)
4. Conclusion and future work suggested.
5. Knowledge of references utilized.

Evaluation Criteria:

Following criteria and weightage is suggested for evaluation of Project-Phase II Term Work.

1. Availability of standard Data set / Input parameters: 10%
2. Depth of Understanding of implemented Technology / Algorithm / Domain / Model: 40%
3. Test cases / Validation and Verification process: 10%
4. Justification of Algorithm / Model / Architecture / System: 10%
5. Analysis of results and conclusion: 10%
6. Presentation Skill: 10%
7. Report preparation and Paper publication: 10%

Project report contains the details as Follows:

It is suggested to have only one Project report which includes work carried at Project Phase-I as well. Project report must have:

- **i.** Certificate from the institute.
- **ii.** Certificate sponsoring organization (If any).
- **iii.** Acknowledgement.
- **iv.** Abstract.
- **v.** Contents.
- **vi.** List of Abbreviations (As applicable).
- **vii.** List of Figures (As applicable).
- **viii.** List of Graphs (As applicable).
- **ix.** List of Tables (As applicable).

1) Introduction and aims/motivation and objectives.
2) Literature Survey (with proper citation).
3) Problem Statement/definition.
4) Software Requirement Specification (In SRS Documentation only).
5) Flowchart
6) Project Requirement specification.
7) Proposed system Architecture.
8) High level design of the project (DFD , UML , ER Diagrams).
9) System implementation-code documentation: Algorithm style, Description of detailed methodologies, protocols used etc..as applicable.
10) Test cases.
11) GUI/Working modules and Experimental Results in suitable format.
12) Project Plan.
13) Analysis and Conclusions with future work.
14) Bibliography in IEEE format.

Appendices

- **a)** Plagiarism Report of Paper and Project report from any open source tool.
- **b)** Base Paper(s) [If any].
- **c)** Tools used / Hardware Components specifications [If any].
- **d)** Published Papers and Certificates (Both Papers).

Use appropriate plagiarism tools, reference managers, Latex for efficient and effective project writing.

Savitribai Phule Pune University, Pune
Final Year Information Technology (2019 Course)
414454: Lab Practice - V

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR): 4 hrs/week	02 Credits	PR: 25 Marks TW: 50 Marks

Prerequisites:

1. Operating Systems
2. Computer Network Technology
3. Web Application Development

Course Objectives:

1. The course aims to provide an understanding of the principles on which the distributed systems are based, their architecture, algorithms and how they meet the demands of Distributed applications.
2. The course covers the building blocks for a study related to the design and the implementation of distributed systems and applications.

Course Outcomes:

Upon successful completion of this course student will be able to:

1. Demonstrate knowledge of the core concepts and techniques in distributed systems.
2. Learn how to apply principles of state-of-the-Art Distributed systems in practical application.
3. Design, build and test application programs on distributed systems

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments, and it should be made available to students and laboratory instructor/Assistant.
The instructor's manual should include prologue, university syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, algorithm written in pseudo language, sample test cases and references.

Guidelines for Student's Lab Journal

1. The laboratory assignments are to be submitted by students in the form of journals. The Journal consists of prologue, Certificate, table of contents, and handwritten/printed write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, Software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept, algorithms, printouts of the code written using coding standards, sample test cases etc.)
2. Practical Examination will be based on the term work.
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if the journal of the candidate is completed in all respects and certified by concerned faculty and head of the department.

Guidelines for Lab /TW Assessment

Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten/printed write-up along with results of implemented assignment, attendance etc.
Examiners will judge the understanding of the practical performed in the examination by asking some

questions related to theory & implementation of experiments he/she has carried out.

Guidelines for Laboratory Conduction

Staff in-charge will suitably frame the assignments and flexibility may be incorporated. All the assignments should be conducted on the latest version of Open-Source Operating Systems, tools and Multi-core CPU supporting Virtualization and Multi-Threading.

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements for practical examination. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to judge the student 's understanding of the fundamentals, effective and efficient implementation. The evaluation should be done by both external and internal examiners.

List of Laboratory Assignments

1. Implement multi-threaded client/server Process communication using RMI.
2. Develop any distributed application using CORBA to demonstrate object brokering. (Calculator or String operations).
3. Develop a distributed system, to find sum of N elements in an array by distributing N/n elements to n number of processors MPI or OpenMP. Demonstrate by displaying the intermediate sums calculated at different processors.
4. Implement Berkeley algorithm for clock synchronization.
5. Implement token ring based mutual exclusion algorithm.
6. Implement Bully and Ring algorithm for leader election.
7. Create a simple web service and write any distributed application to consume the web service.
8. **Mini Project (In group):** A Distributed Application for Interactive Multiplayer Games

Reference Books:

1. Distributed Systems –Concept and Design, George Coulouris, Jean Dollimore, Tim Kindberg& Gordon Blair,Pearson,5th Edition,ISBN:978-13-214301-1.
2. Distributed Algorithms,Nancy Ann Lynch, Morgan Kaufmann Publishers, illustrated, reprint, ISBN: 9781558603486.
3. Java Network Programming & Distributed Computing by David Reilly, Michael Reilly
4. Distributed Systems - An Algorithmic approach by Sukumar Ghosh (good book for distributed algorithms)
5. Distributed Algorithms: Principles, Algorithms, and Systems by A. D. Kshemkalyani and M. Singhal (Good for algorithms, but very detailed, has lots of algorithms; good reference)
6. Design and Analysis of Distributed Algorithms by Nicola Santoro (good, distributed algorithms book)

Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

314448 : Laboratory Practice-I (Machine Learning)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 4 hrs/week	02 Credits	PR : 25 Marks TW: 25 Marks

HOME

Prerequisites:

1. Python programming language

Course Objectives:

1. The objective of this course is to provide students with the fundamental elements of machine learning for classification, regression, clustering.
2. Design and evaluate the performance of a different machine learning models.

Course Outcomes:

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

CO1: Implement different supervised and unsupervised learning algorithms.

CO2: Evaluate performance of machine learning algorithms for real-world applications.

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

Guidelines for Student's Lab Journal

1. Students should submit term work in the form of a handwritten journal based on a specified listof assignments.
2. Practical Examination will be based on the term work.
3. Students are expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.

Guidelines for Lab /TW Assessment

1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten write-up along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware related to respective laboratories should be as a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers of the program in a journal may be avoided. There must be hand-written write-ups for every assignment in the journal. The DVD/CD containing student programs should be attached to the journal by every student and the same to be maintained by the department/lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Laboratory Conduction

1. All the assignments should be implemented using python programming language
2. **Implement any 4 assignments out of 6**
3. **Assignment clustering with K-Means is compulsory**
4. The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic.
5. The instructor may frame multiple sets of assignments and distribute them among batches of students.
6. All the assignments should be conducted on multicore hardware and 64-bit open-sources software

Guidelines for Practical Examination

1. Both internal and external examiners should jointly set problem statements for practical examination. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement.
2. The supplementary and relevant questions may be asked at the time of evaluation to judge the student 's understanding of the fundamentals, effective and efficient implementation.
3. The evaluation should be done by both external and internal examiners.

List of Laboratory Assignments

Group A

1. **Data preparation:**

   Download heart dataset from following link.
   https://www.kaggle.com/zhaoyingzhu/heartcsv
   Perform following operation on given dataset.
   a) Find Shape of Data
   b) Find Missing Values
   c) Find data type of each column
   d) Finding out Zero's
   e) Find Mean age of patients
   f) Now extract only Age, Sex, ChestPain, RestBP, Chol. Randomly divide dataset in training (75%) and testing (25%).

   Through the diagnosis test I predicted 100 report as COVID positive, but only 45 of those were actually positive. Total 50 people in my sample were actually COVID positive. I have total 500 samples.
   Create confusion matrix based on above data and find
   I. Accuracy
   II. Precision
   III. Recall
   IV. F-1 score
2. **Assignment on Regression technique**

   Download temperature data from below link. https://www.kaggle.com/venky73/temperatures-of-india?select=temperatures.csv

   This data consists of temperatures of INDIA averaging the temperatures of all places month wise. Temperatures values are recorded in CELSIUS
   a. Apply Linear Regression using suitable library function and predict the Month-wise

temperature.

b. Assess the performance of regression models using MSE, MAE and R-Square metrics
c. Visualize simple regression model.

3. Assignment on Classification technique

Every year many students give the GRE exam to get admission in foreign Universities. The data set contains GRE Scores (out of 340), TOEFL Scores (out of 120), University Rating (out of 5), Statement of Purpose strength (out of 5), Letter of Recommendation strength (out of 5), Undergraduate GPA (out of 10), Research Experience (0=no, 1=yes), Admitted (0=no, 1=yes). Admitted is the target variable.

Data Set Available on kaggle (The last column of the dataset needs to be changed to 0 or 1)Data Set : https://www.kaggle.com/mohansacharya/graduate-admissions

The counselor of the firm is supposed check whether the student will get an admission or not based on his/her GRE score and Academic Score. So to help the counselor to take appropriate decisions build a machine learning model classifier using Decision tree to predict whether a student will get admission or not.

Apply Data pre-processing (Label Encoding, Data Transformation….) techniques if necessary.

Perform data-preparation (Train-Test Split)

C. Apply Machine Learning Algorithm

D. Evaluate Model.

4. Assignment on Improving Performance of Classifier Models

A SMS unsolicited mail (every now and then known as cell smartphone junk mail) is any junk message brought to a cellular phone as textual content messaging via the Short Message Service (SMS). Use probabilistic approach (Naive Bayes Classifier / Bayesian Network) to implement SMS Spam Filtering system. SMS messages are categorized as SPAM or HAM using features like length of message, word depend, unique keywords etc.

Download Data -Set from : http://archive.ics.uci.edu/ml/datasets/sms+spam+collection

This dataset is composed by just one text file, where each line has the correct class followed by the raw message.

a. Apply Data pre-processing (Label Encoding, Data Transformation….) techniques if necessary
b. Perform data-preparation (Train-Test Split)
c. Apply at least two Machine Learning Algorithms and Evaluate Models
d. Apply Cross-Validation and Evaluate Models and compare performance.
e. Apply Hyper parameter tuning and evaluate models and compare performance.

5. Assignment on Clustering Techniques

Download the following customer dataset from below link:

Data Set: https://www.kaggle.com/shwetabh123/mall-customers

This dataset gives the data of Income and money spent by the customers visiting a Shopping Mall. The data set contains Customer ID, Gender, Age, Annual Income, Spending Score. Therefore, as a mall owner you need to find the group of people who are the profitable customers for the mall owner. Apply at least two clustering algorithms (based on Spending Score) to find the group of customers.

a. Apply Data pre-processing (Label Encoding , Data Transformation….) techniques if necessary.
b. Perform data-preparation(Train-Test Split)

c. Apply Machine Learning Algorithm
d. Evaluate Model.
e. Apply Cross-Validation and Evaluate Model

6. Assignment on Association Rule Learning

Download Market Basket Optimization dataset from below link.

Data Set: https://www.kaggle.com/hemanthkumar05/market-basket-optimization

This dataset comprises the list of transactions of a retail company over the period of one week. It contains a total of 7501 transaction records where each record consists of the list of items sold in one transaction. Using this record of transactions and items in each transaction, find the association rules between items.

There is no header in the dataset and the first row contains the first transaction, so mentioned header = None here while loading dataset.

a. Follow following steps :
b. Data Preprocessing
c. Generate the list of transactions from the dataset
d. Train Apriori algorithm on the dataset
e. Visualize the list of rules

F. Generated rules depend on the values of hyper parameters. By increasing the minimum confidence value and find the rules accordingly

7. Assignment on Multilayer Neural Network Model

Download the dataset of National Institute of Diabetes and Digestive and Kidney Diseases from below link :

Data Set: https://raw.githubusercontent.com/jbrownlee/Datasets/master/pima-indians-diabetes.data.csv

The dataset is has total 9 attributes where the last attribute is “Class attribute” having values 0 and 1. (1=”Positive for Diabetes”, 0=”Negative”)

a. Load the dataset in the program. Define the ANN Model with Keras. Define at least two hidden layers. Specify the ReLU function as activation function for the hidden layer and Sigmoid for the output layer.
b. Compile the model with necessary parameters. Set the number of epochs and batch size and fit the model.
c. Evaluate the performance of the model for different values of epochs and batch sizes.
d. Evaluate model performance using different activation functions Visualize the model using ANN Visualizer.

Reference Books:

1. Ethem Alpaydin, Introduction to Machine Learning, PHI 2nd Edition-2013
2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
3. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition 2012
4. Tom M. Mitchell , Machine Learning, 1997, McGraw-Hill, First EditionC. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
5. Ian H Witten, Eibe Frank, Mark A Hall: Data Mining, Practical Machine Learning Tools and Techniques, Elsevier, 3rd Edition
6. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition 2012.

7. Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012.
8. Shalev-Shwartz S., Ben-David S., Understanding Machine Learning: From Theory to Algorithms, CUP, 2014
9. Jack Zurada: Introduction to Artificial Neural Systems, PWS Publishing Co. Boston, 2002

Virtual Laboratory:

1. http://vlabs.iitb.ac.in/vlabs-dev/labs/machine_learning/labs/index.php

Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

314458: Laboratory Practice-II (Web Application Development)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) : 4 hrs/week	02 Credit	PR : 25 Marks TW : 50 Marks

HOME

Prerequisites: Programming languages C++, Java

Course Objectives:

1. To understand basic concepts of web programming and scripting languages.
2. To learn Version Control Environment.
3. To learn front end technologies and back end technologies.
4. To understand mobile web development.
5. To comprehend web application deployment.

Course Outcomes:

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

CO1: Develop Static and Dynamic responsive website using technologies HTML, CSS, Bootstrapand AJAX.
CO2: Create Version Control Environment.
CO3: Develop an application using front end and backend technologies.
CO4: Develop mobile website using JQuery Mobile.
CO5: Deploy web application on cloud using AWS.

Guidelines for Instructor's Manual

Lab Assignments: Following is a list of suggested laboratory assignments for reference. Laboratory Instructors may design a suitable set of assignments for their respective courses at their level. Beyond curriculum assignments, the mini-project is also included as a part of laboratory work. The Inclusion of few optional assignments that are intricate and/or beyond the scope of curriculum will surely be the value addition for the students and it will satisfy the intellectuals within the group of the learners and will add to the perspective of the learners. For each laboratory assignment, it is essential for students to draw/write/generate flowchart, algorithm, test cases, mathematical model, Test data set and comparative/complexity analysis (as applicable).

Guidelines for Student's Lab Journal

Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD or similar media containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journals may be avoided. Submission of journal/ term work in the form of softcopy is desirable and appreciated.

Guidelines for Lab /TW Assessment
Term work is continuous assessment that evaluates a student's progress throughout the semester. Term work assessment criteria specify the standards that must be met and the evidence that will be gathered to demonstrate the achievement of course outcomes. Categorical assessment criteria for the term work should establish unambiguous standards of achievement for each course outcome. They should describe what the learner is expected to perform in the laboratories or on the fields to show that the course outcomes have been achieved. It is recommended to conduct an internal monthly practical examination as part of continuous assessment.
Guidelines for Laboratory Conduction
Following is a list of suggested laboratory assignments for reference. Laboratory Instructors may design a suitable set of assignments for respective courses at their level. Beyond curriculum assignments and mini-project may be included as a part of laboratory work. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. The Inclusion of few optional assignmentsthat are intricate and/or beyond the scope of curriculum will surely be the value addition for the students and it will satisfy the intellectuals within the group of the learners and will add to the perspective of the learners. For each laboratory assignment, it is essential for students to draw/write/generate flowchart, algorithm, test cases, mathematical model, Test data set and comparative/complexity analysis (as applicable). Batch size for practical and tutorials may be as per guidelines of authority.
Guidelines for Practical Examination
Students' work will be evaluated typically based on the criteria like attentiveness, proficiency in execution of the task, regularity, punctuality, use of referencing, accuracy of language, use of supporting evidence in drawing conclusions, quality of critical thinking and similar performance measuring criteria.
List of Laboratory Assignments
Group A-(WAD)
Assignment 1 **a.** Create a responsive web page which shows the ecommerce/college/exam admin dashboard with sidebar and statistics in cards using HTML, CSS and Bootstrap. **b.** Write a JavaScript Program to get the user registration data and push to array/local storage with AJAX POST method and data list in new page.

Assignment 2

a. Create version control account on GitHub and using Git commands to create repository and push your code to GitHub.

b. Create Docker Container Environment (NVIDEIA Docker or any other).

c. Create an Angular application which will do following actions: Register User, Login User, Show User Data on Profile Component

Assignment 3

a. Create a Node.JS Application which serves a static website.

b. Create four API using Node.JS, ExpressJS and MongoDB for CURD Operations on assignment 2.C.

Assignment 4

a. Create a simple Mobile Website using jQuery Mobile.

b. Deploy/Host Your web application on AWS VPC or AWS Elastic Beanstalk. Mini Project

Develop a web application using full stack development technologies in any of the following domains:

1. Social Media
2. ecommerce
3. Restaurant
4. Medical
5. Finance
6. Education
7. Any other

Reference Books:

1. Kogent Learning Solutions Inc, Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, XML and AJAX, Blackbook, Dreamtech Press, Second Edition, ISBN: 9788177228496.
2. Raymond Camden, Andy Matthews, jQuery Mobile Web Development Essentials, Packt Publishing, Second Edition, 9781782167891.
3. Steven M. Schafer, “HTML, XHTML and CSS”, Wiley India Edition, Fourth Edition, 978- 81-265-1635-3
4. Dr.HirenJoshi, Web Technology and Application Development, DreamTech, First,ISBN:978-93-5004-088-1
5. Steven M. Schafer, “HTML, XHTML and CSS”, Wiley India Edition, Fourth Edition, 978- 81-265-1635-3
6. Ivan Bayross,”Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP,BPB Publications,4th Edition,ISBN:978-8183330084.
7. Brain Fling, Mobile Design and Development, O'REILLY, First Edition, ISBN: 13:978-81- 8404-817-
8. Adam Bretz & Colin J Ihrig, Full Stack Javascript Development with MEAN, SPD, First Edition, ISBN:978-0992461256.

- Books / E- Learning References

1. https://www.meanacademy.in/web-technologies
2. https://www.meanacademy.in/angular
3. https://www.meanacademy.in/mongodb
4. https://www.meanacademy.in/nodejs
5. https://www.meanacademy.in/aws

Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

314455: Internship

HOME

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH) : 4 hrs/week	04 Credit	Team work: 100 Marks

Prerequisite Courses: if Any

Course Objectives:

- To encourage and provide opportunities for students to get professional/personal experience through internships.
- To learn and apply the technical knowledge gained from academics /classroom learning in real life/industrial situations.
- To get familiar with various tools and technologies used in industries and their applications.
- To enable students to develop professional skills and expand their professional network with the development of employer-valued skills like teamwork, communication.
- To apply the experience gained from industrial internship to the academic course completion project.
- To nurture professional and societal ethics in students
- Understand the social, economic and administrative considerations that influence the working environment of industrial organizations

Course Outcomes:

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

CO1: Develop professional competence through industry internship.
CO2: Apply academic knowledge in a personal and professional environment
CO3: Build the professional network and expose students to future employees.
CO4: Apply professional and societal ethics in their day-to-day life.
CO5: Become a responsible professional having social, economic and administrative considerations.
CO6: Make own career goals and personal aspirations.

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 theoretical 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 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./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 makethemselves ready for the industry.

Contacting various companies for Internship and 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.

Student can take internship work in the form of Online/onsite work from any of the following but not limited to:

- Working for consultancy/ research project,
- Participation at Events (Technical / Business)/in innovation related completions like Hackathon,
- 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,
- Participation in IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos,
- Industry / Government Organization Internship,
- Internship through Internshala,
- In-house product development, intercollegiate, inter department research internship under research lab/group, micro/small/medium enterprise/onle ineinternship,
- 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 after every day by the supervisor/ in charge of the section where the student has been working.

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 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

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 /faculty 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 & Presentation Skills
- Team Work
- Creativity
- Planning & Organizational skills
- Adaptability
- Analytical Skills
- Attitude & Behavior at work

- Societal Understanding
- Ethics
- Regularity and punctuality
- Attendance record
- Log book
- Student's Feedback from External Internship Supervisor

After completion of Internship, the student should prepare a comprehensive report to indicate what he/she has observed and learnt in the training period. The student may contactIndustrial Supervisor/ Faculty Mentor/Faculty/TPO for assigning special topics and problems and should prepare the final report on the student's presence physically, if the student is found absent without prior intimation to the department/institute/concern authority/T & P Cell, entire training can be cancelled.

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 / personal observations
- 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/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.

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214456: Database Management System Lab

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR):04hrs/week	02	PR: 25 Marks TW: 25 Marks

Prerequisites: Data structures and Software engineering principles and practices.

Course Objectives :

1. Understand the fundamental concepts of database management. These concepts include aspects of database design, database languages, and database-system implementation.
2. To provide a strong formal foundation in database concepts, recent technologies and best industry practices.
3. To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
4. To learn the SQL database system.
5. To learn and understand various Database Architectures and its use for application development.
6. To program PL/SQL including stored procedures, stored functions, cursors and packages.

Course Outcomes :

On completion of this course student will be able to --

CO1: Install and configure database systems.
CO2: Analyze database models & entity relationship models.
CO3 : Design and implement a database schema for a given problem-domain
CO4: Implement relational database systems.
CO5: Populate and query a database using SQL DDL / DML / DCL commands.
CO6 : Design a backend database of any one organization: CASE STUDY

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

Guidelines for Student's Lab Journal

1. Student should submit term work in the form of journal with write-ups based on specified list of assignments.
2. Practical and Oral Examination will be based on all the assignments in the lab manual
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted only if the journal of the candidate is complete in all respects.

Guidelines for Oral /Practical Assessment

1. Examiners will assess the student based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of

handwritten write-up along with results of implemented assignment, attendance etc.

2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.

Suggested List of Laboratory Assignments

Group A: Study of Databases

Mapping of Course Outcomes Group A -- CO1

1. Study of MySQL Open source software. Discuss the characteristics like efficiency, scalability, performance and transactional properties
2. Install and configure client and server of MySQL.(Show all commands and necessary steps for installation and configuration)
3. Study of SQLite: What is SQLite? Uses of Sqlite. Building and installing SQLite.

Group B: MySQL

Mapping of Course Outcomes Group B -- CO2, CO3, CO4, CO5

1. Design any database with at least 3 entities and relationships between them. Draw suitable ER/EER diagram for the system.
2. Design and implement a database (for assignment no 1) using DDL statements and apply normalization on them
3. Create Table with primary key and foreign key constraints.
   a. Alter table with add n modify b. Drop table
4. Perform following SQL queries on the database created in assignment 1.
   - Implementation of relational operators in SQL
   - Boolean operators and pattern matching
   - Arithmetic operations and built in functions
   - Group functions
   - Processing Date and Time functions
   - Complex queries and set operators
5. Execute DDL/DML statements which demonstrate the use of views. Update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.

Group C: PL/SQL

Mapping of Course Outcomes Group C -- CO6

1. Write and execute PL/SQL stored procedure and function to perform a suitable task on the database. Demonstrate its use.
2. Write and execute suitable database triggers .Consider row level and statement level triggers.
3. Write a PL/SQL block to implement all types of cursor.

Group D: Relational Database Design

Mapping of Course Outcomes Group D -- CO5, CO6

Design and case study of any organization (back end only), Project Proposal and High Level SRS

To prepare for project, do the following:

1. Form teams of around 3 to 4 people
2. Create requirements document with the following information:-
   a. Give one or two paragraph description of your goals for the topic(s).
   b. List what all types of users will be accessing your application
   c. List the various functionalities that your application will support. Explain each in about a paragraph worth of detail.
   d. List the hardware and software requirements at the backend and at the front end.
   e. Give an estimate of the number of users of each type, the expected load (transactions per day), and the expected database size.

Project ER Diagram and Database Design

For ER diagram and Database design following guidelines can be used:

1. Draw an ER diagram of your project.
2. Reduce this ER diagram into the tables and complete database design.
3. Subsequently, list all the functional dependencies on each table that you expect will hold.
4. Check that the database schema is in 3NF/BCNF. If it is not, apply normalization. Use non-loss decomposition and bring the database schema in 3NF/BCNF.

Give the ER diagram and the data dictionary as part of the requirement specifications file which you created for the project proposal.

Reference Books:

1. Dr. P. S. Deshpande, “SQL and PL/SQL for Oracle 10g Black Book”, DreamTech
2. Ivan Bayross, “SQL, PL/SQL: The Programming Language of Oracle”, BPB Publication
3. Reese G., Yarger R., King T., Williums H, “Managing and Using MySQL”, Shroff Publishers and Distributors Pvt. Ltd., ISBN: 81 - 7366 - 465 – X, 2nd Edition
4. Eric Redmond, Jim Wilson, “Seven databases in seven weeks”, SPD, ISBN: 978-93-5023-91
5. Jay Kreibich, Using SQLite, SPD, ISBN: 978-93-5110-934-1, 1st edition

202052 - Project Based Learning - II		
Teaching Scheme	**Credits**	**Examination Scheme**
Practical : 04 Hr./Week	**02** Practical : 02	Term Work : 50 Marks

Preamble

Currently, engineering education is undergoing significant structural changes worldwide. The rapidly evolving technological landscape forces educators to constantly reassess the content of engineering curricula in the context of emerging fields and with a multidisciplinary focus. In this process, it is necessary to devise, implement and evaluate innovative pedagogical approaches for the incorporation of these novel subjects into the educational programs without compromising the cultivation of the traditional skills. In this context, the educational community is showing rapidly rising interest in project-based learning approaches.

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

Course Objectives

1. To emphasize project based learning activities that are long-term, interdisciplinary and student-centric.
2. To inculcate independent and group learning by solving real world problems with the help of available resources.
3. To be able to develop applications based on the fundamentals of mechanical engineering by possibly applying previously acquired knowledge.
4. To get practical experience in all steps in the life cycle of the development of mechanical systems: specification, design, implementation, and testing.
5. To be able to select and utilize appropriate concepts of mechanical engineering to design and analyze selected mechanical system.

Course Outcomes

On completion of the course, learner will be able to

CO1. IDENTIFY the real-world problem (possibly of interdisciplinary nature) through a rigorous literature survey and formulate / set relevant aims and objectives.
CO2. ANALYZE the results and arrive at valid conclusions.
CO3. PROPOSE a suitable solution based on the fundamentals of mechanical engineering by possibly integration of previously acquired knowledge.
CO4. CONTRIBUTE to society through proposed solutions by strictly following professional ethics and safety measures.
CO5. USE of technology in proposed work and demonstrate learning in oral and written form.
CO6. DEVELOP ability to work as an individual and as a team member.

Group Structure

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

1. Create groups of 5 (five) to 6 (six) students in each class
2. A supervisor/mentor teacher is assigned to 3-4 groups or one batch

Project Selection

The project can be selected by undertaking a survey of journal papers, patents or field visit (A problem can be theoretical, practical, social, technical, symbolic, cultural and/or scientific). The problem shall consist of following facets: feasibility of arriving at a solution, analyzing the problem, design and development of the system (hardware or virtual).

There are no commonly shared criteria/ guidelines 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 undertaken.

Solution to problem-based projects through ***"learning by doing"*** 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. A problem can be theoretical, practical, social, technical, symbolic, cultural and/or scientific and grows out of students" wandering within different disciplines and professional environments. As stated in the preamble as the world has adapted and propagated multidisciplinary approach, hence the proposed project activity preferably should not be restricted to only mechanical domain specific projects rather should be Interdisciplinary in nature. However the chosen problem should be integration of other streams of engineering with Mechanical engineering.

Although in a genuine case 100% software/ virtual project topic may be allowed.

Ethical Practices, teamwork and project management:
Use Indian standards or any relevant standards for project manufacturing, respect the time of others, attend the reviews, poster presentation and model exhibitions, strictly follow the deadline of project completion, comply with all legislation requirements that govern workplace health and safety practices.

Effective Documentation
In order to make our engineering graduates capable of preparing effective documentation, it is required for the students to learn the effective writing skills. The PBL final report is expected to consist of the Literature Survey, Problem Statement, Aim and Objectives, System Block Diagram, System Implementation Details, Discussion and Analysis of Results, Conclusion, System Limitations and Future Scope. Many freely available software tools (for instance Mendley (Elsevier), Grammarly) are expected to be used during the preparation of PBL synopsis and final report. It is expected that the PBL guides/mentors shall teach students about utilizing valid sources of information (such as reference papers, books, magazines, etc) related to their PBL topic.

Evaluation & Continuous Assessment
The institution/head shall be committed to ensuring the effective and rigorous implementation of the idea of project based learning. Progress of PBL shall be monitored regularly on a weekly basis. Weekly review of the work shall be necessary. During the process of monitoring and continuous assessment and evaluation the individual and 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.

The effectiveness of the concept PBL lies in rigorous and continuous assessment and evaluation of the student performance. It is recommended that all activities are required to be recorded regularly. A regular assessment of PBL work is required to be maintained at the department in PBL log book by students. It is expected that the PBL log book must include following:

1. Information of students and guide
2. Weekly monitoring by the PBL guide,
3. Assessment sheet for PBL work review by PBL guide and PBL Evaluation Committee (PEC).

The PEC structure shall consist of Head of the department, 1/2 senior faculties of the department and one industry expert (optional). Continuous Assessment Sheet (CAS) is to be maintained by the department.

Recommended parameters for assessment, evaluation and weightage

1. Idea Inception (kind of survey). (10%)
2. Documentation (Gathering requirements, design & modeling, implementation/execution, use of technology and final report, other documents). (15%)
3. Attended reviews, poster presentation and model exhibition. (10%)

4. Demonstration (Poster Presentation, Model Exhibition etc). (10%).
5. Awareness /Consideration of - Environment/ Social /Ethics/ Safety measures/Legal aspects. (5%)
6. Outcome (physical model/prototype/ virtual model/ product development/ assembly & disassembly and analysis of standard mechanism or system, design and development of small applications using Arduino, design of control systems, development of various systems/ subsystems of BAJA/SUPRA/Robots/GoKart/ Sunrisers/Hackathon/ application development and similar activities/ System performance and analysis) (40%)
7. Participation in various competitions/ publication/ copyright/ patent) (10%)

Learning Resources

Reference Books / Research Articles

1. John Larmer, John R. Mergendoller, and Suzie Boss, "Setting the Standard for Project Based Learning"
2. John Larmer and Suzie Boss, "Project Based Teaching: How to Create Rigorous and Engaging Learning Experiences"
3. Erin M. Murphy and Ross Cooper, "Hacking Project Based Learning: 10 Easy Steps to PBL and Inquiry"

Web resources

1. https://www.edutopia.org/project-based-learning
2. www.howstuffworks.com
3. https://www.pblworks.org/
4. www.wikipedia.org

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

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

Course Objectives:

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

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

Course Outcomes:

On completion of the course, learners should be able to

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

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

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

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

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

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

****Guidelines:**

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

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

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

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.

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:

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:

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 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.

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 & 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

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, Audit Courses

Course Objectives:

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.
5. To get visibility in industry to Project and Project group

Course Outcomes:

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

CO1. Implement systems approach.
CO2. To conceptualize a novel idea / technique into a product.
CO3. To think in terms of a multi-disciplinary environment.
CO4. To take on the challenges of teamwork, and document all aspects of design work.
CO5. To understand the management techniques of implementing a project.

Course Contents

Project work in the seventh semester is an integral part of the TW 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.

Project work shall be based on any of the following:

1. Fabrication of product/ testing setup of an experimentation unit/ apparatus/ small equipment, in a group.
2. Experimental verification of principles used in Mechanical Engineering Applications.
3. Projects having valid database, data flow, algorithm, and output reports, preferably software based.

4. Study projects are strictly allowed.

Project Lab

1. There has to be a **Project Lab** in the department.
   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 created to maintain the transparency and confidentiality.

Books and other resources

References Books:

- Dissertations and Project Reports: A Step by Step Guide by Dr Stella Cottrell.

Web References:

1. SWAYAM-NPTEL Course.
2. MOOCs'Courses.

Guidelines for Project Execution:

At the end of the 6th Semester

1. Students will make groups 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 7th Semester

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:

- 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

1. Work Diary: Work Diary maintained by 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 30 marks (15 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 40 marks
  - 10 marks for presentation for group,
  - 15 marks for quality of the project work.
  - 15 marks for quality of the project report

Project Report
• Stage I report shall be in the booklet form. • Plagiarism check is must, and certificate shall be attached in the report.
References: • References format MUST BE STANDARD – ASME, SAE or IEEE

402053: Project (Stage II)					
Teaching Scheme		**Credits**		**Examination Scheme**	
Practical	**12 Hrs./Week**	**Practical**	**6**	**Term Work**	**100 Marks**
				Oral	**50 Marks**

Prerequisites: Project Based Learning, Internship/Mini Project, Project (Stage I)

Course Objectives:

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.
5. To get visibility in industry to Project and Project group

Course Outcomes:

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

CO1. Implement systems approach.
CO2. To conceptualize a novel idea / technique into a product.
CO3. To think in terms of a multi-disciplinary environment.
CO4. To take on the challenges of teamwork, and document all aspects of design work.
CO5. To understand the management techniques of implementing a project.

Course Contents

Extended part of Project Stage I

Guidelines for Project Execution

1. Refer Project stage I guidelines.

Term Work Evaluation

1. In Project Stage II, two reviews are to be taken for total 80 marks (40 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 will be third party evaluation by Faculty/Student/Industry person/Alumni
4. Evaluation committee will 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

1. Examination committee will consist of Guide, (Strictly) One Industry person and One Faculty appointed by the Institution.
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, intrateam 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.
    a. Page size: Trimmed A4
    b. Top Margin: 1.00 Inches
    c. Bottom Margin: 1.32 Inches
    d. Left Margin: 1.5 Inches
    e. Right Margin: 1.0 Inches
    f. Para Text: Times New Roman 12-point font
    g. Line Spacing: 1.15 Lines
    h. Page Numbers: Right aligned at footer. Font 12 point Times New Roman
    i. Headings: Times New Roman, 14 Points, Boldface 10.

Certificate

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

402043: Turbomachinery					
Teaching Scheme		**Credits**		**Examination Scheme**	
Theory	**2 Hrs./week**	**Theory**	**2**	**In-Semester**	**-**
Practical	**2 Hrs./week**	**Term Work**	**1**	**End-Semester***	**50 marks**
				Term Work	**25 marks**
				Oral	**25 marks**

Prerequisites: Fluid Mechanics, Thermodynamics, Heat Transfer, Engineering Mathematics

Course Objectives:

1. To provide the knowledge of basic principles, governing equations and applications of Turbomachines.
2. To provide the students with opportunities to apply basic thermos-fluid dynamics flow equations to Turbomachines.
3. To explain construction and working principles of Turbomachines.
4. To evaluate the performance characteristics of Turbomachines.

Course Outcomes:

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

CO 1: **VALIDATE** impulse moment principle using flat, inclined and curved surfaces and **INVESTIGATE** performance characteristics of hydraulic turbines.

CO 2: **DETERMINE** performance parameters of impulse and reaction steam turbine along with discussion of nozzles, governing mechanism & losses.

CO 3: **MEASURE** performance parameters of single & multistage centrifugal pumps along with discussion of cavitation and selection.

CO 4: **EXPLAIN** performance parameters of centrifugal compressor along with discussion of theoretical aspects of axial compressor.

Course Contents	
Unit 1	**Impact of Jet and Hydraulic Turbines**

Introduction and Impact of Jet: Introduction to Turbomachines (Hydraulic & Thermal), Classification of Turbo machines, Applications of Turbomachines. Impulse momentum principle and its application to fixed and moving flat, inclined, and curved plate/vanes. Velocity triangles and their analysis, work done equations, vane efficiency (No numerical)

Hydraulic Turbines:
Introduction to Hydro power plant, Classification of Hydraulic Turbines, Concept of Impulse and Reaction Turbines. Construction, Principle of Working, design aspects, velocity diagrams and its analysis of Pelton wheel, Francis, and Kaplan turbines, Degree of reaction, Draft tube: types and efficiencies, governing of hydraulic turbines,Cavitation in turbines.

Unit 2	**Steam Turbines**

Steam Nozzle: Equations for velocity and mass flow rate (No derivation, no numerical)
Steam Turbines: Construction and working of Impulse and Reaction steam turbine, velocity diagram, work done efficiencies, Multi-staging, compounding, Degree of reaction, losses in steam turbine, governing of steam turbines

Unit 3	**Centrifugal Pumps**

Introduction & classification of rotodynamic Pumps, Main Components of Centrifugal Pump, Construction and Working of Centrifugal Pump, Types of heads, Velocitytriangles and their analysis, Effect of outlet blade angle, Work done and Efficiency, Series and parallel operation of pumps, Priming of pumps, specific speed

Unit 4	**Rotary Compressors**

Centrifugal Compressors: Classification of Centrifugal Compressor, construction and working, velocity diagram, flow process on T-S Diagram, Euler's work, actual work input, various losses in Centrifugal Compressor

Axial flow compressors: Construction and working, stage velocity triangle and it's analysis, enthalpy entropy diagram, stage losses and various efficiencies of axial flow compressors, [No numerical]

Books and other resources

Text Books:

1. Fluid mechanics and hydraulic machines, Dr. R.K. Bansal, Laxmi Publication
2. Hydraulics & Fluid Mechanics and Machinery, Modi P N & Seth S N, Standard Book House
3. Turbines, Compressors & Fans, S.M. Yahya, Tata-McGraw Hill
4. Turbomachines, B. U. Pai, Wiley India
5. Steam and Gas Turbines and Power Plant Engineering, R. Yadav, Central Publication house

Web References:

https://nptel.ac.in/courses/112105206

https://nptel.ac.in/courses/112105182
https://nptel.ac.in/courses/112104117

Guidelines for Laboratory Conduction

- Term work shall consist of eleven experiments.
- Experiment No1,3,8,10,11 and 12 are compulsory.
- From remaining experiments (2,4,5,6,7 and 9) any five experiments are to be performed.
- Data from any one trial performed should be analyzed by using suitable software.

Term Work

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

1. Study of Impulse momentum principle and its application to fixed flat, moving, inclined, and curved plates/vanes.
2. Verification of Impulse Momentum Principle.
3. Study of Unit quantities, Specific speed and performance characteristics of hydraulic turbines.
4. Study and Trial on Impulse water Turbine and plotting the main and operating characteristics
5. Study and Trial on any one hydraulic Reaction Turbine and plotting the main and operatingcharacteristics.
6. Study and Trial on Convergent-Divergent Air/Steam nozzle
7. Study and Trial on steam Turbine and plotting the operating characteristics.
8. Study of Cavitation, NPSH, Thoma's cavitation factor, maximum suction lift.
9. Study and Trial on Centrifugal Pump and plotting the operating characteristics.
10. Study of Surging, stalling and choking phenomenon in compressors, performancecharacteristics of Centrifugal and Axial flow Compressors.
11. Visit to hydro/steam power plant and report to be submitted.
12. Visit to Pumping Station and report to be submitted.

OR

12. Design of Pumping system installation using Manufacturers catalogue, specific to housing or industrial application.

302044: Mechatronics					
Teaching Scheme		**Credits**		**Examination Scheme**	
Theory	**3Hrs./Week**	**Theory**	**3**	**In-Semester**	**30 Marks**
Practical	**2 Hrs./Week**	**Practical**	**1**	**End-Semester**	**70 Marks**
				Oral	**25 Marks**

Prerequisites: Basics of Electrical components, Binary to Decimal Conversion, Data communication Module, Op amp Circuits, Linear Algebra, Laplace Transformation method, Logic gates.

Course Objectives:

1. **UNDERSTAND** the key elements of mechatronics, principle of sensor and its characteristics.
2. **UNDERSTAND** the concept of signal processing and use of interfacing systems such as ADC, DAC, Digital I/O.
3. **UNDERSTAND** the block diagram representation and concept of transfer function.
4. **UNDERSTAND** the system modeling and analysis in frequency domain.
5. **UNDERSTAND** the system modeling and analysis in time domain, controller modes and its industrial applications..
6. **UTILIZE** the concepts of PLC system and its ladder programming and significance of PLC system in industrial application.

Course Outcomes:

On completion of the course, learner will be able to

CO1. **DEFINE** key elements of mechatronics, principle of sensor and its characteristics.
CO2. **UTILIZE** concept of signal processing and **MAKE** use of interfacing systems such as ADC, DAC, Digital I/O.
CO3. **DETERMINE** the transfer function by using block diagram reduction technique.
CO4. **EVALUATE** Poles and Zero, frequency domain parameter for mathematical modeling for mechanical system.
CO5. **APPLY** the concept of different controller modes to an industrial application.
CO6. **DEVELOP** the ladder programming for industrial application.

Course Contents

Unit 1	**Introduction to Mechatronics, Sensors & Actuators**	**07 Hrs.**

Introduction to Mechatronics and its Applications Measurement Characteristics (Static/Dynamic),

Sensors: Types of sensors; Motion Sensors – Encoder (Absolute & incremental), Lidar, Eddy Current, Proximity (Optical, Inductive, Capacitive), MEMS Accelerometer;

Temperature sensor –Pyrometer, Infrared Thermometer; Force / Pressure Sensors – Strain gauges, Piezoelectric sensor; Flow sensors – Electromagnetic, Ultrasonic, Hot-wire anemometer; Color sensor – RGB type; Biosensors – Enzyme, ECG, EMG

Actuators: Servo motor; Hydraulic and Pneumatic (must be restricted to classification and working of one type of linear and rotary actuator); linear electrical actuators Selection of Sensor & Actuator

Unit 2	Data Acquisition and Signal Communication	08 Hrs.
Signal Communication: Serial, Parallel; Synchronous, Asynchronous Introduction to DAQ, Types, Components of a Data Acquisition System (Sensor, Signal conditioning, processing, controlling and storage/display/action) Data Acquisition: Signal collection, Signal conditioning – Isolation& Filtering, Amplification, Sampling, Aliasing, Sample and hold circuit, Quantization, Analog-to-digital converters (4 bit Successive Approximation type ADC), Digital-to-Analog converters (4 bit R2R type DAC), Data storage Applications: DAQ in Household ,Digital Pressure Gauge, Digital Flow measurement, DVB Digital Video Broadcast, AM/FM		
Unit 3	**Control systems & transfer function based modelling**	**07 Hrs.**
Introduction to control systems, need, Types- Open and Closed loop, Concept of Transfer Function, Block Diagram & Reduction principles and problems; Applications (Household, Automotive, Industrial shop floor) Transfer Function based modeling of Mechanical, Thermal and Fluid system; Concept of Poles & Zeros; Pole zero plot, Stability Analysis using Routh Hurwitz Criterion (Numerical Approach)		
Unit 4	**Time and Frequency Domain Analysis**	**08 Hrs.**
Time Domain Analysis – Unit step Response analysis via Transient response specifications (Percentage overshoot, Rise time, Delay time, Steady state error etc.) Frequency Domain Analysis – Frequency Domain Parameters - Natural Frequency, Damping Frequency and Damping Factor; Mapping of Pole Zero plot with damping factor, natural frequency and unit step response ; Introduction to Bode Plot, Gain Margin, Phase Margin		
Unit 5	**Controllers**	**07 Hrs.**
Introduction to controllers, Need for Control, Proportional (P), Integral (I) and Derivative (D) control actions; PI, PD and PID control systems in parallel form; (Numerical approach), Feed forward anticipatory control Manual tuning of PID control, Ziegler–Nichols method Applications: Electro–Hydraulic/Pneumatic Control, Automotive Control		
Unit 6	**Programmable Logic Controller (PLC)**	**08 Hrs.**
Introduction to PLC; Architecture of PLC; Selection of PLC; Ladder Logic programming for different types of logic gates; Latching; Timers, Counters; PLC control of Hydraulics / Pneumatics / Mechatronics systems involving timing and counting operations.		

Books and other resources

Text Books:

1. William Bolton, Mechatronics: Electronics Control Systems in Mechanical and Electrical Engineering, 6th Ed, 2019
2. K.P. Ramchandran, G.K. Vijyaraghavan, M.S. Balasundaram, Mechatronics: Integrated Mechanical Electronic Systems, Willey Publication, 2008

References Books:

1. Alciatore and Histand, Introduction to Mechatronics and Measurement Systems, 5th Ed, 2019
2. Bishop (Editor),Mechatronics – An Introduction CRC 2006
3. Mahalik, Mechatronics – Principles, concepts and applications, Tata Mc-Graw Hill publication, New Delhi
4. C.D.Johnson, Process Control Instrumentation Technology, Prentice Hall,New Delhi
5. Bolton, Programmable Logic Controller, 4th Ed, Newnes, 2006

Web References:

1. https://www.elprocus.com/what-is-a-biosensor-types-of-biosensors-and-applications/
2. https://www.elprocus.com/color-sensor-working-and-applications/
3. https://www.youtube.com/watch?v=kbjCGGTXqUo&ab_channel=Controlengineering
4. https://youtu.be/clTA0pONnMs?list=PLHMDN3JFtE5wEz95H2XuzRaafK3fUsaki
5. https://nptel.ac.in/content/storage2/courses/108105063/pdf/L-12(SS)%20(IA&C)%20((EE)NPTEL).pdf
6. https://nptel.ac.in/content/storage2/courses/112104158/lecture5.pdf

Term Work

The Term work shall consist of completion of Practical, Self-learning Study Assignments and Presentations. Oral examination shall be based on the Term work undertaken during the semester.

Practical (**Any one** experiments out of experiment no **1 to 3** from the following list whereas experiment no. **4 to 10** are mandatory).

1. Experiment on measurement of temperature using suitable sensor.
2. Experiment on measurement of load using suitable sensor.
3. Experiment on measurement of displacement using suitable sensor.
4. Development of a data acquisition / mechatronics system using low cost open source hardware and software.
5. Experiment on interfacing of suitable sensor and actuator with DAQ.
6. Modeling and analysis of mechanical system and its verification using suitable simulation software.
7. PID control of Mechanical System using suitable simulation software and experimental verification (verification only if experimental setup is available).
8. Ladder Logic Simulation of suitable application.
9. Demonstration of PLC controlled electro hydraulic / elector pneumatic circuit.
10. Industrial visit to understand integration and application of Mechatronics.

Assignments:

1. Application of Sensors and Actuators in Health Science and Selection of Suitable Sensor and Actuator.
2. Block Diagram Representation of Feedback Control System and determination of Closed Loop Transfer Function.

Savitribai Phule Pune University

Board of Studies - Mechanical and Automobile Engineering

Undergraduate Program – Final Year Mechanical Engineering (2019 pattern)

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

Pre-requisites: Thermodynamics, Applied Thermodynamics, Fluid Mechanics, Heat and Mass transfer.

Course Objectives:

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

Course Outcomes:

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

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

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

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

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

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

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

Course Contents

Unit 1	**Gas Cycle Refrigeration and Refrigerants**

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

Refrigerants: Introduction, Definition and requirement, Classification of refrigerants, Designation of refrigerants, Desirable properties of Refrigerants-Thermodynamic, Chemical and Physical. Properties of ideal refrigerant. Environmental issues like ODP, GWP & LCCP. Selection of environment friendly refrigerants, Alternative refrigerants, Secondary refrigerants, Anti-freeze solutions, Zeotropes and Azeotropes, Refrigerant recovery, reclaims, recycle and recharge.

Unit 2	**Multi Pressure Systems Systems**

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

Multi evaporator system: single compressor-individual expansion valve, single compressor-multiple expansion valve, individual compressor-multiple expansion valve, individual compressor with compound compression and flash inter cooling. (Limited to two evaporators). Ammonia-CO_2 cascade cycle.

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

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

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

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

Unit 4	**Applied Psychrometry**

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

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

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

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

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

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

Ventilation and infiltration: Natural ventilation, Mechanical ventilation

Duct Design: Definition of duct and types of ducts, Economic factors influencing duct layout, Materials for ducts and its specification, Flow through duct, Pressure in ducts, Friction loss in ducts,

Friction chart for circular ducts, Equivalent diameter of a circular duct for rectangular sections, Methods of duct designs. (Numerical treatment on duct design)

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

Unit 6	**Advanced Air Conditioning Systems**

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

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

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

Text Books:

1. Arora C. P., Refrigeration and Air Conditioning, Tata McGraw-Hill.
2. Manohar Prasad, Refrigeration and Air Conditioning, Willey Eastern Ltd, 1983.
3. McQuiston, - Heating Ventilating and air Conditioning: Analysis and Design‖ 6th Edition, Wiley India.
4. Arora and Domkundwar, Refrigeration & Air Conditioning, Dhanpatrai & Company, New Delhi.
5. Khurmi R.S. and Gupta J.K., Refrigeration and Air conditioning, Eurasia Publishing House Pvt.Ltd, New Delhi,1994.
6. Ballaney P.L., Refrigeration and Air conditioning, Khanna Publishers, New Delhi, 1992.
7. S.N.Sapali , Refrigeration and Air conditioning, Eastern Economy Edition.
8. Arora R.C., Refrigeration and Air Conditioning, PHI, India.

References Books:

1. Dossat Ray J, Principles of refrigeration, S.I. version, Willey Eastern Ltd, 2000.
2. Stockers W.F and Jones J.W., Refrigeration and Air conditioning, McGraw Hill International editions 1982.
3. Threlkeld J.L, Thermal Environmental Engineering, Prentice Hall Inc., New Delhi.
4. Aanatnarayan, Basics of refrigeration and Air Conditioning, Tata McGraw Hill Publications.
5. Roger Legg, Air Conditioning System Design, Commissioning and Maintenance.
6. ASHRAE Handbook (HVAC Equipments) & ISHRAE handbook.
7. Shan Wang, Handbook of Refrigeration and Air Conditioning, McGraw Hill Publications.
8. Wilbert Stocker, Industrial Refrigeration, McGraw Hill Publications.
9. ASHRAE, Air Conditioning System Design Manual, IInd edition, ASHRAE.

Term Work

The student shall complete the following activity as a Term Work (Any eight experiments, No. 8 or 9 are compulsory)

1. Test on Ice plant test rig.
2. Performance Simulation of Central Air-conditioning plant using Newton Raphson Method.
3. Test on air-conditioning system for cooling load estimation
4. Performance analysis of Counter flow or cross flow cooling tower. (Theoretical/Practical)
5. Building heat load simulation using suitable software (Trace 700, Energy plus etc.)
6. Design of cold storage with process layout.
7. Analysis of VCC by Cool pack software.
8. Visit to Refrigeration or cold storage Plant
9. Visit to Air Conditioning Plant.
10. Trial on heat pump/ejector/cascade/desiccant/evaporative systems

202044 - Engineering Materials and Metallurgy

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 Term Work : 25 Marks

Prerequisite Courses

Higher Secondary Science courses, Engineering Physics, Engineering Chemistry, Systems in Mechanical Engineering

Course Objectives

1. To impart fundamental knowledge of material science and engineering.
2. To establish significance of structure property relationship.
3. To explain various characterization techniques.
4. To indicate the importance of heat treatment on structure and properties of materials.
5. To explain the material selection process.

Course Outcomes

On completion of the course, learner will be able to

CO1. COMPARE crystal structures and ASSESS different lattice parameters.

CO2. CORRELATE crystal structures and imperfections in crystals with mechanical behaviour of materials.

CO3. DIFFERENTIATE and DETERMINE mechanical properties using destructive and non-destructive testing of materials.

CO4. IDENTIFY & ESTIMATE different parameters of the system viz., phases, variables, component, grains, grain boundary, and degree of freedom. etc.

CO5. ANALYSE effect of alloying element & heat treatment on properties of ferrous & nonferrous alloy.

CO6. SELECT appropriate materials for various applications.

Course Contents

Unit I Crystal Structures and Deformation of Materials [08 Hr.]

Crystal Structures: Study of Crystal structures BCC, FCC, HCP and lattice parameters & properties, Miller indices, Crystal imperfections, and Diffusion Mechanisms

Material Properties: Mechanical (Impact, hardness, etc.), Electrical, optical and Magnetic properties

Deformation of Materials: Elastic deformation, Plastic deformation: slip, twinning, work hardening, baushinger effect, recovery, re-crystallization and grain growth, Fracture: Types of fractures (brittle, ductile), Creep & Fatigue failures

Unit II Material Testing and Characterization Techniques [06 Hr.]

Destructive Testing: Impact test, Cupping test and Hardness test

Non-Destructive Testing: Eddy current test, Sonic & Ultrasonic testing, X-ray Radiography testing (Principle and Applications only)

Microscopic Techniques: Sample Preparation and etching procedure, optical microscopy, Electronic microscopy - only SEM, TEM and X-ray diffraction (Principle and Applications only)

Macroscopy: Sulphur printing, flow line observation, spark test

Unit III Phase Diagrams and Iron-Carbon Diagram [09 Hr.]

Solid solutions: Introduction, Types, Humerothery rule for substitutional solid solutions

Solidification: Nucleation & crystal growth, solidification of pure metals, solidification of alloys.

Phase Diagrams: Cooling curves, types of phase diagrams, Gibbs phase rules

Iron-Carbon Diagram: Iron-carbon equilibrium diagrams in detail with emphasis in the invariant reactions

Unit IV **Heat Treatments** **[08 Hr.]**

Austenite transformation in steel: Time temperature transformation diagrams, continuous cooling transformation diagrams. Retained austenite and its effect

Steps in Heat treatment and Cooling Medium

Heat Treatment Processes: Introduction, Annealing (Full annealing, Process annealing, Spheroidise annealing, isothermal annealing, stress relief annealing), Normalising, Hardening, Tempering, Austempering, Martempering, Sub-Zero Treatment, Hardenability

Surface Hardening: Classification, Flame hardening, Induction hardening, Carburising, Nitriding, Carbonitriding

Unit V **Ferrous Materials** **[07 Hr.]**

Carbon Steel: Classification, types & their composition, properties and Industrial application

Alloy Steels: Classification of alloy steels & Effect of alloying elements, examples of alloy steels, (Stainless steel, Tool steel) sensitization of stainless steel

Designation of carbon steel and alloy steels as per IS, AISI, SAE Standards

Cast Iron: Classification, types & their composition, properties and Industrial application of (White CI, Gray CI, SG CI, Malleable Cast and alloy Cast Iron)

Microstructure and property relationship of various ferrous Materials

Unit VI **Non-Ferrous Materials** **[07 Hr.]**

Classification of Non-Ferrous Metals: Study of Non-ferrous alloys with Designation, Composition, Microstructure

Mechanical & other properties for Industrial Applications: Copper and its Alloys (Gilding Metal, Cartridge Brass, Muntz Metal, Tin Bronze, Beryllium Bronze), Aluminium and its Alloy (LM5, Duralumin, Y-Alloy, Hinduminum), Nickel and its Alloys (Invar, Inconel), Titanium and its Alloys (α Alloys, α-β Alloys), Cobalt and its Alloys (Stellite Alloys, Alnico), Bearing Alloys (Classification, lead based alloys, tin based alloys), Age Hardening

Microstructure and Property relationship of various Non-ferrous Materials

Recent Material used in Additive Manufacturing: Properties, Composition and Application only

Books & Other Resources

Text Books

1. Dr. V. D. Kodgire & S. V. Kodgire, "Material Science & Metallurgy For Engineers", Everest Publication.
2. William D. Callister, "Materials Science and Engineering an Introduction", Jr, John Wiley & Sons, Inc.

Reference Books

1. A. K. Bhargava, C.P. Sharma, "Mechanical Behaviour & Testing of Materials", P H I Learning Private Ltd.
2. Raghvan V., "Material Science & Engineering",Prentice Hall of India, New Delhi. 2003
3. Avner, S.H., "Introduction to Physical Metallurgy", Tata McGraw-Hill, 1997.
4. Higgins R. A., "Engineering Metallurgy", Viva books Pvt. Ltd.
5. George Ellwood Dieter, "Mechanical Metallurgy", McGraw-Hill 1988
6. Smith, W.F, Hashemi, J., and Prakash, R., "Materials Science and Engineering in SI Units", Tata McGraw Hill Education Pvt. Ltd.

Guidelines for Laboratory Conduction

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

Total 10 experiments from the following list must be performed. Term Work of the Student is evaluated based on the completion of Practical, Assignments, and Industrial Visits.

Practical *(Any Seven)*

1. Destructive testing - Hardness testing (Rockwell/Vickers) Hardness conversion number
2. Brinell and Poldi hardness Test

3. Impact Test for Steel, Aluminum, Brass and Copper (Charpy/Izod)
4. Non Destructive testing - Dye Penetrant Test/ Magnetic Particle test/ Ultrasonic Test
5. Steps for Specimen Preparation for microscopic examination & Demonstration of Optical Metallurgical microscope
6. Observation and Drawing of Microstructure of Steels, Cast Iron of various compositions
7. Observation and Drawing of Microstructure of Non Ferrous Metals of various compositions
8. Heat Treatment of steels based on relative hardness
9. Jominy End Quench Test for hardenability

Miniature commitment or Assignments *(Any Two)*

1. Exploration of engineering Alloy (Name, composition, properties, microstructure, Heat treatment, Designation & specific applications)- One student one Alloy or material
2. Examine aspects of component form material and manufacturing process point of view (Name, Material, Drawing, Manufacturing Process, properties, microstructure, Heat treatment, & specific applications) - For example spur gear, Needle etc. One student one component
3. Creep and Fatigue Test (Virtual Lab IIT Bombay)
4. Fluorescence Microscope (Virtual Lab IIT Bombay)

Industrial Visits

To provide awareness and understanding of the course, Compulsory Industrial Visit must be arranged for the students.

The Industrial Visit must be preferably to

- Material & Metallurgy related like Engineering Cluster, NDT Lab, and Nearby NABL lab or
- Any manufacturing unit with material orientation

Student must submit a properly documented Industrial Visit Report.

Guidelines for Instructor's Manual

The Instructor's Manual should contain following related to every experiment:

1. Brief theory related to the experiment
2. Apparatus with their detailed specifications
3. Standard ASME/ IS numbers of test procedure
4. Schematic, Layout/diagram
5. Observation table/graphs.
6. Sample calculations for one/two reading
7. Result table, Graph and Conclusions.
8. 3/4 questions related to the experiment
9. Relevance of practical in industry with recent software of image analysis

Guidelines for Student's Lab Journal

The Student's Lab Journal should contain following related to every experiment:

1. Theory related to the experiment
2. Apparatus with their detailed specifications
3. Schematic, Layout/diagram
4. Observation table/simulation plots/graphs
5. Sample calculations for one/two reading
6. Result table. Graph and Conclusions
7. 3/4 questions related to the experiment
8. Attach Photo of experiment or image related to Experiment

Guidelines for Lab/TW Assessment

1. There should be continuous assessment for the TW
2. Assessment must be based on understanding of theory, attentiveness during practical, and understanding
3. Session, how efficiently the student is able to do connections and get the results
4. Online evolutions of practical with objective type of Questions
5. Timely submission of journal

202047 - Kinematics of Machinery

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

Systems in Mechanical Engineering, Engineering Mathematics - I and II, Engineering Physics, Engineering Mechanics, Geometric Modeling & Drafting

Course Objectives

1. To make the students conversant with kinematic analysis of mechanisms applied to real life and industrial applications.
2. To develop the competency to analyze the velocity and acceleration in mechanisms using analytical and graphical approach.
3. To develop the skill to propose and synthesize the mechanisms using graphical and analytical technique.
4. To develop the competency to understand & apply the principles of gear theory to design various applications.
5. To develop the competency to design a cam profile for various follower motions.

Course Outcomes

On completion of the course, learner will be able to

CO1. APPLY kinematic analysis to simple mechanisms
CO2. ANALYZE velocity and acceleration in mechanisms by vector and graphical method
CO3. SYNTHESIZE a four bar mechanism with analytical and graphical methods
CO4. APPLY fundamentals of gear theory as a prerequisite for gear design
CO5. CONSTRUCT cam profile for given follower motion

Course Contents

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

Kinematic link, Types of links, Kinematic pair, Types of constrained motions, Types of Kinematic pairs, Kinematic chain, Types of joints, Mechanism, Machine, Degree of freedom, Mobility of Mechanism, Inversion, Grashoff's law, Four-Bar Chain and its Inversions, Slider crank Chain and its Inversions, Double slider crank Chain and its Conversions, Mechanisms with Higher pairs, Equivalent Linkages and its Cases - Sliding Pairs in Place of Turning Pairs, Spring in Place of Turning Pairs, Cam Pair in Place of Turning Pairs

Unit II **Kinematic Analysis of Mechanisms: Analytical Method** **[07 Hr.]**

Analytical methods for displacement, velocity and acceleration analysis of slider crank Mechanism, Velocity and acceleration analysis of Four-Bar and Slider crank mechanisms using Vector and Complex Algebra Methods. Computer-aided Kinematic Analysis of Mechanism like Slider crank and Four-Bar mechanism, Analysis of Single and Double Hook's joint

Unit III **Kinematic Analysis of Mechanisms: Graphical Method** **[08 Hr.]**

Displacement, velocity and acceleration analysis mechanisms by Relative Velocity Method (Mechanisms up to 6 Links), Instantaneous Centre of Velocity, Kennedy's Theorem, Angular Velocity ratio Theorem, Analysis of mechanism by ICR method (Mechanisms up to 6 Links), Coriolis component of Acceleration (Theoretical treatment only)

Unit IV **Synthesis of Mechanisms** **[07 Hr.]**

Steps in Synthesis: Type synthesis, Number Synthesis, Dimensional synthesis, Tasks of Kinematic synthesis - Path, function and motion generation (Body guidance), Precision Positions, Chebychev spacing, Mechanical and structural errors

Graphical Synthesis: Inversion and relative pole method for three position synthesis of Four-Bar and Single Slider Crank Mechanisms

Analytical Synthesis: Three position synthesis of Four-Bar mechanism using Freudenstein's equation, Blotch synthesis

Unit V **Kinematics of Gears** **[08 Hr.]**

Gear: Classification

Spur Gear: Terminology, law of gearing, Involute and cycloidal tooth profile, path of contact, arc of contact, sliding velocity, Interference and undercutting, Minimum number of teeth to avoid interference, Force Analysis (theoretical treatment only)

Helical and Spiral Gears: Terminology, Geometrical Relationships, virtual number of teeth for helical gears

Bevel Gear & Worm and Worm Wheel: Terminology, Geometrical Relationships

Gear Train: Types, Analysis of Epicyclic gear Trains, Holding torque - simple, compound and Epicyclic gear Trains, Torque on Sun and Planetary gear Train, compound Epicyclic gear Train

Unit VI **Mechanisms in Automation Systems** **[08 Hr.]**

Cams & Followers: Introduction, Classification of Followers and Cams, Terminology of Cam Displacement diagram for the Motion of follower as Uniform velocity, Simple Harmonic Motion (SHM), Uniform Acceleration and Retardation Motion (UARM), Cycloid motion, Cam Profile construction for Knife-edge Follower and Roller Follower, Cam jump Phenomenon

Automation: Introductions, Types of Automation

Method of Work Part Transport: Continuous transfer, Intermittent or Synchronous Transfer, Asynchronous transfer, Different type of transfer mechanisms - Linear transfer mechanisms and Rotary transfer mechanisms

Automated Assembly-Line: Types, Assembly line balancing Buffer Storages, Automated assembly line for car manufacturing, Artificial intelligence in automation

Books & Other Resources

Text Books

1. S. S. Rattan, "Theory of Machines", Third Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi.
2. Bevan T, "Theory of Machines", Third Edition, Longman Publication
3. G. Ambekar, "Mechanism and Machine Theory", PHI
4. J. J. Uicker, G. R. Pennock, J. E. Shigley, "Theory of Machines and Mechanisms", Fifth Edition, International Student Edition, Oxford

Reference Books

1. Paul E. Sandin, "Robot Mechanisms and Mechanical Devices Illustrated", Tata McGraw Hill Publication
2. Stephen J. Derby, "Design of Automatic Machinery", 2005, Marcel Dekker, New York
3. Neil Sclater, "Mechanisms and Mechanical Devices Sourcebook", Fifth Edition, Tata McGraw Hill Publication
4. Ghosh Malik, "Theory of Mechanism and Machines", East-West Pvt. Ltd.
5. Hannah and Stephans, "Mechanics of Machines", Edward Arnolde Publication
6. R. L. Norton, "Kinematics and Dynamics of Machinery", First Edition, McGraw Hill Education (India) P Ltd. New Delhi
7. Sadhu Singh, "Theory of Machines", Pearson
8. Dr. V. P. Singh, "Theory of Machine", Dhanpatrai and Sons
9. C. S. Sharma & Kamlesh Purohit, "Theory of Machine and Mechanism", PHI
10. M.P. Groover, "Automation, production systems and computer-integrated manufacturing", Prentice-Hall of India Pvt. Ltd, New Delhi

Web References

1. https://nptel.ac.in/courses/112104121/ (NPTEL1, Kinematics of Machines, Prof. Ashok K Mallik, IIT Kanpur)
2. https://nptel.ac.in/courses/112/106/112106270/ (NPTEL2, Theory of Mechanism, Prof. Sujatha Srinivasan, IIT Madras)
3. https://nptel.ac.in/courses/112/105/112105268/ (NPTEL3, Kinematics of Mechanisms and Machines, Prof. Anirvan DasGupta, IIT Kharagpur)

4. https://nptel.ac.in/courses/112/105/112105236/ (NPTEL4, Mechanism and Robot Kinematics, Prof.Anirvan DasGupta, IIT Kharagpur)
5. http://www.cdeep.iitb.ac.in/webpage_data/nptel/Mechanical/Robotics Course/Course_home_lect1.html (NPTEL5, Introduction to Robotics and Automation, IIT Bombay)

Guidelines for Laboratory Conduction

The student shall complete the following activity as a Term Work

Total 10 experiments from the following list must be performed. Term Work of the Student is evaluated based on the completion of Practical, Assignments using Drawing Aids, Assignments using Software & Programming Languages, Assignments using Virtual Laboratory and Detailed Industrial Visit Report.

Practical *(Experiment # 1 is compulsory and Select any Two from Experiment # 2 to 4)*

1. To make a model of any mechanism by using waste material by the group of 4 to 6 students and to give a presentation using PPTs.
2. Speed and torque analysis of epicyclic gear train to determine holding torque.
3. To study and verify cam jump phenomenon.
4. To study manufacturing of gear using gear generation with rack as a cutter and to generate an involute profile.

Assignments using Drawing Aids *(Experiment #1 to 3 and 6 are compulsory and Select any One from Experiment #4-5)*

Do following graphical assignments on Half Imperial drawing sheet:

1. Identify mechanisms in real life and Analyze for types and number of links, pairs, obtain degrees of freedom. Submit the sheet and working video of the mechanism.
2. To solve two problems on velocity and acceleration analysis using relative velocity and acceleration method.
3. To solve two problems on velocity analysis using the ICR method.
4. To draw conjugate profile for any general type of gear tooth.
5. To study various types of gearboxes.
6. To draw cam profile for any two problems with combination of various follower motion with radial and off-set cam.

Assignments using Software *(Any Three Assignments - Minimum one computer programming based and Minimum one based on use of software)*

Do following assignments by using Software or by using Coding/Programming Languages:

1. To design a simple Planer Mechanism by using any software (Geogebra, SAM, Working Model, any 3D Modelling Software, etc.)
2. To do computer programming (using software/programming languages like C, Python, Scilab, Matlab etc.) for Kinematic Analysis of Slider Crank Mechanism using Analytical Method
3. To do computer programming (using software/programming languages like C, Python, Scilab, Matlab etc.) for Kinematic Analysis of Hooke's joint Mechanism using Analytical Method
4. To generate a Cam Profile using any Modelling Software (Mech Analyser, any 3D Modelling Software)
5. To synthesize the Four-Bar and Slider Crank Mechanism (Geogebra, SAM, any 2D/3D Modelling Software)
6. To do computer programming (using software/programming languages like C, Python, Scilab, Matlab etc.) for the Synthesis of Mechanism using Chebychevs spacing, Freudensteins equation and function generation

Assignments using Virtual Laboratory *(minimum Two experiments)*

Please visit the links given below for exploring experiments on Kinematics of Machinery using Virtual Laboratory. Write a Brief Reports of using Virtual Laboratory to perform following assignment:

1. Mechanics-of-Machines Lab (All Experiments), http://mm-nitk.vlabs.ac.in/index.html
2. Mechanisms and Robotics - Oldham Coupling Mechanism, http://vlabs.iitkgp.ernet.in/mr/index.html
3. Mechanisms and Robotics - Quick Return Mechanism, http://vlabs.iitkgp.ernet.in/mr/index.html

4. Mechanisms and Robotics - CAM Follower Mechanism, http://vlabs.iitkgp.ernet.in/mr/index.html

Industrial Visits

A Compulsory industrial visit must be arranged to industries/ establishments consisting automation and mechanization during semester to provide awareness and understanding of the course.

The Industrial Visit must be preferably to

- Manufacturing industries with Assembly-line Automation
- Sugar factory
- Bottle filling plants

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

Assignments on Content beyond syllabus

Following assignments can be attempted:

1. Forward and Inverse Kinematics of 2R/2P/RP/PR Manipulators using Software (Geogebra, RoboAnalyser, Vlab, etc.)
2. Kinematic Analysis of 6 DOF Industrial Robot using Software (RoboAnalyzer, Vlab, etc.)