**Supporting Documents for**

# 2.6 Student Performance and Learning Outcome

## 2.6.1
*Teachers and Students are aware of the stated Programme and Course Outcomes (COs) for all Programmes offered by the institution.*

# INDEX

# *Institute Website Displays Course Outcomes and Program Outcomes*

# Course Outcomes and Program Outcomes Displayed on Institute Website
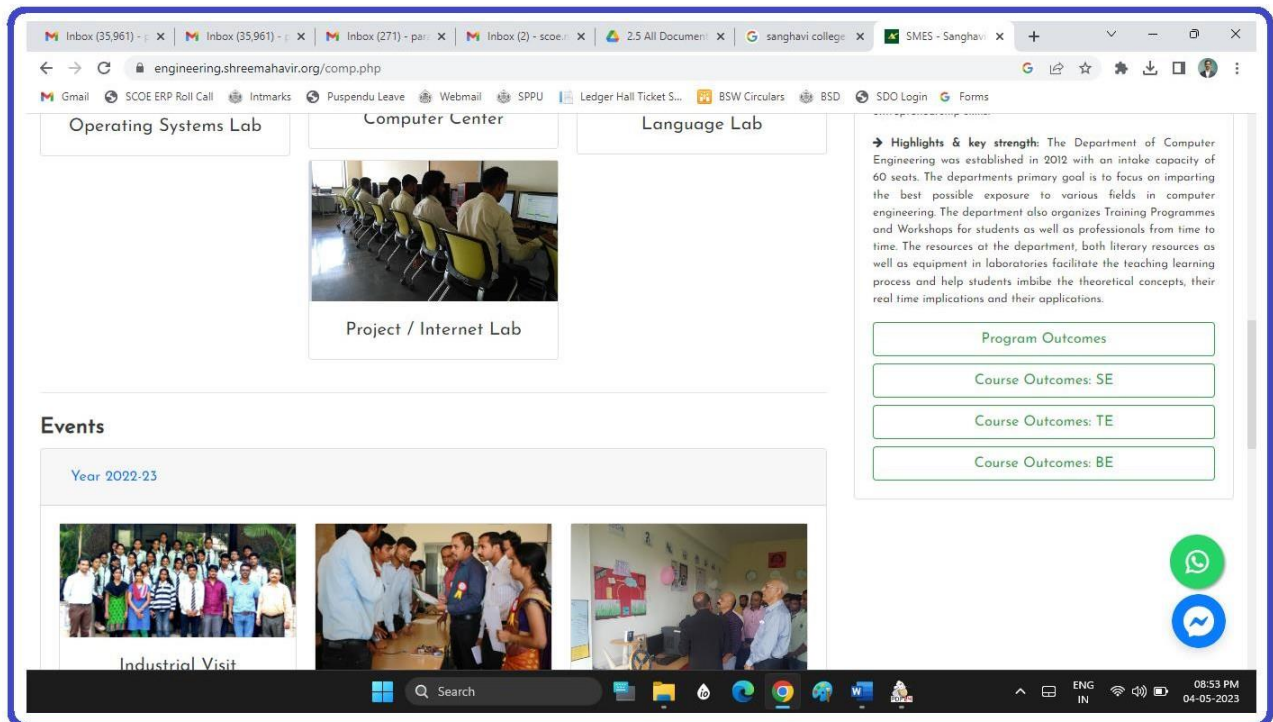


# Program Outcomes

**Computer Engineering POs:**

https://engineering.shreemahavir.org/POs_COs/Comp%20PO.pdf

# Course Outcomes

**SE Computer COs:**
https://engineering.shreemahavir.org/POs_COs/Comp%201.%20SE%20Cos.pdf

**TE Computer COs:**
https://engineering.shreemahavir.org/POs_COs/Comp%202.%20TE%20Cos.pdf

**BE Computer COs:**
https://engineering.shreemahavir.org/POs_COs/Comp%203.%20BE%20Cos.pdf

# *Course Outcomes attached in Course Files*

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

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

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

**Course Outcomes:** On completion of the course, learner will be able to
- CO1. **ANALYZE & APPLY** the modes of heat transfer equations for one dimensional thermal system.
- CO2. **DESIGN a** thermal system considering fins, thermal insulation and & Transient heat conduction.
- CO3. **EVALUATE** the heat transfer rate in natural and forced convection & validate with experimentation results.
- CO4. **INTERPRET** heat transfer by radiation between objects with simple geometries, for black and grey surfaces.
- CO5. **ABILITY** to analyze the rate of mass transfer using Fick's Law of Diffusion and understands mass diffusion in different coordinate systems.
- CO6. **DESIGN & ANALYSIS** of heat transfer equipments and investigation of its performance.

| Course Contents | | |
|---|---|---|
| **Unit 1** | **Fundamentals of Heat Transfer** | 08 Hrs. |

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

## 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.

# *Display of COs, POs at Respective Departments*

Department of Mechanical Engineering

GENERAL

ACADEMICS

EXAMINATION

Course Outcomes

# *Syllabus Copies showcasing Course Outcomes*
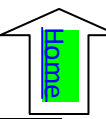
## Savitribai Phule Pune University
## Bachelor of Computer Engineering
## Program Outcomes (POs)

**Learners are expected to know and be able to–**

| | | |
|---|---|---|
| PO1 | **Engineering knowledge** | Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems. |
| PO2 | **Problem analysis** | Identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics natural sciences, and Engineering sciences. |
| PO3 | **Design / Development of Solutions** | Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations. |
| PO4 | **Conduct Investigations of Complex Problems** | Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| PO5 | **Modern Tool Usage** | Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations. |
| PO6 | **The Engineer and Society** | Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| PO7 | **Environment and Sustainability** | Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |
| PO8 | **Ethics** | Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice. |
| PO9 | **Individual and Team Work** | Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| PO10 | **Communication Skills** | Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| PO11 | **Project Management and Finance** | Demonstrate knowledge and understanding of the Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary Environments. |
| PO12 | **Life-long Learning** | Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |

## Program Specific Outcomes (PSO)

| | | |
|---|---|---|
| PSO1 | **Professional Skills**-The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexities. | |
| PSO2 | **Problem-Solving Skills**- The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success. | |
| PSO3 | **Successful Career and Entrepreneurship**- The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies. | |

Home
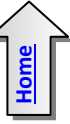
| Savitribai Phule Pune University<br>Second Year of Computer Engineering (2019 Course)<br>210245: Digital Electronics and Logic Design | | |
|---|---|---|
| **Teaching Scheme:** | **Credit** | **Examination Scheme:** |
| TH:     03 Hours/Week | 03 | Mid_Semester(TH):  30 Marks<br>End_Semester(TH):  70 Marks |

**Prerequisite Courses, if any:** 104010 Basic Electronics Engineering

**Companion Course, if any:** 210249 Digital Electronics Lab

**Course Objectives:**
- To study number systems and develop skills for design and implementation of combinational logic circuits and sequential circuits
- To understand the functionalities, properties and applicability of Logic Families.
- To introduce programmable logic devices and ASM chart and synchronous state machines.
- To basics of microprocessor.

**Course Outcomes:**
On completion of the course, learner will be able to–
    CO1:  Simplify Boolean Expressions using K Map.
    CO2:  Design and implement combinational circuits.
    CO3:  Design and implement sequential circuits.
    CO4:  Develop simple real-world application using ASM and PLD.
    CO5:  Choose appropriate logic families IC packages as per the given design  specifications.
    CO6:  Explain organization and architecture of computer system

## Course Contents

| **Unit I** | **Minimization Technique** | **(06 Hours)** |
|---|---|---|

Logic Design Minimization Technique -: Minimization of Boolean function using K-map(up to 4 variables) and Quine Mc-Clusky Method, Representation of signed number- sign magnitude representation ,1's complement and 2's complement form (red marked can be removed), Sum of product and Product of sum form, Minimization of SOP and POS using K-map.

| **#Exemplar/Case Studies** | Digital locks using logic gates |
|---|---|
| **Mapping of Course Outcomes for Unit I** | CO1 |

| **Unit II** | **Combinational Logic Design** | **(06 Hours)** |
|---|---|---|

Code converter -: BCD, Excess-3, Gray code, Binary Code. Half- Adder, Full Adder, Half Subtractor, Full Subtractor, Binary Adder (IC 7483), BCD adder, Look ahead  carry generator, Multiplexers (MUX): MUX (IC 74153, 74151), Cascading multiplexers, Demultiplexers (DEMUX)- Decoder (IC 74138, IC 74154), Implementation of SOP and POS using MUX, DMUX, Comparators (2 bit), Parity generators and Checker.

| **#Exemplar/Case Studies** | Combinational Logic Design of BCD to 7-segment display Controller |
|---|---|
| **Mapping of Course Outcomes for Unit II** | CO1, CO2 |

| **Unit III** | **Sequential Logic Design** | **(06 Hours)** |
|---|---|---|

Flip-Flop: SR, JK,D,T; Preset &Clear, Master Slave JK Flip Flops, Truth Tables and Excitation tables, Conversion from one type to another type of Flop Flop. Registers: SISO, SIPO, PISO, PIPO, Shift Registers, Bidirectional Shift Register, Ring Counter , Universal Shift Register Counters: Asynchronous Counter, Synchronous Counter, BCD Counter, Johnson Counter, Modulus of the counter ( IC 7490),Synchronous Sequential Circuit Design :Models- Moore and Mealy, State diagram and State Table ,Design Procedure, Sequence Generator and detector.

| #Exemplar/Case Studies | Electronic Voting Machine (EVM) |
|---|---|
| Mapping of Course Outcomes for Unit III | CO2,CO3 |

| Unit IV | Algorithmic State Machines and Programmable Logic Devices | (06 Hours) |
|---|---|---|

Algorithmic State Machines: Finite State Machines (FSM) and ASM, ASM charts, notations, construction of ASM chart and realization for sequential circuits.
PLDS:PLD, ROM as PLD, Programmable Logic Array (PLA), Programmable Array Logic (PAL), Designing combinational circuits using PLDs.

| #Exemplar/Case Studies | Wave form generator using MUX controller method |
|---|---|
| Mapping of Course Outcomes for Unit IV | CO2, CO3, CO4 |

| Unit V | Logic Families | (06 Hours) |
|---|---|---|

Classification of logic families:  Unipolar and Bipolar Logic Families, Characteristics of Digital ICs: Fan-in, Fan-out, Current and voltage parameters, Noise immunity, Propagation Delay, Power Dissipation, Figure of Merits, Operating Temperature Range, power supply requirements.
Transistor-Transistor Logic: Operation of TTL NAND Gate  (Two input ), TTL with active pull up, TTL with open collector output, Wired AND Connection, Tristate TTL Devices, TTL characteristics.
CMOS: CMOS Inverter, CMOS characteristics, CMOS configurations- Wired Logic, Open drain outputs.

| #Exemplar/Case Studies | To study the various basic gate design using  TTL/CMOS logic  family |
|---|---|
| Mapping of Course Outcomes for Unit V | CO3 |

| Unit VI | Introduction to Computer Architecture | (06 Hours) |
|---|---|---|

Introduction to Ideal Microprocessor – Data Bus, Address Bus, Control Bus. Microprocessor based Systems – Basic Operation, Microprocessor operation, Block Diagram of Microprocessor. Functional Units of Microprocessor – ALU using IC 74181, Basic Arithmetic operations using ALU IC 74181, 4-bit Multiplier circuit using ALU and shift registers. Memory Organization and Operations, digital circuit using decoder and registers for memory operations.

| #Exemplar/Case Studies | Microprocessor based system in Communication /Instrumentation Control |
|---|---|
| Mapping of Course Outcomes for Unit VI | CO2, CO3, CO6 |

## Learning Resources

### Text Books:
1. Modern Digital Electronics by R.P.Jain, 4$^{th}$ Edition, ISBN 978-0-07-06691-16 Tata McGraw Hill
2. Digital Logic and Computer Design by Moris Mano, Pearson , ISBN 978-93-325-4252-5

### Reference Books:
1. John Yarbrough, —Digital Logic applications and Design, Cengage Learning, ISBN – 13: 978-81-315-0058-3
2. D. Leach, Malvino, Saha, —Digital Principles and Applications , Tata McGraw Hill, ISBN – 13:978-0-07-014170-4.
3. Anil Maini, —Digital Electronics: Principles and Integrated Circuits , Wiley India Ltd, ISBN:978-81-265-1466-3.
4. Norman B & Bradley, —Digital Logic Design Principles, Wiley India Ltd, ISBN:978-81-265-1258-

### MOOC Courses:
1. Digital Circuits, by Prof. Santanu Chattopadhyay , https://swayam.gov.in/nd1_noc19_ee51/preview
2. Digital Circuits and Systems , Prof. S. Srinivasan https://nptel.ac.in/courses/117/106/117106086/

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

# 203142: Material Science

| Teaching Scheme<br>**Lecture** : 03 Hrs/ Week<br>**Practical** : 04 Hrs/ Week | Credits<br>**Th**: 03<br>**PR**:02 | Examination Scheme [Marks]<br>**In Sem** : 30 Marks<br>**End Sem** : 70 Marks<br>**Term Work**: 25 Marks<br>**Oral** : 25 Marks |
|---|---|---|

**Prerequisite:**

Students should have knowledge of various classes of materials like solid, liquid, gaseous, conducting, insulating, magnetic and resistive along with their basic characteristics.

**Course Objectives:** The course aims to :

1. Explain classification,properties and characteristics of electrical engineering materials.
2. Describe applications and measuring methods for parameters of dielectric, insulating, magnetic, conducting and resistive materials.
3. Illustrate solving of simple problems based on dielectric, magnetic and conducting materials.
4. Impart knowledge of Nano-technology to electrical engineering.5. Demonstrate testing methods of dielectric, insulating, magnetic, conducting and resistive materials as per IS.
5. Enable students to create self learning resource material through active learning based on practical /case study/assignments.

**Course Outcomes:**

Upon successful completion of this course, the students will be able to :

**CO1**: Discuss classification,properties and characteristics of different electrical engineering materials.

**CO2**: State various applicationsmeasuring methods for parameters of different classes of electrical engineering materials.

**CO3**: Solve simple problems based on dielectric, magnetic and conducting materials.

**CO4**: Apply knowledge of Nano-technology to electrical engineering.

**CO5**: Execute tests ondielectric, insulating, magnetic, conducting, resistive materials as per IS to decide the quality of thematerials.

**CO6**: Create learning resource material ethically to demonstrate **self learning leading to** lifelong learning skills and usage of ICT/ online technology through collaborative/active learning activities.

**Unit 01: Dielectric Properties of Insulating Materials:** (6 Hrs)

Static Field, Parameters of Dielectric material [Dielectric constant, Dipole moment, Polarization, Polarizability], Introduction to Polar and Non- Polar dielectric materials. Mechanisms of Polarizations-Electronic, Ionic and Orientation Polarization (descriptive treatment only), Clausius Mossotti Equation, Piezo-Electric, Pyro-Electric & Ferro-Electric Materials, Dielectric loss and loss tangent, Concept of negative tan delta.

**Unit 02: A) Dielectric Breakdown:** (2 Hrs) Introduction, Concept of Primary and Secondary Ionization of Gases (descriptive treatment only), Breakdown Voltage, Breakdown Strength, Factors affecting Breakdown Strengths of Solid, Liquid and Gaseous dielectric materials.

**Unit 02: B) Testing of Materials:** (4Hrs)Explanation of following with objectives, equipment required, circuit diagrams and observations to be taken.
1.  Measurement of dielectric loss tangent (tan δ) by Schering Bridge-IS 13585-1994.
2.  Measurement of dielectric strength of solid insulating material-IS 2584.
3.  Measurement of dielectric strength of liquid insulating material -IS 6798.
4.  Measurement of dielectric strength of gaseous insulating material as per IS.

**Unit 03 : Insulating Materials, Properties & Applications:** (6 Hrs)

Introduction, Characteristics of Good Insulating Material, Classification, Solid Insulating Materials-Paper, Press Board, Fibrous Materials, Ceramics, Mica, Asbestos, Resins, Liquid Insulating Materials such as Transformer Oil, Varnish, Askarel. Insulating Gases like Air, $SF_6$.

Insulating Materials for Power and Distribution Transformers, Rotating Machines, Capacitors, Cables, Line Insulators and Switchgears.

## Unit 04 : Magnetic Materials: (6 Hrs)

Introduction, Parameters of Magnetic material [Permeability, Magnetic Susceptibility, Magnetization], Classification of Magnetic Materials, Diamagnetism, Paramagnetism, Ferromagnetism, Ferri-magnetism, Ferro-magnetic behavior below Critical Temperature, Spontaneous Magnetization, Anti-ferromagnetism, Ferrites, Applications of Ferro magnetic Materials, Magnetic materials for Electric Devices such as Transformer Core, Core of Rotating Machines, Soft Magnetic Materials, Hard Magnetic Materials.

## Unit 05 : Conducting Materials: (6 Hrs)

General Properties of Conductor, Electrical Conducting Materials - Copper, Aluminum and its applications, Materials of High and Low Resistivity-Constantan, Nickel-Chromium Alloy, Tungsten, Kanthal, Silver and Silver alloys, Characteristics of Copper Alloys (Brass & Bronze), Electrical Carbon Materials. Materials used for Lamp Filaments, Solders, Metals and Alloys for different types of Thermal Bimetal and Thermocouples.

## Unit 06 : Nanotechnology: (6 Hrs)

Introduction, Concepts of Energy bands and various Conducting Mechanism in Nano-structures, Carbon Nano-structures, Carbon Molecules, Carbon Clusters, Carbon Nano-tubes and applications. Special Topics in Nano Technology such as Single Electron Transistor, Molecular Machines, BN Nanotubes, Nano wires. Nano materials used in Batteries, Photovoltaic Cells and in Supercapacitors.

## Industrial Visit:

Minimum one visit should be arranged to an industry related to manufacturing of batteries, capacitors, cables, transformers, motors (Any one industry). A hand written report should be submitted by every student as a part of term work

**\*Guidelines for TW Assessment will be given later.**
There is **Term Work of 25 marks** for the subject.
Practical section will comprise of two parts: (Refer SE Structure 2019 Pattern)
**PART A:** 2 Hours per week:
Regular curriculum listed practical total 12 numbers out of which conduction of 8 numbers will be mandatory. Out of 25 marks of Term Work, **15 Marks** will be based on continuous assessment that should be carried out such as checking of previous experiment along with its mock oral session (minimum 4-5 questions to each student), while conducting new experiment.
**PART B:** 2 Hours a week:
Practical/case studies/assignments to enable active learning based on advances related to subject to bridge gap between curriculum and enhance practical knowledge required in field. **10 Marks**

## List of Experiments:

**Part A:** Term Work **(TW): 15 Marks**
**List of total 12 numbers of experiments out of which conduction of 8 numbers of experiments will be mandatory.**

1. To measure dielectric strength of solid insulating material-IS 2584.
2. To measure dielectric strength of liquid insulating material-IS 6789.
3. To measure dielectric strength of gaseous insulating material as per IS using Sphere Gap-Unit.
4. To obtain hysteresis loop of the ferromagnetic material.
5. To understand the principle of thermocouple and to obtain characteristics of different thermocouples.
6. To measure insulation resistance and kVAr capacity of power capacitor.
7. To measure resistivity of high resistive alloys.
8. To observe development of tracks due to ageing on different insulating materials e.g. Bakelite, Perspex, polyesters, Mica, Fiberglass etc.
9. Testing of resins and polymers.
10. Measurement of Tangent of Dielectric Loss Angle (tan δ) of solid/liquid dielectric materials.
11. Measurement of Flux Density by Gauss-meter.
12. Write report on visit to an industry related to manufacturing of batteries, capacitors, cables,

transformers (Any one industry).

**List of Experiments: Part B:Part B :**2 Hours per week (**Term Work(TW) : 10 Marks**) (**Total 6 activities from the list below are mandatory for evaluation of Term Work for Part B. Activity numbers 1, 4 and 6 are compulsory**)

Practical/case studies/assignments to enable self,active, collaborative **learning leading to** lifelong learning, based on advances related to subject to bridge gap between curriculum and enhance application knowledge of the subject.

Guidance/monitoring/assessment/presentation/field visits /expert sessions related activity can be carried out in **'Part B'** practical schedules .

1) Review of research/on line literature from latest journal papers /transactions related to different insulating, magnetic, semiconducting and conducting materials, advanced material developments and their applications. Draft of paper, presentation among students, in conference /publishing it.

2) Detailed case study of complete insulation system in transformer, comparison of various types of solid, liquid materials and study of recent advances related with major and minor insulating materials.

3) Detailed study of patents on caster oil used in transformer, its properties and comparison with other liquid insulating material.

4) Mini project on development of prototype of various electrical gadgets right from draft of specifications,design, selection of conducting, magnetic and insulating material.

5) Testing and diagnosis of induction motor, cable, transformer insulation by measurement of Polarization index, Dielectric Absorption Ratio, Step Voltage, dielectric discharge and ramp testing using 5/10KV IR Tester.

6) Laboratory visits/survey/role play/games/debates/any activity focusing collaborative, student centrist, active learning on Industrial/ Social/ Sustainability/ Public Health/ Safety/Ethical/Cultural/ Societal and Environmental aspects related to advanced materials Presentations of industrial case studies related with material science.

7) Two - Three household appliances like mixer -motor, ceiling fan- motor etc can be opened up by students either individually or by group of students and analyzed w.r.t. the materials found in it. Name each material used and to which category of materials does it belong, other applications of the same materials can be listed.

8) Detailed study of insulation system of resin casted transformer, comparison of various resins, study of testing of insulation system with applicable IS/IEC /IEEE standards

9) Visit to NABL accredited Laboratory to study testing of oil for DGA, furan analysis, study of equipment's used, test procedure and applicable IS/IEEE/IEC standard and recommended limits.

10) Discussions/Presentations/any activity using or related to IS/ IEC /IEEE standards/Recent Patents related with insulating, conducting and magnetic materials .

11) Case study on failure modes of various insulating materials and measures to reduce failure. Recent advancement in testing and diagnostic of solid and liquid insulating materials.

12) Case study on recent advancement of magnetic materials, high temperature superconductors and its applications.

13) Any activity using advanced ICT tool like Virtual Labs/animations/simulations/advanced software/on line certificate course like NPTEL/on line quiz etc related to curriculum.

**Guidelines for Instructor's Manual - Practical Sessions**
Instructor's Manual should contain following things related to every experiment-
1. The circuit diagram of the experiment should be drawn at the start.
2. Aim, apparatus, theory related to that experiment should be written.
3. One sample calculation should be shown, result table should be made and graph should be plotted if required.
4. Conclusion based on calculations, result and graph (if any) should be written.
5. Five - six questions based on that experiment should be written at the end.

**Guidelines for Student's Lab Journal**
Student's Lab Journal should be **Hand Written/ Drawn** containing, following things related to

every experiment-
1. The circuit diagram of the experiment should be drawn on the graph paper at the start of the experiment.
2. Aim, apparatus, theory related to that experiment should be written.
3. One sample calculation should be shown, result table should be made and graph should be plotted if required.
4. Conclusion based on calculations, result and graph (if any) should be written.
5. Students should write answers to five - six questions based on that experiment at the end.

**Guidelines for Laboratory Conduction**
1. The circuit diagram should be explained to students in such a way that they should be able to develop it at their own.
2. Detail explanation of the experiment along with its circuit diagram, observation table, calculations, result table and plotting of graphs (if any).
3. While conducting new experiment, assessment of previous experiment should be carried out by its checking along with its mock oral session (minimum 4 -5 questions to each student).

**Text Books:**
[T1] "A Course in Electrical Engineering Materials", by S.P. Seth, Dhanpat Rai and Sons publication.
[T2] A Textbook of "Electrical Engineering Materials" by R.K.Rajput, Laxmi Publications (P) Ltd.
[T3] "Electrical Engineering Materials", by T.T.T.I, Madras.
[T4] "Electrical Engineering Materials", by K. B. Raina and S. K. Bhattacharya, S. K. Kataria Sons.
[T5] "Material Science for Electrical Engineering", by P.K. Palanisamy, Scitech Pub. Pvt. Ltd., Chennai (India).
[T6] "Introduction to Nanotechnology" by Charles P. Poole, Jr. Frank & J. Ownes (Wiley Student Edition)

**Reference Books:**
[R1] "Electrical Power Capacitors-Design & Manufacture", by D. M. Tagare, Tata McGraw Hill Publication.
[R2] "Electrical Engineering Materials", by S. P. Chalotra and B. K. Bhattacharya, Khanna Publishers, Nath Market.
[R3] "Electrical Engineering Materials", by C. S. Indulkar and S. Thiruvengadam, S. Chand and Company Ltd.
[R4] "High Voltage Engineering" by Kamraju and Naidu, Tata McGraw Hill Publication.
[R5] "Introduction to Material Science for Engineering", Sixth Edition by James F. Shackelford & M. K. Muralidhara, Pearson Education.
[R6] "Insulation Technology Course Material" of IEEMA Ratner, Pearson Education.
[R7] "Materials Science for Engineering Students", by Traugott Fischer, Elsevier Publications.
[R8] "Energy Conversion Systems", by Rakosh Das Begamudre, New Age International Publishers.
[R9] "Advanced Nanomaterials and Their Applications in Renewable Energy", by Jingbo Louise Liu, Sajid Bashir, ELSEVIER Publications.

| Unit No. | Text Book | Reference Book |
|---|---|---|
| 1 | T1, T2 | R1, R3, R8 |
| 2 | T1, T2, T3 | R1, R2, R4 |
| 3 | T1, T2, T3, T4 | R1, R3, R4, R6 |
| 4 | T1, T2, T3, T4 | R3, R5 |
| 5 | T1, T2, T4 | R7, R8 |
| 6 | T6 | R9 |
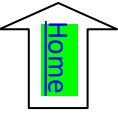
## Savitribai Phule Pune University
## Fourth Year of Computer Engineering (2019 Course)
## 410241: Design and Analysis of Algorithms

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

**Prerequisites Courses:** Discrete Mathematics (210241), Fundamentals of Data Structures(210242, Data Structures and Algorithms(210252), Theory of Computation ( 310242)

**Companion Course:** Laboratory Practice III(410246)

**Course Objectives:**
- To develop problem solving abilities using mathematical theories.
- To apply algorithmic strategies while solving problems.
- To analyze performance of different algorithmic strategies in terms of time and space.
- To develop time and space efficient algorithms.
- To study algorithmic examples in distributed and concurrent environments
- To Understand Multithreaded and Distributed Algorithms

**Course Outcomes:**

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

**CO1: Formulate** the problem

**CO2: Analyze** the asymptotic performance of algorithms

**CO3:** Decide and **apply** algorithmic strategies to solve given problem

**CO4: Find** optimal solution by applying various methods

**CO5: Analyze** and **Apply** Scheduling and Sorting Algorithms.

**CO6: Solve** problems for multi-core or distributed or concurrent environments

## Course Contents

| Unit I | Algorithms and Problem Solving | 07 Hours |
|---|---|---|

Algorithm: The Role of Algorithms in Computing - What are algorithms, Algorithms as technology, Evolution of Algorithms, Design of Algorithm, Need of Correctness of Algorithm, Confirming correctness of Algorithm – sample examples, Iterative algorithm design issues.
Problem solving Principles: Classification of problem, problem solving strategies, classification of timecomplexities (linear, logarithmic etc.)

| #Exemplar/Case Studies | Towers of Hanoi |
|---|---|
| *Mapping of Course Outcomes for Unit I | CO1,CO3 |

| Unit II | Analysis of Algorithms and Complexity Theory | 07 Hours |
|---|---|---|

Analysis: Input size, best case, worst case, average case
Counting Dominant operators, Growth rate, upper bounds, asymptotic growth, $O$, $\Omega$, $\Theta$, $o$ and $\omega$ notations, polynomial and non-polynomial problems, deterministic and non-deterministic algorithms, P- class problems, NP-class of problems, Polynomial problem reduction NP complete problems- vertex cover and 3-SAT and NP hard problem - Hamiltonian cycle.

| #Exemplar/Case Studies | Analysis of iterative and recursive algorithm |
|---|---|

| **\*Mapping of Course Outcomes for Unit II** | CO2 |
|---|---|

| **Unit III** | **Greedy And Dynamic Programming algorithmic Strate** | **08 Hours** |
|---|---|---|

Greedy strategy: Principle, control abstraction, time analysis of control abstraction, knapsack problem,scheduling algorithms-Job scheduling and activity selection problem.
Dynamic Programming: Principle, control abstraction, time analysis of control abstraction, binomialcoefficients, OBST, 0/1 knapsack, Chain Matrix multiplication.

| **#Exemplar/Case Studies** | Rail tracks connecting all the cities |
|---|---|
| **\*Mapping of Course Outcomes for Unit III** | CO3, CO4 |

| **Unit IV** | **Backtracking and Branch-n-Bound** | **08 Hours** |
|---|---|---|

Backtracking: Principle, control abstraction, time analysis of control abstraction, 8-queen problem,graph coloring problem, sum of subsets problem.
Branch-n-Bound: Principle, control abstraction, time analysis of control abstraction, strategies- FIFO,
LIFO and LC approaches, TSP, knapsack problem.

| **#Exemplar/Case Studies** | Airline Crew Scheduling |
|---|---|
| **\*Mapping of Course Outcomes for Unit IV** | CO3, CO4 |

| **Unit V** | **Amortized Analysis** | **07 Hours** |
|---|---|---|

Amortized Analysis: Aggregate Analysis, Accounting Method, Potential Function method, Amortized analysis-binary counter, stack Time-Space tradeoff, Introduction to Tractable and Non-tractable Problems, Introduction to Randomized and Approximate algorithms, Embedded Algorithms: Embedded system scheduling (power optimized scheduling algorithm), sorting algorithm for embedded systems.

| **#Exemplar/Case Studies** | cutting stock problem |
|---|---|
| **\*Mapping of Course Outcomes for Unit V** | CO3,CO5 |

| **Unit VI** | **Multithreaded And Distributed Algorithms** | **07 Hours** |
|---|---|---|

Multithreaded Algorithms - Introduction, Performance measures, Analyzing multithreaded algorithms,Parallel loops, Race conditions.
Problem Solving using Multithreaded Algorithms  - Multithreaded matrix multiplication, Multithreadedmerge sort.
Distributed Algorithms - Introduction, Distributed breadth first search, Distributed Minimum SpanningTree.
String Matching- Introduction, The Naive string matching algorithm, The Rabin-Karp algorithm.

| **#Exemplar/Case Studies** | Plagiarism detection |
|---|---|

| **\*Mapping of Course Outcomes for UnitVI** | CO6 |
| --- | --- |

| **Learning Resources** | #12/128 |
| --- | --- |
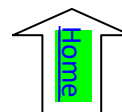
**Text Books:**
1. Parag Himanshu Dave, Himanshu Bhalchandra Dave, ―Design And Analysis of Algorithms‖,Pearson Education, ISBN 81-7758-595-9
2. Gilles Brassard, Paul Bratley, ―Fundamentals of Algorithmics‖, PHI, ISBN 978-81-203-1131-2

**Reference Books :**

1. Michael T. Goodrich, Roberto Tamassia, ―Algorithm Design: Foundations,‖ Analysis and InternetExamples‖, Wiley, ISBN 978-81-265-0986-7
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, ―Introduction toAlgorithms‖, MIT Press; ISBN 978-0-262-03384-8
3. Horowitz and Sahani, "Fundamentals of Computer Algorithms", University Press, ISBN: 978 817371 6126, 81 7371 61262
4. Rajeev Motwani and Prabhakar Raghavan, ‒Randomized Algorithms‖ Cambridge University Press, ISBN: 978-0-521-61390-3
5. Dan Gusfield, ‒Algorithms on Strings, Trees and Sequences‖, Cambridge University Press,ISBN:0-521-67035-7

**e-B ooks :**
1. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/design_and_analysis_of_algorithms_tutorial.pdf
2. https://www.ebooks.com/en-in/book/1679384/algorithms-design-techniques-and-analysis/m-h-alsuwaiyel

**MOOC Courses links :**
- Design and Analysis of Algorithms - https://nptel.ac.in/courses/106106131

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

## Savitribai Phule Pune University
## Fourth Year of Computer Engineering (2019 Course)
## Elective IV
## 410245 (D): Software Testing and Quality Assurance

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

**Prerequisite Courses:** Software Engineering (210253), Software Project Management(310245(D))

**Companion Course**: **Lab Practice IV**

**Course Objectives:**

- Introduce basic concepts of software testing.
- Understand the best way to increase the effectiveness, test coverage, and execution speed in software testing.
- Understand white box, block box, object oriented, web based and cloud testing.
- Understand the importance of software quality and assurance software systems development.
- Know in details automation testing and tools used for automation testing.
- To learn and understand the combination of practices and tools that are designed to help QAprofessionals test more efficiently.

**Course Outcomes:**

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

**CO1: Describe** fundamental concepts in software testing such as manual testing, automation testingand software quality assurance.

**CO2: Design and Develop** project test plan, design test cases, test data, and conduct test operations.

**CO3: Apply** recent automation tool for various software testing for testing software.

**CO4: Apply** different approaches of quality management, assurance, and quality standard to softwaresystem.

**CO5: Apply** and analyze effectiveness Software Quality Tools.

**CO6: Apply** tools necessary for efficient testing framework.

## Course Contents

| Unit I | Introduction to Software Testing | 07 Hours |
|---|---|---|

**Introduction**: historical perspective, Definition, Core Components, Customers suppliers and process, Objectives of Testing, Testing and Debugging, Need of Testing, Quality Assurance and Testing, Why Software has Errors, Defects and Failures and its Causes and Effects, Total Quality Management(TQM), Quality practices of TQM, Quality Management through- Statistical process Control, Cultural Changes, Continual Improvement cycle, Benchmarking and metrics, Problem Solving Techniques and Software Tools. Software Quality, Constraints of Software product Quality assessment, Quality and Productivity Relationship, Requirements of Product, Software Development Process, Types of Products, Software Development Lifecycle Models, Software Quality Management, Processes related to Software Quality, Quality Management System's Structure, Pillars of Quality Management System, Important aspects of quality management.

| **#Exemplar/Case Studies** | 1. Offshore delivery model for an Airline Company.<br>2. SAP test automation CoE for Financial Service Provider. |
|---|---|

| **\*Mapping of Course Outcomes for  Unit I** | CO1 |
|---|---|

| **Unit II** | **Test Planning and Quality Management** | **07 Hours** |
|---|---|---|

**Test Planning** –Artifacts, Strategy, Test Organization –Test Manager &amp; Tester Role, Test plan purpose &amp; contents, Test Strategy and Approach, Test cases &amp; Test Data, Test Entry-Exit criteria, Test Execution Schedule, Use case Testing, Scenario Testing, Test Monitoring &amp; Control- Test Metrics –Test Case Productivity, Test case Coverage, Defect Acceptance &amp; Rejection, Test Efficiency, Efforts and Schedule Variance, Test Efforts  biasing Factors, Test Report &amp; configuration Management, Quality Assurance Process, Documentation Risk &amp; Issues. Software Quality, Quality Management Importance, Quality Best practices.

| **#Exemplar/CaseStudies** | 1. Online Recommendation System<br>2. Quality Engineering services for Medical Devices company \| CaseStudy (cigniti.com) |
|---|---|
| **\*Mapping of Course Outcomes for  Unit II** | CO2 |

| **Unit III** | **Test Case Design Techniques** | **07 Hours** |
|---|---|---|

**Software Testing Methodologies:** White Box Testing, Black Box Testing, Grey Box Testing. Test Case Design Techniques: Static Techniques: Informal Reviews, Walkthroughs, Technical Reviews, Inspection. Dynamic Techniques: Structural Techniques: Statement Coverage Testing, Branch Coverage Testing, Path Coverage Testing, Conditional Coverage Testing, Loop Coverage Testing Black Box Techniques: Boundary Value Analysis, Equivalence Class Partition, State Transition Technique, Cause Effective Graph, Decision Table, Use Case Testing, Experienced Based Techniques: Error guessing, Exploratory testing

**Levels of Testing**: Functional Testing: Unit Testing, Integration Testing, System Testing, User Acceptance Testing, Sanity/Smoke Testing, Regression Test, Retest. Non-Functional Testing: Performance Testing, Memory Test, Scalability Testing, Compatibility Testing, Security Testing, Cookies Testing, Session Testing, Recovery Testing, Installation Testing, Adhoc Testing, Risk Based Testing, I18N Testing, L1ON Testing, Compliance Testing.
Link:https://www.besanttechnologies.com/training-courses/software-testing-training/manual-testing-training-institute-in-chennai

| **#Exemplar/Case Studies** | 1. Case Study: Manual Testing (Online Marketing SoftwarePlatform)<br><br>Link:  https://www.360logica.com/blog/case-study-manual-testing-online-marketing-software-platform/<br><br>2. Case Study: Decision Table Testing (transferring money online to an account which is already added and approved.) |
|---|---|
| **\*Mapping of Course Outcomes for Unit III** | **CO3** |

| **Unit IV** | **Software Quality Assurance and Quality Control** | **07 Hours** |
|---|---|---|

**Software Quality Assurance**: Introduction, Constraints of Software Product Quality Assessment, Quality and Productivity Relationship, Requirements of a Product, Characteristics of Software,

Software Development Process, Types of Products, Schemes of Criticality Definitions, Software Quality Management, Why Software Has Defects? Processes Related to Software Quality, Quality Management System Structure, Pillars of Quality Management System, Important Aspects ofQualityManagement.

**Software Quality Control**: Software quality models, Quality measurement and metrics, Quality plan, implementation and documentation, Quality tools including CASE tools, Quality control and reliability of quality process, Quality management system models, Complexity metrics and Customer Satisfaction, International quality standards – ISO, CMM

| #Exemplar/Case Studies | 1. Case Study #1 – Android Application Acceptance Test Suite<br>2. Case Study #2 – API Acceptance Test Suite<br><br>Link for above case studies - Software Quality Assurance Case Studies - Beta Breakers |
|---|---|
| *Mapping of Course Outcomes for Unit IV | CO4 |

| Unit V | Automation Testing Tools / Performance Testing Tools | 07 Hours |
|---|---|---|

**Automation Testing:** What is automation testing, Automated Testing Process, Automation Frameworks, Benefits of automation testing, how to choose automation testing tools. Selenium Automation Tools: Selenium's Tool Suite- Selenium IDE, Selenium RC, Selenium Web driver, Selenium Grid. Automation Tools: SoapUI, Robotic Process Automation (RPA), Tosca, Appium.

Performance Testing : What is Performance Testing what is use of it? Tools used for performance testing - Apache Jmeter.

| #Exemplar/Case Studies | 1. Case Study: Cucumber open-source automation testingframework.<br>2. Case Study: (PDF) Automated Software Testing—A Case Study(researchgate.net) |
|---|---|
| *Mapping of Course Outcomes for Unit V | CO5 |

| Unit VI | Testing Framework | 07 Hours |
|---|---|---|

**Testing Framework:** Software Quality, Software Quality Dilemma, Achieving Software Quality, Software Quality Assurance Elements of SQA, SQA Tasks, Goals and Metrics, Formal Approaches to SQA, Statistical Software Quality Assurance, Six Sigma for Software Engineering, ISO 9000 Quality Standards, SQA Plan, Total Quality Management, Product Quality Metrics, In process Quality Metrics, Software maintenance, Ishikawa's 7 basic tools, Flow Chart, Checklists, Pareto diagrams, Histogram, Run Charts, Scatter diagrams, Control chart, Cause Effect diagram. Defect Removal Effectiveness and Process.

| #Exemplar/Case Studies | 1. Case study: Software Quality In AcademicCurriculum.<br>2. Case study: Evaluation of an Automated Testing Framework: ACase Study (scielo.sa.cr) |
|---|---|
| *Mapping of Course Outcomes for Unit VI | CO6 |

| Learning Resources |
|---|

**Text Books:**

1. M G Limaye, ―Software Testing Principles, Techniques and Tools‖, Tata McGraw Hill, ISBN:9780070139909 0070139903

2. Srinivasan Desikan, Gopal Swamy Ramesh, ‒Software Testing Principles and Practices‖, Pearson,ISBN-10: 817758121X

**Reference Books:**

1. Naresh Chauhan, ―Software Testing Principles and Practices", OXFORD, ISBN-10: 0198061846. ISBN-13: 9780198061847

2. Stephen Kan, ― Metrics and Models in Software Quality Engineering‖, Pearson, ISBN-10: 0133988082; ISBN-13: 978-0133988086

**e-Books :**

1. M G Limaye, ‒Software Testing Principles, Techniques and Tools"
https://books.google.co.in/books?id=zUm8My7SiakC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
2. Srinivasan Desikan, Gopalswamy Ramesh, ―Software Testing Principles and Practices‖
https://kupdf.net/queue/software-testing-principles-and-practices-by-srinivasan_5b0ae8eae2b6f51f7d862d26_pdf?queue_id=-1&x=1656562364&z=MTE1LjI0Mi4yNDIuNzA=
3. Naresh Chauhan, ‒Software Testing Principles and Practice"
. https://pdfcoffee.com/download/se-4-pdf-free.html

**MOOC Courses Links:**

- https://nptel.ac.in/courses/106105150
- NPTEL : NOC: Software Testing (2017) (Computer Science and Engineering) (digimat.in)

## @The CO-PO Mapping Matrix

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

# Unit Test Papers mapped with COs

**Unit Test - I**

| Name of College: | Engineering | | | Date: | |
|---|---|---|---|---|---|
| Name of Department: | Computer | | | | |
| Academic Year: | 2022-23 | Class: | TE | Semester: | Odd |
| Name of Subject: | Internet of Things & Embedded System | Marks: | 25 | Time: | 1   Hrs |
| Roll No.: | | Name Of the Student: | | | |

| Q. No. | Question Description | | | | Marks | CO |
|---|---|---|---|---|---|---|
| 1 | An embedded system is a combination of_____. | | | | 2 | CO1 |
| | a) Software | b) Hardware | c) Both A & B | d) Devices | | |
| 2 | Which of the following designed system factors are optimized or enhanced for an embedded application? | | | | 2 | CO1 |
| | a) Performance | b) Reliability | c) Efficiency | d) All the above | | |
| 3 | The_____Operating System pays more attention to the meeting of the time limits | | | | 2 | CO1 |
| | a) Network | b) Distributed | c) Online | d) Real-time | | |
| 4 | Hard real time operating system has_____jitter than a soft real time operating system. | | | | 2 | CO1 |
| | a) less | b) more | c) equal | d) none of the mentioned | | |
| 5 | Which of the following should a microcontroller at-least should consist of? | | | | 2 | CO1 |
| | a) PU, ROM, I/O ports, and timers | b) RAM, ROM, I/O ports, and timers | c) CPU, RAM, I/O ports,  and timers | d) CPU, RAM, ROM, I/O ports, and timers | | |
| 6 | ARM stands for _____ | | | | 2 | CO1 |
| | a) Advanced Rate Machines | b) Advanced RISC Machines | c) Artificial Running Machines | d) Aviary Running Machines | | |
| 7 | Embedded system as a_____to perform a specific task | | | | 2 | CO1 |
| | a) microcontroller-based | b) software-driven | c) Real-time control system | d) All of the above | | |

| 8 | What is IoT? | | | | 2 | CO2 |
|---|---|---|---|---|---|---|
| | a) network of physical objects embedded with sensors | b) network of virtual objects | c) network of objects in the ring structure | d) network of sensors | | |
| 9 | Which of the following is not an IoT device? | | | | 2 | CO2 |
| | a) Table | b)Laptop | c) Arduino | d) Tablet | | |
| 10 | What is the role of Cloud in smart grid architecture of IoT? | | | | 2 | CO2 |
| | a) Security | b) Collect data | c) Manage data | d) Store data | | |
| 11 | What is the role of cloud computing in IoT? | | | | 2 | CO2 |
| | a) To store and process data collected by IoT devices | b) To provide connectivity between IoT devices | c) To analyze data generated by IoT devices | d) To manage and control IoT devices | | |
| 12 | Which of the following is an example of an IoT application in home automation? | | | | 1 | CO2 |
| | a) Smart lighting system | b) Online grocery delivery service | c) Smart home security system | d) Virtual reality entertainment system | | |
| 13 | What is the role of machine learning in IoT? | | | | 2 | CO2 |
| | a) To control and manage IoT devices | b) To analyze and make predictions based on IoT data | c) To provide connectivity between IoT devices | d) To store and process IoT data | | |
| | | | | **Marks for CO1** | | |
| | | | | **Marks for CO2** | | |
| | | | | **Total Marks Obtained** | | |

| Name of College: | **Engineering** | | | Date: | |
|---|---|---|---|---|---|
| Name of Department: | **Computer** | | | | |
| Academic Year: | **2022-23** | Class: | TE | Semester: | Odd |
| Name of Subject: | **Internet of Things & Embedded System** | Marks: | 25 | Time: | 1 Hrs |
| Roll No.: | | | Name Of the Student: | | |

| Q. No. | Question Description | | | | Marks | CO |
|---|---|---|---|---|---|---|
| 1 | What is Purpose and Requirements Specification in Design Methodology? | | | | 2 | CO3 |
| | a) Data collection requirements | b) Data analysis requirements | c) System management requirements | d) All Aove | | |
| 2 | Which of the following not networking component of IoT | | | | 2 | CO3 |
| | a) Sensors | b) Connectivity | c) Data Processing | d) None of the above | | |
| 3 | Which of the following is not Communication Models in IoT | | | | 2 | CO3 |
| | a) Request & Response Model | b) Publisher-Subscriber Model | c) Push-Pull Model | d) IP Model | | |
| 4 | Which activity perform in Request & Response Model | | | | 2 | CO3 |
| | a) Request | b) Response | c) Fetch | d) All of the Above | | |
| 5 | The pillars of Iot are | | | | 2 | CO3 |
| | a) People | b) Process & data | c) Things | d) All of the Above | | |
| 6 | What is the full form of SCADA? | | | | 2 | CO3 |
| | a) Supervisory Control and Document Acquisition | b) Supervisory Control and Data Acquisition | c) Supervisory Column and Data Assessment | d) Supervisory Column and Data Assessment | | |
| 7 | Which of the following is the function of a dedicated sensor? | | | | 2 | CO3 |
| | a) Records and monitors physical condition of environment | b) Organizes collected data at a location that is centralized | c) Both a and b | d) None of the above | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 8 | MQTT is mainly used for _____ | | | | 2 | CO4 |
| | a) M2M communication | b) Device communication | c Internet communication | d) Wireless communication | | |
| 9 | CoAP is specialized in _____ | | | | 2 | CO4 |
| | a) Internet applications | b) Device applications | c) Wireless applications | d) Wired applications | | |
| 10 | XMPP Full form is _____ | | | | 2 | CO4 |
| | a) Extensible Messaging and Presence Protocol | b) Extensible Module and presence protocol | c) Extra Message and Presence Protocol | d) xtensible Messaging and Particular Protocol | | |
| 11 | Does HTTP protocol have_____handshakes. | | | | 2 | CO4 |
| | a) 2 way | b) 1 way | c) 3 way | d) 5 way | | |
| 12 | Which protocol has a quality of service ? | | | | 1 | CO4 |
| | a) XMPP | b) HTTP | c) CoAP | d) MQTT | | |
| 13 | In IoT, does the_____layer help in end-to-end communication? | | | | 2 | CO4 |
| | a) security | b) transport | c) data communication | d) logical | | |
| | Marks for CO3 | | | | | |
| | Marks for CO4 | | | | | |
| | Total Marks Obtained | | | | | |

| F / 45 / 00 | FORMAT | |
|---|---|---|
| | **Unit Test - I** | |

| Name of College: | Engineering | | | Date: | DD/MM/YYYY |
|---|---|---|---|---|---|
| Name of Department: | Electrical | | | | |
| Academic Year: | 2022-23 | Class: | SE | Semester: | Odd |
| Name of Subject: | MS | Marks: | 25 | Time: | 1Hrs |
| Roll No.: | | | Name of Student: | | |

| Q. No. | Question Description | | | | Marks | CO |
|---|---|---|---|---|---|---|
| 1 | This set of Engineering Physics Multiple Choice Questions & Answers (MCQs) focuses on "Piezoelectricity". | | | | 2 | CO1 |
| | a) Voltage is applied | b)Mechanical Stress is applied | c)Electric field is applied | d)Magnetic field is applied | | |
| 2 | Piezoelectricity means _____ | | | | 2 | CO1 |
| | a)Electric polarization | b)Electric dielectric | c)Pressure electricity | d)Polar dielectric | | |
| 3 | Piezoelectricity is shown by substances which are _____ | | | | 2 | CO1 |
| | a)Polar | b)Non-polar | c)Symmetric | d)Asymmetric | | |
| 4 | In conductors, opposite charges are separated by | | | | 2 | CO1 |
| | a)dielectric | b)insulator | c)microscopic distances | d)large distances | | |
| 5 | Electric susceptibility is inversely proportional to | | | | 2 | CO1 |
| | a)permittivity | b)polarization vector | c)magnetic field intensity | d)permeability | | |
| 6 | If the dipole moment of a water drop is 4 X 10-30 m and radius is 1 mm, what is the polarization of the drop? | | | | 2 | CO1 |
| | a)5.6 X 10-13 m-2 | b)7.4 X 10-13 m-2 | c)8.4 X 10-13 m-2 | d)9.4 X 10-13 m-2 | | |
| 7 | Breakdown strength decreases with increase in (i)-----& increases with increase in -----(ii). | | | | 2 | CO2 |
| | a) i) humidity ii) electrode diameter | b) i) temperature ii) gap distance | c) A & B | d) None of these | | |

| 8 | An electron liberated due to impact of free electron is ---------- ionization & due to impact of positive ion is------------ionization. | | | | 2 | CO2 |
|---|---|---|---|---|---|---|
| | a)primary, secondary | b)secondary, primary | c) primary, tertiary | d)can be all | | |
| 9 | In secondary ionization, electron is liberated from ------------- by------------ --. | | | | 2 | CO2 |
| | a)positive ion, electrode surface | b)free electron , electrode surface | c)electrode surface, free electron | d)electrode surface, positive ion | | |
| 10 | Solid insulating material regains its dielectric strength------------- | | | | 2 | CO2 |
| | a)fully | b)partially | c)90.00% | d)none of the above | | |
| 11 | Which of the following material is used for cable insulation? | | | | 2 | CO2 |
| | a)phenol formaldehyde | b)polytetra fluroethylene | c)polyvinyl chloride | d) acrylontrile butadiene styrene | | |
| 12 | tanδ' is known as | | | | 2 | CO2 |
| | a)Dissipation factor | b)Dielectric loss tangent | c)Power factor of dielectric | d)All of them | | |
| 13 | The dielectric loss tangent is dependent on | | | | 1 | CO2 |
| | a)frequency | b)applied voltage | c)value of capacitance | d)all of these | | |
| | Q.1toQ.6.(CO1) | | | | | |
| | Q.7.to Q.13 (CO2) | | | | | |
| | Obtained Marks | | | | | |

**Unit Test - II**

| Name of College: | Engineering | | | Date: | DD/MM/YYYY |
|---|---|---|---|---|---|
| Name of Department: | Electrical | | | | |
| Academic Year: | 2022-23 | Class: | SE | Semester: | Odd |
| Name of Subject: | MS | Marks: | 25 | Time: | 1Hrs |
| Roll No.: | | | Name of Student: | | |

| Q. No. | Question Description | | | | Marks | CO |
|---|---|---|---|---|---|---|
| 1 | SF6 gas | | | | 2 | CO3 |
| | A. Is yellow in colour | B. Is lighter than air | C. Is nontoxic | D. Has pungent small | | |
| 2 | What is the main cause for the failure of overhead line insulators? | | | | 2 | CO3 |
| | a) Surges | b) Flashover | c) Arching | d) Grounding | | |
| 3 | How should the properties of strength and dielectric strength in insulating materials? | | | | 2 | CO3 |
| | a) High strength, low Dielectric strength | b) Low strength, low Dielectric strength | c) High strength, high Dielectric strength | d) Low strength, high Dielectric strength | | |
| 4 | What is property of porosity and temperature change in insulating materials? | | | | 2 | CO3 |
| | a) Less, less affected | b) Less, highly affected | c) High, highly affected | d) High, less affected | | |
| 5 | What is the other name of Polymer Insulator? | | | | 2 | CO3 |
| | a) Moisture insulator | b) Core insulator | c) Composite insulator | d) Mixed insulator | | |
| 6 | Suspension insulator are made up of _____ | | | | 2 | CO3 |
| | a) glass | b) porcelain | c) steatite | d) epoxy resin | | |
| 7 | Which of the following is a diamagnetic material? | | | | 2 | CO4 |
| | a) Sodium | b) Calcium | c) steatite | d) Nitrogen (at STP) | | |
| 8 | The phenomenon of perfect diamagnetism is called _____ | | | | 2 | CO4 |
| | a) Superconductivity | b) Diamagnetic Effect | c) Zero Kelvin Effect | d) Meissner Effect | | |

| 9 | Materials in which magnetization persists even after the field has been removed are called _____ | | | | 2 | CO4 |
|---|---|---|---|---|---|---|
| | a) Diamagnetic | b) Paramagnetic | c) Soft Ferro magnets | d) Hard Ferro magnets | | |
| 10 | At high temperature a Ferro magnet becomes _____ | | | | 2 | CO4 |
| | a) Diamagnetic | b) Paramagnetic | c) Hard Ferro magnet | d) Soft Ferro Magnet | | |
| 11 | When a ferromagnetic rod is placed in a solenoid with current, what happens to the rod? | | | | 2 | CO4 |
| | a) Retentivity increases | b) Coercivity Increases | c) Permanently Magnetized | d) Nothing | | |
| 12 | If the number of atoms in the domain in ferromagnetic iron, in the form of a cube of side length 1μm, is 8.65 X 1010 atoms and dipole moment of each iron atom is 9.27 X 10-24 Am2, what is the maximum Magnetization of the domain? | | | | 2 | CO4 |
| | a) 6 X 105 A/m | b) 7 X 105 A/m | c) 8 X 105 A/m | d) 9 X 105 A/m | | |
| 13 | The value of B at H=0 in a Hysteresis curve is called _____ | | | | 1 | CO4 |
| | a) Remanence | b) Coercivity | c) Magnetization | d) Porosity | | |
| | Q.1toQ.6.(CO3) | | | | | |
| | Q.7.to Q.13 (CO4) | | | | | |
| | Total Obtained Marks | | | | | |

| Name of College: | Engineering | | | | Date: | |
| --- | --- | --- | --- | --- | --- | --- |
| Name of Department: | Electrical | | | | | |
| Academic Year: | 2022-23 | Class: | BE | | Semester: | Even |
| Name of Subject: | Advance Electrical Drives & Control | Marks : | 25 | | Time: | 1Hrs |
| Roll No.: | | | Name of Student: | | | |

| Q. No. | Question Description | | | | Marks | CO |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | What is an electric drive? | | | | 2 | CO1 |
| | a) A machine that converts electrical energy into kinetic energy | b) A machine that converts mechanical energy into electrical energy | c) A machine that converts electrical energy into mechanical energy | d) A machine that converts kinetic energy into electrical energy | | |
| 2 | Which of the following is NOT a type of electrical drive? | | | | 2 | CO1 |
| | a) AC drive | b) DC drive | c) IC drive | d) Servo drive | | |
| 3 | Which type of drive is suitable for high-power applications like electric locomotives and heavy industrial machinery? | | | | 2 | CO1 |
| | a) AC drive | b) DC drive | c) Servo drive | d) Stepper drive | | |
| 4 | When a motor is acting as a generator, absorbing mechanical energy from the load and feeding it back to the power supply, it is operating in which quadrant? | | | | 2 | CO1 |
| | a) First quadrant | b) Second quadrant | c) Third quadrant | d) Fourth quadrant | | |
| 5 | Which component of load torque depends on the type of mechanical load being driven by the motor? | | | | 2 | CO1 |
| | a) Braking torque | b) Inertia torque | c) Friction torque | d) Starting torque | | |
| 6 | Motor load dynamics refers to | | | | 2 | CO1 |
| | a) The study of different types of motors and their applications | b) The study of how loads affect the dynamics of a motor during operation | c)The study of the electrical properties of a motor's stator and rotor | d) The study of mechanical vibrations in a motor system | | |
| 7 | What is the main purpose of a DC motor drive? | | | | 2 | CO2 |
| | a) To generate electrical power | b) To control the speed and direction of a DC | c) To provide protection against | d) To convert AC power to DC power | | |

| | | motor | electrical faults | | | |
|---|---|---|---|---|---|---|
| 8 | What type of DC motor drive control method provides smooth and continuous variation of motor speed? | | | | 2 | CO2 |
| | a) On/Off control | b) Open-loop control | c) Closed-loop control | d) Variable resistance control | | |
| 9 | What is the function of the "chopper" in a DC motor drive? | | | | 2 | CO2 |
| | a) To switch between forward and reverse directions | b) To convert AC power to DC power | c) To control the speed of the motor | d) To regulate the DC voltage supplied to the motor | | |
| 10 | In a regenerative braking system using a DC motor drive, what happens to the energy generated during braking? | | | | 2 | CO2 |
| | a) It is dissipated as heat in the motor | b) It is stored in a battery for later use | c) It is returned to the power supply | d) It is used to power other electrical devices in the system | | |
| 11 | Which type of DC motor drive control method does not require the use of position or speed sensors? | | | | 2 | CO2 |
| | a) Open-loop control | b) Closed-loop control | c) Sensor less control | d) Field-oriented control (FOC) | | |
| 12 | Which DC motor braking method is most suitable for applications where the motor is driving a heavy load and needs to be stopped quickly? | | | | 2 | CO2 |
| | a) Dynamic braking | b) Plugging braking | c)Regenerative braking | d) Rheostatic braking | | |
| 13 | Which braking method can be used to rapidly reverse the direction of rotation of a DC motor? | | | | 1 | CO2 |
| | a) Rheostatic braking | b) Plugging braking | c) Dynamic braking | d) Regenerative braking | | |
| | | | | Q.1toQ.6.(CO1) | | |
| | | | | Q.7.to Q.13 (CO2) | | |
| | | | | Obtained Marks | | |

**Unit Test - II**

| Name of College: | Engineering | | | Date: | |
|---|---|---|---|---|---|
| Name of Department: | Electrical | | | | |
| Academic Year: | 2022-23 | Class: | BE | Semester: | Even |
| Name of Subject: | Advance Electrical Drives & Control | Marks : | 25 | Time: | 1Hrs |
| Roll No.: | | | Name of Student: | | |

| Q. No. | Question Description | | | | Marks | CO |
|---|---|---|---|---|---|---|
| 1 | Regenerative braking in induction motors is used to: | | | | 2 | CO3 |
| | a) Increase the motor's speed | b) Reduce the motor's speed | c) Convert kinetic energy into electrical energy | d) Convert electrical energy into kinetic energy | | |
| 2 | Which braking method uses a resistor to dissipate excess energy during braking? | | | | 2 | CO3 |
| | a) Dynamic braking | b) Plugging | c) Regenerative braking | d) Eddy current braking | | |
| 3 | Plugging braking is also known as: | | | | 2 | CO3 |
| | a) Reverse braking | b) Rheostatic braking | c) Reverse regenerative braking | d) Double braking | | |
| 4 | V/f control is a popular speed control technique used in induction motor drives because: | | | | 2 | CO3 |
| | a) It provides high torque at low speeds | b) It is simple to implement | c) It is cost-effective | d) It eliminates the need for a VFD | | |
| 5 | In vector control, the control of the motor is based on the information obtained from: | | | | 2 | CO3 |
| | a) The rotor position sensor | b) The stator current sensor | c) The stator voltage sensor | d) The rotor resistance | | |
| 6 | What is the primary objective of vector control in an induction motor drive? | | | | 2 | CO3 |
| | a) To achieve high starting torque | b) To reduce the motor's operating speed | c) To decouple torque and flux control | d) To eliminate the need for a VFD | | |
| 7 | The primary advantage of using a BLDC motor over a brushed DC motor is: | | | | 2 | CO4 |
| | a) Higher efficiency | b) Lower cost | c) Simpler construction | d) Higher torque | | |
| 8 | The construction of a BLDC motor typically includes: | | | | 2 | CO4 |
| | a) Commutator and brushes | b) Slip rings and brushes | c) Permanent magnets and stator windings | d) Rotor windings and stator windings | | |
| 9 | The working principle of a BLDC motor is based on: | | | | 2 | CO4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | a) Induced voltage in the rotor windings | b) Commutation of the stator windings | c) Slip between rotor and stator | d) Mechanical brushes contacting the rotor | | |
| 10 | Closed-loop control of a BLDC drive involves: | | | | 2 | CO4 |
| 10 | a) Operating the motor without any control strategy | b) Controlling the motor speed without sensor feedback | c) Using sensor feedback to regulate motor speed and torque | d) Controlling the motor using an open-loop system | 2 | CO4 |
| 11 | What is the primary advantage of vector control in BLDC drives? | | | | 2 | CO4 |
| 11 | a) Higher efficiency at low speeds | b) Simplified motor construction | c) Reduced cost of the drive system | d) Elimination of the need for sensors | 2 | CO4 |
| 12 | In vector control of BLDC drives, what physical quantities are represented in a rotating reference frame? | | | | 2 | CO4 |
| 12 | a) Stator current and voltage | b) Rotor position and speed | c) Stator resistance and inductance | d) Rotor flux and torque | 2 | CO4 |
| 13 | What type of sensors are commonly used in closed-loop control of BLDC drives to detect rotor position? | | | | 1 | CO4 |
| 13 | a) Hall effect sensors | b) Optical encoders | c) Potentiometers | d) Thermocouples | 1 | CO4 |
| | | | | Q.1toQ.6.(CO3) | | |
| | | | | Q.7.to Q.13 (CO4) | | |
| | | | | Obtained Marks | | |

# Assignments mapped with COs

| F /24 / 00 | | FORMAT | | | |
|---|---|---|---|---|---|

**Assignments With CO**

| Name of College: | Engineering | | | Date: | |
|---|---|---|---|---|---|
| Name of Department: | Mechanical | | | | |
| Year: | TE | | | Semester: | 5th |
| Course (Subject) Name: | Heat Transfer | | | Course (Subject) Code: | 302042 |
| Assignment No: | A4 | Unit No: | 04 | Date of Submission: | DD/MM/YYYY |

| COs | Course Outcomes Statement |
|---|---|
| 01 | ANALYZE & APPLY the modes of heat transfer equations for one dimensional thermal system. |
| 02 | DESIGN a thermal system considering fins, thermal insulation and & Transient heat conduction |
| 03 | EVALUATE the heat transfer rate in natural and forced convection & validate with experimentation results. |
| 04 | INTERPRET heat transfer by radiation between objects with simple geometries, for black and grey surfaces. |
| 05 | ABILITY to analyse the rate of mass transfer using Fick's Law of Diffusion and understands mass diffusion in different coordinate systems. |
| 06 | DESIGN & ANALYSIS of heat transfer equipment's and investigation of its performance. |

| Sr. No | Questions | Attainment of CO |
|---|---|---|
| 1 | Write the statement and mathematical expression for i) Stefan Boltzman Law ii) Wein's Law iii) Planck's Law. | 04 |
| 2 | What is shape factor? What is shape factor for a plane surface and convex surface with respect to itself? | 04 |
| 3 | Define Radiosity and Irradiation with their characteristics. | 04 |
| 4 | Find shape factor for following w.r.t. itself i) Cylindrical Cavity of diameter D and depth H. ii) Conical hole of diameter D and Depth H. iii) Hemispherical Hole of diameter H | 04 |
| 5 | Write a short note on Radiation Shield | 04 |
| 6 | Two parallel infinite gray surfaces are maintained at 127 $^0$C and 227 $^0$C. If the temperature of hot surface is increased to 327 $^0$C. By what factor is net radiation exchange per unit area increased? Assume the emissivity of cooler and hotter surface to be 0.9 and 0.7 respectively. | 04 |

**Name and Signature of Faculty**

| F /24 / 00 | | FORMAT | | | |
|---|---|---|---|---|---|

| Name of College: | Engineering | | | Date: | |
|---|---|---|---|---|---|
| Name of Department: | Mechanical | | | | |
| Year: | TE | | Semester: | 6$^{th}$ | |
| Course (Subject) Name: | Refrigeration and Air Conditioning | | Course (Subject) Code: | 302049 | |
| Assignment No: | A5 | Unit No: | 05 | Date of Submission: | DD/MM/YYYY |

| Cos | Course Outcomes Statement |
|---|---|
| 01 | Student should be able to identify applications of refrigeration and should be able to select environmentally friendly refrigerant. |
| 02 | Student should be able to conduct trial on VCC and VAC test rigs, represent them on P-h and T-s Diagrams and analyze their performance. |
| 03 | Students should be able to explain the working with T-s, P-h and block diagram of Multi-Pressure Systems and analyze Multi Evaporator System. |
| 04 | To represent and analyze different psychrometric processes on psychometric charts and should be able to calculate cooling load for comfort and industrial applications. |
| 05 | To select suitable Air conditioning systems for different seasonal requirements and should be able to select components and suitable safety control. |
| 06 | To design Ducts using appropriate method based on different governing factors and to select suitable components for Air Handling Unit. |

| Sr. No | Questions | Attainment of CO |
|---|---|---|
| 1 | State the factors which should be taken into consideration while selecting a system of air-conditioning. | 01, 05 |
| 2 | Enumerate the functional elements of a control unit. | 05 |
| 3 | Explain briefly the following types of reciprocating compressors: i) Open type vertical reciprocating compressor ii) Semi sealed type iii) Hermetically sealed type. | 05 |
| 4 | Give the main types of condensers in use with specific application of each type. | 05 |
| 5 | Explain with neat sketches the following evaporators: i) Flooded type evaporator ii) Dry expansion evaporator. | 05 |
| 6 | Describe with sketch, physical working of humidity sensor and smoke sensors. | 05 |

**Name and Signature of Faculty**

| Name of College: | Engineering | | | Date: | |
|---|---|---|---|---|---|
| Name of Department: | E&TC | | | | |
| Year: | 3$^{rd}$ | | | Semester: | Odd |
| Course (Subject) Name: | ETL | | | Course (Subject) Code: | 304183 |
| Assignment No: | A5 | Unit No: | 5 | Date of Submission: | DD/MM/YYYY |

| COs | Course Outcomes Statement | |
|---|---|---|
| CO1 | Understand the basic mathematical concepts related to electromagnetic vector fields. | |
| CO2 | Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density. | |
| CO3 | Apply the principles of magnetostatics to the solutions of problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density. | |
| CO4 | Understand the concepts related to Faraday's law, induced emf and Maxwell's equations. | |
| CO5 | Apply Maxwell's equations to solutions of problems relating to transmission lines and uniform plane wave propagation. | |
| Sr. No | Questions | Attainment to which CO |
| 1 | Derive the expression for characteristic impedance and propagation constant in terms of primary constants of transmission line | 5 |
| 2 | Find primary constants R, L, G,C of a transmission line, if characteristic impedance is 692 < −12° ohm and propagation constant is 0.0363< 78° at the frequency of 1 KHz | 5 |
| 3 | What is distortion less line? Derive the condition for distortion less line. What are types of distortion in a transmission line | 5 |
| 4 | A Lossless transmission line with characteristic impedance 50 ohm is 30m long and operates at 2 MHz. Transmission line is terminated with a 1oad impedance of 60 + j40 ohm. If velocity is 0.6 C (C is speed of EM wave in free space) on the line, using Smith Chart determine: i) Reflection coefficient ii) SWR iii) Input Impedance iv) Load admittance | 5 |
| 5 | Define: i) Reflection coefficient ii) SWR iii) Input Impedance iv) Load admittance | 5 |

**Name of Faculty and Signature**

# *Course Outcome Attainment Evaluation*

# Sanghavi College of Engineering, Nashik
## Attainment Sheet- Part A - CO Attainment

Department : Electrical Engineering      Class: BE

A.Y. 2022-23 Sem-I      Subject Teacher: Ms. Snehal S. Uphade

Subject: Power Quality Management      Subject Code:    403143B

| Sr. No. | Seat No. | Name of student | Internal Assessment Tools | | | | | | External Assessment Tools | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unit test-I | | Unit test-II | | Assignment | | Oral Exam | University Exam |
| | | | 12 | 13 | 12 | 13 | 25 | 25 | 25 | 100 |
| | | | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | All COs | All COs |
| 1 | B191172501 | AARTI KISHOR WAGHCHAURE | 4 | 5 | 8 | 9 | 16 | 18 | 20 | 34 |
| 2 | B191172502 | ANKUSH RAMAN SHEWALE | 5 | 3 | 4 | 2 | 10 | 12 | 7 | 30 |
| 3 | B191172503 | ASHUTOSH DNYANESHWAR DUSANE | 9 | 4 | 5 | 4 | 18 | 16 | 19 | 16 |
| 4 | B191172504 | BARDE RUPALI BHAGAWAN | 7 | 6 | 5 | 9 | 14 | 17 | 20 | 34 |
| 5 | B191172505 | BHALERAO JAYESH RAJU | 6 | 3 | 7 | 6 | 12 | 17 | 18 | 35 |
| 6 | B191172506 | BHAMARE LALIT NILESH | 8 | 9 | 9 | 7 | 16 | 18 | 21 | 31 |
| 7 | B191172507 | BHAVSAR RUSHIKESH MAHESH | 11 | 10 | 9 | 11 | 22 | 19 | 23 | 46 |
| 8 | B191172508 | CHAUDHARI HRUSHIKESH SUBHASH | 9 | 6 | 8 | 7 | 18 | 16 | 21 | 30 |
| 9 | B191172509 | CHAUDHARI PANKAJ RATAN | 8 | 6 | 9 | 6 | 16 | 13 | 22 | 31 |
| 10 | B191172510 | CHAUDHARI VIJAY LAXMAN | 10 | 11 | 11 | 9 | 20 | 19 | 23 | 51 |
| 11 | B191172511 | GAIKWAD CHAITANYA SHIRISH | 4 | 4 | 8 | 4 | 8 | 15 | 18 | 27 |
| 12 | B191172512 | GAIKWAD GAYATRI DIGAMBAR | 7 | 8 | 6 | 5 | 14 | 16 | 21 | 32 |
| 13 | B191172513 | GAIKWAD MOHAN MOTIRAM | 4 | 6 | 5 | 8 | 17 | 17 | 20 | 37 |
| 14 | B191172514 | GAIKWAD YADNYESH VISHNU | 5 | 9 | 7 | 8 | 16 | 18 | 22 | 42 |
| 15 | B191172515 | GORE PRANJAL DNYANESHWAR | 7 | 4 | 9 | 5 | 15 | 15 | 21 | 31 |
| 16 | B191172516 | GUNJAL VICKY PRAKASH | 5 | 3 | 6 | 5 | 10 | 13 | 5 | 20 |
| 17 | B191172517 | KALE SURAJ KIRAN | 6 | 5 | 6 | 7 | 12 | 17 | 19 | 22 |
| 18 | B191172518 | KATKADE AISHWARYA RAOSAHEB | 5 | 7 | 6 | 5 | 10 | 13 | 21 | 23 |
| 19 | B191172519 | KOLHE KRUNAL SUPADA | 9 | 3 | 8 | 9 | 18 | 20 | 20 | 0 |
| 20 | B191172520 | LOKHANDE SURAJ MADHUKAR | 8 | 3 | 5 | 1 | 16 | 20 | 19 | 0 |
| 21 | B191172521 | MAHALE PAVAN SHANTARAM | 7 | 8 | 5 | 9 | 16 | 17 | 21 | 43 |
| 22 | B191172522 | MALI VAIBHAV MAHESH | 7 | 8 | 5 | 6 | 17 | 12 | 20 | 49 |
| 23 | B191172523 | MULANE TEJAS VIJAY | 6 | 8 | 9 | 5 | 15 | 22 | 21 | 45 |
| 24 | B191172524 | NIKAM BHAVESH VILAS | 9 | 4 | 8 | 5 | 18 | 14 | 20 | 30 |
| 25 | B191172525 | PALVE PRAVIN ARJUN | 5 | 6 | 4 | 7 | 10 | 14 | 8 | 35 |
| 26 | B191172526 | PAWAR GANESH SURESH | 5 | 7 | 8 | 9 | 10 | 12 | 22 | 30 |
| 27 | B191172527 | PAWAR MANOHAR HEMARAJ | 9 | 4 | 8 | 5 | 18 | 18 | 8 | 33 |
| 28 | B191172528 | PAWAR ROHINI MOHAN | 6 | 5 | 7 | 8 | 12 | 15 | 22 | 45 |
| 29 | B191172529 | ROHIT ARUN TAJANE | 5 | 7 | 8 | 6 | 18 | 17 | 20 | 38 |
| 30 | B191172530 | SARONE SHWETA PRAMOD | 8 | 9 | 5 | 6 | 16 | 21 | 21 | 30 |
| 31 | B191172531 | SHARDUL DHARMARAJ PANDURANG | 7 | 3 | 5 | 3 | 14 | 16 | 7 | 30 |
| 32 | B191172532 | TANK JAHANVI RAJESH | 9 | 8 | 6 | 5 | 18 | 16 | 21 | 47 |
| 33 | B191172533 | VIDHATE VIRAJ HARISHCHANDRA | 4 | 4 | 3 | 5 | 8 | 15 | 6 | 31 |
| 34 | B191172534 | VRUSHABH DIPAK ZOPE | 5 | 9 | 6 | 7 | 10 | 14 | 22 | 31 |
| 35 | B191172535 | ZOLE ARTI GOVIND | 6 | 3 | 4 | 6 | 12 | 16 | 5 | 48 |
| 36 | | | | | | | | | | |
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| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| **% Target** | 40 | 40 | 40 | 40 | 60 | 60 | 40 | 30 |
| **Minimum Marks required to achieve the Target** | 4.8 | 5.2 | 4.8 | 5.2 | 15 | 15 | 10 | 30 |
| **Number of students achieved the target** | 27 | 20 | 31 | 21 | 20 | 26 | 28 | 22 |
| **Total No. of Students** | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| **% of Number of students achieved the Target** | 77 | 57 | 89 | 60 | 57 | 74 | 80 | 63 |
| **Attainment Levels (To fill the values, refer following table)** | **3.0** | **2.7** | **3.0** | **3.0** | **2.7** | **3.0** | **3.0** | **3.0** |

| Attainment Levels | | |
|---|---|---|
| | 60% and more | 3 |
| **% of Number of Students achieved Target** | 50% and more | 2 |
| | 40 % and more | 1 |
| | Less than 40 % | 0 |

| Instructions for the Teacher before filling the sheet: | |
|---|---|
| **Colour Codes:** | |
| | Not to be edited |
| | Subject Teacher needs to enter the marks from the source document |
| | Subject Teacher needs to edit entries as applicable |
| | Subject Teacher needs to edit the formula as applicable |
| **Steps to be followed while filling up this sheet:** | |
| Step 1 | Edit the header as applicable |
| Step 2 | Fill up the marks for each assessment tool from the corresponding source. |
| Step 3 | Set up the target for each assessment tool, target can be different for every tool. (% Target) |
| Step 4 | Edit the formula for "Number of students achieved the target" for each assessment tool for minimum marks |
| Step 5 | Insert "Total No. of Students" in only first cell of the row. |
| Step 6 | Fill up the "Attainment Levels" for each tool (Scale 1 to 3) as guided in the table of Attainment Levels |

## Sanghavi College of Engineering, Nashik
## Attainment Sheet- Part B - PO Attainment

**Department : Electrical Engineering**    **Class: BE**

**A.Y. 2022-23 Sem-I**    **Subject Teacher: Ms. Snehal S. Uphade**

**Subject: Power Quality Management**    **Subject Code:  403143B**

| Attainment Levels | | |
|---|---|---|
| **% of Number of Students achieved Target** | **60% and more** | **3** |
| | **50% and more** | **2** |
| | **40 % and more** | **1** |
| | **Less than 40 %** | **0 (Dash)** |

| CO Attainment | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sr. No.** | **Type of Assessment** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** | **CO6** | |
| 1 | **Internal Assessment** | 3.0 | 2.7 | 3.0 | 3.0 | 2.7 | 3.0 | |
| 2 | **External Assessment (Oral)** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| 3 | **External Assessment (Theory Exam)** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| | **Average of External Assessment** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| | **Average (30 % Internal + 70 % External)** | 3.00 | 2.91 | 3.00 | 3.00 | 2.91 | 3.00 | |
| | **CO Attainment Average** | **2.97** | | | | | | |

**Note: Internal Assessment has given 30 % weightage and External Assessment has given 70 % weightage**

## Course Articulation Matrix

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | - | 1 | - | 1 | - | - | - | - | - | 2 | - | - |
| CO2 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | - | - | - | - | 1 | - | - |
| CO3 | 3 | 1 | - | 2 | 1 | 1 | 1 | - | - | - | - | 1 | - | - |
| CO4 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | - | - | - | - | 1 | - | - |
| CO5 | 3 | 2 | 3 | 3 | 2 | 1 | 1 | - | - | - | - | 1 | - | - |
| CO6 | 3 | 1 | 2 | - | 3 | - | - | - | 3 | - | 1 | 1 | - | - |
| **CO-PO Articulation Average** | **3.0** | **1.8** | **2.5** | **1.8** | **1.8** | **1.2** | **1.0** | **-** | **3.0** | **-** | **1.0** | **1.2** | **-** | **-** |

## PO Attainment

| Subject Code | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **403143B** | 2.97 | 1.78 | 2.48 | 1.78 | 1.78 | 1.19 | 0.99 | - | 2.97 | - | 0.99 | 1.16 | - | - |

| Note: PO Attainment is calculated using following rule, |
|---|
| **PO Attainment = (CO Attainment Average/3) x (CO-PO Articulation Average)** |

| Instructions for the Teacher before filling the sheet: | |
|---|---|
| **Colour Codes:** | |
| | **Not to be edited** |
| | **Subject Teacher needs to edit entries as applicable** |
| Step 1 | **Fill up the Course Articulation Matrix to map the POs to the COs on the scale of 1 to 3** |

# Sanghavi College of Engineering, Nashik
## Attainment Sheet- Part A - CO Attainment

**Department : Computer Engineering**　　　　　　**Class: BE**

**A.Y. 2022-23 Sem-I**　　　　　　**Subject Teacher: Mr. B. S. Shirole**

**Subject: Software Testing & Quality Assurance**　　　　　　**Subject Code:　410245 (D)**

| Sr. No. | Seat No. | Name of student | Internal Assessment Tools | | | | | | External Assessment Tools | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unit test-I | | Unit test-II | | Assignment | | Oral Exam | University Exam |
| | | | 12 | 13 | 12 | 13 | 25 | 25 | 25 | 100 |
| | | | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | All COs | All COs |
| 1 | B191174201 | BADGUJAR SONALI KANTILAL | 11 | 8 | 10 | 9 | 20 | 20 | 40 | 66 |
| 2 | B191174202 | BHAMARE DIVYA GANESH | 6 | 7 | 6 | 7 | 16 | 16 | 40 | 46 |
| 3 | B191174203 | BHANGARE UNNATI DATTATRAY | 4 | 7 | 6 | 5 | 18 | 19 | 38 | 43 |
| 4 | B191174204 | BHASKAR RAJDEV RAJESHKUMAR | 5 | 7 | 6 | 7 | 20 | 21 | 42 | 46 |
| 5 | B191174205 | BHOIR SAYALI DHIRAJ | 9 | 10 | 9 | 10 | 18 | 20 | 39 | 68 |
| 6 | B191174206 | BHOJ HARSHAL TANAJI | 4 | 6 | 5 | 6 | 18 | 20 | 40 | 34 |
| 7 | B191174207 | CHAVHAN MAYUR KAILAS | 2 | 3 | 2 | 3 | 14 | 13 | 38 | 14 |
| 8 | B191174208 | DAPKE ATUL VALMIK | 8 | 9 | 8 | 6 | 21 | 20 | 41 | 66 |
| 9 | B191174209 | DESALE KALYANI DEVIDAS | 9 | 11 | 10 | 11 | 22 | 20 | 41 | 76 |
| 10 | B191174210 | DHAGE ADITYA SUNIL | 7 | 8 | 7 | 8 | 21 | 18 | 35 | 56 |
| 11 | B191174211 | GAIKWAD AJAY BALASAHEB | 4 | 7 | 6 | 7 | 21 | 18 | 37 | 44 |
| 12 | B191174212 | GULDAGAD OMSHREE BABASAHEB | 5 | 6 | 4 | 6 | 22 | 12 | 39 | 35 |
| 13 | B191174213 | JADHAV PRANAV NARAYAN | 5 | 6 | 5 | 5 | 18 | 20 | 35 | 34 |
| 14 | B191174214 | JADHAV PRATIK YOGESH | 6 | 7 | 4 | 7 | 20 | 18 | 40 | 46 |
| 15 | B191174215 | JADHAV SHUBHAM CHANDRABHAN | 4 | 7 | 6 | 6 | 18 | 20 | 38 | 42 |
| 16 | B191174216 | JAGTAP SARIKA KRUSHNA | 5 | 8 | 7 | 8 | 20 | 22 | 40 | 51 |
| 17 | B191174217 | KHAIRNAR LALIT BHARAT | 2 | 3 | 2 | 3 | 13 | 14 | 39 | 16 |
| 18 | B191174218 | MAHALE AARTI DHANANJAY | 7 | 8 | 7 | 8 | 18 | 20 | 36 | 54 |
| 19 | B191174219 | MOHITE PRATHMESH SOMNATH | 0 | 1 | 0 | 5 | 18 | 20 | 40 | 0 |
| 20 | B191174220 | MULANE PRATHAMESH KAILAS | 5 | 6 | 4 | 6 | 12 | 20 | 38 | 36 |
| 21 | B191174221 | NEHRE ASHA DINKAR | 4 | 5 | 4 | 5 | 15 | 17 | 30 | 27 |
| 22 | B191174222 | NIKAM PRASANNA ARVIND | 7 | 8 | 7 | 8 | 18 | 18 | 40 | 52 |
| 23 | B191174223 | NIRGHUDE PRITAM KAILAS | 4 | 5 | 4 | 5 | 20 | 20 | 40 | 33 |
| 24 | B191174224 | PINGAL PRASHANT ABASAHEB | 4 | 5 | 4 | 5 | 19 | 18 | 38 | 31 |
| 25 | B191174225 | RANDIVE ROHAN SHANKAR | 5 | 6 | 5 | 6 | 21 | 18 | 36 | 34 |
| 26 | B191174226 | SHILAWAT VARSHARANI SUNIL | 4 | 5 | 4 | 5 | 17 | 18 | 40 | 30 |
| 27 | B191174227 | SONAWANE AKSHAY RAKESH | 8 | 9 | 8 | 9 | 20 | 12 | 42 | 60 |
| 28 | B191174228 | SONAWANE ROHIT UDDHAV | 5 | 6 | 5 | 6 | 20 | 20 | 41 | 40 |
| 29 | B191174229 | TANK KEYUR KISHOR | 4 | 7 | 4 | 5 | 20 | 18 | 41 | 42 |
| 30 | B191174230 | VENKATESH SANJAY NIKAM | 6 | 7 | 6 | 7 | 21 | 20 | 39 | 47 |
| 31 | B191174231 | WAGH LINESH SADASHIV | 4 | 7 | 4 | 7 | 22 | 20 | 40 | 43 |
| 32 | B191174232 | YERWAL DIKSHANT NAMDEO | 7 | 8 | 7 | 8 | 18 | 20 | 39 | 54 |
| 33 | | | | | | | | | | |
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| 59 | | | | | | | | | |
| 60 | | | | | | | | | |
| % Target | | 40 | 40 | 40 | 40 | 60 | 60 | 40 | 40 |
| Minimum Marks required to achieve the Target | | 5 | 6 | 5 | 6 | 15 | 15 | 10 | 40 |
| Number of students achieved the target | | 19 | 26 | 20 | 22 | 29 | 28 | 32 | 20 |
| Total No. of Students | | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| % of Number of students achieved the Target | | 54 | 74 | 57 | 63 | 83 | 80 | 91 | 57 |
| Attainment Levels (To fill the values, refer following table) | | 2.4 | 3.0 | 2.7 | 3.0 | 3.0 | 3.0 | 3.0 | 2.7 |

| Attainment Levels | | |
|---|---|---|
| | 60% and more | 3 |
| | 50% and more | 2 |
| % of Number of Students achieved Target | 40 % and more | 1 |
| | Less than 40 % | 0 (type dash "-") |

| Instructions for the Teacher before filling the sheet: |
|---|
| **Colour Codes:** |

| | |
|---|---|
| | Not to be edited |
| | Subject Teacher needs to enter the marks from the source document |
| | Subject Teacher needs to edit entries as applicable |
| | Subject Teacher needs to edit the formula as applicable |

| Steps to be followed while filling up this sheet: | |
|---|---|
| Step 1 | Edit the header as applicable |
| Step 2 | Fill up the marks for each assessment tool from the corresponding source. |
| Step 3 | Set up the target for each assessment tool, target can be different for every tool. (% Target) |
| Step 4 | Edit the formula for "Number of students achieved the target" for each assessment tool for minimum marks |
| Step 5 | Insert "Total No. of Students" in only first cell of the row. |
| Step 6 | Fill up the "Attainment Levels" for each tool (Scale 1 to 3) as guided in the table of Attainment Levels |

# Sanghavi College of Engineering, Nashik
## Attainment Sheet- Part B - PO Attainment

**Department : Computer Engineering**       **Class: BE**

**A.Y. 2022-23 Sem-I**       **Subject Teacher: Mr. B. S. Shirole**

**Subject: Software Testing & Quality Assurance**       **Subject Code:**      **410245 (D)**

| Attainment Levels | | |
|---|---|---|
| **% of Number of Students achieved Target** | **60% and more** | **3** |
| | **50% and more** | **2** |
| | **40 % and more** | **1** |
| | **Less than 40 %** | **0 (Dash)** |

| CO Attainment | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sr. No.** | **Type of Assessment** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** | **CO6** | |
| 1 | **Internal Assessment** | **2.4** | **3.0** | **2.7** | **3.0** | **3.0** | **3.0** | |
| 2 | **External Assessment (Oral)** | **3.0** | **3.0** | **3.0** | **3.0** | **3.0** | **3.0** | |
| 3 | **External Assessment (Theory Exam)** | **2.7** | **2.7** | **2.7** | **2.7** | **2.7** | **2.7** | |
| | **Average of External Assessment** | **2.9** | **2.9** | **2.9** | **2.9** | **2.9** | **2.9** | |
| | **Average (30 % Internal + 70 % External)** | **2.72** | **2.90** | **2.81** | **2.90** | **2.90** | **2.90** | |
| | **CO Attainment Average** | **2.85** | | | | | | |

**Note: Internal Assessment has given 30 % weightage and External Assessment has given 70 % weightage**

## Course Articulation Matrix

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 2 | 2 | - | - | 1 | 1 | 1 | 1 | 1 | - | - |
| CO2 | 1 | 3 | 3 | 2 | 1 | - | 1 | 1 | 1 | - | 1 | - | - | - |
| CO3 | 1 | - | 1 | 1 | 3 | - | 1 | - | 1 | - | - | - | - | - |
| CO4 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | - | 1 | - | - | - |
| CO5 | 1 | 2 | 1 | 1 | 3 | - | 1 | - | 1 | - | - | - | - | - |
| CO6 | 1 | 2 | 3 | 1 | 3 | - | - | - | 1 | 1 | 1 | - | - | - |
| **CO-PO Articulation Average** | **1.33** | **1.80** | **1.83** | **1.50** | **2.17** | **1.00** | **1.00** | **1.33** | **1.00** | **1.00** | **1.00** | **1.00** | **-** | **-** |

## PO Attainment

| Subject Code | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **410245 (D)** | 1.27 | 1.71 | 1.74 | 1.43 | 2.06 | 0.95 | 0.95 | 1.27 | 0.95 | 0.95 | 0.95 | 0.95 | - | - |

| Note: PO Attainment is calculated using following rule, |
|---|
| **PO Attainment = (CO Attainment Average/3) x (CO-PO Articulation Average)** |

| Instructions for the Teacher before filling the sheet: | |
|---|---|
| **Colour Codes:** | |
| | **Not to be edited** |
| | **Subject Teacher needs to edit entries as applicable** |
| Step 1 | **Fill up the Course Articulation Matrix to map the POs to the COs on the scale of 1 to 3** |

# Sanghavi College of Engineering, Nashik
## Attainment Sheet- Part A - CO Attainment

Department : Electrical Engineering 

Class: TE

A.Y. 2022-23 Sem-I 

Subject Teacher: Mr. R S. Bankar

Subject: Electrical Installation Design & Condition Based Maintenance 

Subject Code: 303144

| Sr. No. | Seat No. | Name of student | Internal Assessment Tools | | | | | | External Assessment Tools | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unit test-I | | Unit test-II | | Assignment | | Oral Exam | University Exam |
| | | | 12 | 13 | 12 | 13 | 25 | 25 | 25 | 100 |
| | | | CO1 | CO1 | CO2 | CO3 | CO4 | CO5 | All COs | All COs |
| 1 | T191172501 | RENIWAL ABHISHEK VINOD | 3 | 5 | 4 | 4 | 8 | 8 | 13 | 25 |
| 2 | T191172504 | BAGUL VIKRAM ANNASAHEB | 4 | 5 | 6 | 5 | 9 | 11 | 12 | 31 |
| 3 | T191172505 | BHADKE CHAINTAYA NILKHANTHA | 4 | 4 | 6 | 4 | 8 | 10 | 15 | 29 |
| 4 | T191172506 | BHADKE RUTIK SHAM | 3 | 4 | 5 | 4 | 7 | 9 | 14 | 22 |
| 5 | T191172507 | BHAGWAT SUNNY BHARAT | 5 | 7 | 6 | 6 | 16 | 12 | 20 | 35 |
| 6 | T191172509 | BHOYE PALLAVI VISHNU | 6 | 7 | 8 | 7 | 15 | 15 | 23 | 47 |
| 7 | T191172510 | BHUSARE MAYUR TANAJI | 4 | 6 | 5 | 5 | 10 | 10 | 12 | 40 |
| 8 | T191172511 | CHAUDHARI VISHAL ASHOK | 9 | 6 | 9 | 10 | 15 | 19 | 20 | 54 |
| 9 | T191172512 | DEEP BALKRISHNA TUNGARE | 9 | 10 | 9 | 10 | 19 | 19 | 22 | 62 |
| 10 | T191172513 | DESHMUKH SWAJAL OMKARRO | 10 | 9 | 10 | 11 | 19 | 21 | 23 | 63 |
| 11 | T191172515 | GAVIT MIHIR SONIRAM | 6 | 7 | 8 | 7 | 15 | 15 | 21 | 42 |
| 12 | T191172516 | GOVIND DURGESH SADASHIV | 4 | 1 | 4 | 5 | 5 | 9 | 12 | AB |
| 13 | T191172518 | JAGTAP YADNESH DHARMRAJ | 6 | 8 | 7 | 7 | 14 | 14 | 21 | 47 |
| 14 | T191172519 | KADAM ABHISHEK RAMKRUSHNA | 4 | 5 | 5 | 4 | 15 | 9 | 21 | 32 |
| 15 | T191172520 | KALOGE ADITYA PUNDLIK | 3 | 4 | 4 | 4 | 7 | 8 | 17 | 19 |
| 16 | T191172521 | KEDARE SUBODH SATISH | 4 | 4 | 5 | 5 | 8 | 10 | 15 | 31 |
| 17 | T191172522 | KHANDAVE ARJUN DNYANESHWAR | 4 | 5 | 4 | 5 | 16 | 9 | 19 | 29 |
| 18 | T191172523 | KHODE YOGESH RAVINDRA | 5 | 7 | 6 | 6 | 17 | 12 | 21 | 50 |
| 19 | T191172524 | KORADKAR KUNAL SUNIL | 6 | 9 | 8 | 7 | 18 | 15 | 20 | 50 |
| 20 | T191172525 | KUMAVAT AKASH EKNATH | 5 | 7 | 6 | 5 | 12 | 11 | 16 | 46 |
| 21 | T191172526 | KUNAL ABHIMAN GOLAIT | 6 | 9 | 8 | 7 | 15 | 15 | 15 | 42 |
| 22 | T191172528 | NIKAM KANCHANMALA ASHOK | 2 | 3 | 3 | 3 | 5 | 6 | 12 | 11 |
| 23 | T191172529 | NIKHIL PANDURANG JADHAV | 8 | 7 | 8 | 9 | 19 | 17 | 19 | 49 |
| 24 | T191172530 | PAGAR MAYUR RAJENDRA | 7 | 9 | 8 | 8 | 20 | 16 | 22 | 44 |
| 25 | T191172531 | PAGARE LALIT NANDU | 2 | 3 | 3 | 3 | 5 | 6 | 15 | 12 |
| 26 | T191172532 | PAGARE POOJA SANDIP | 4 | 4 | 5 | 5 | 8 | 10 | 12 | 28 |
| 27 | T191172533 | PAWAR RISHABH RAJESH | 6 | 7 | 8 | 7 | 22 | 15 | 23 | 47 |
| 28 | T191172534 | PAWAR SHUBHAM CHANDRAKANT | 8 | 7 | 8 | 9 | 21 | 17 | 23 | 50 |
| 29 | T191172535 | PENDHARKAR SNEHA ANIL | 5 | 7 | 6 | 5 | 12 | 11 | 17 | 41 |
| 30 | T191172536 | RAJOLE SHIVAM SURESH | 10 | 9 | 10 | 11 | 21 | 21 | 23 | 61 |
| 31 | T191172539 | SHINDE AKSHAY VILAS | 3 | 4 | 4 | 4 | 7 | 8 | 14 | 25 |
| 32 | T191172540 | SHUBHAM DASHRATH JAGZAP | 4 | 5 | 5 | 5 | 17 | 10 | 18 | 27 |
| 33 | T191172541 | SURYAWANSHI MAHESH KESHAV | 6 | 7 | 8 | 7 | 13 | 15 | 16 | 45 |
| 34 | T191172542 | TANGTODE VRUSHALI RAJENDRA | 7 | 8 | 9 | 8 | 22 | 17 | 23 | 58 |
| 35 | T191172543 | WAGH NIKITA PANDURANG | 11 | 10 | 11 | 12 | 21 | 23 | 23 | 75 |
| 36 | | | | | | | | | | |
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| 59 | | | | | | | | | | |
| 60 | | | | | | | | | | |
| **% Target** | | 40 | 40 | 40 | 40 | 60 | 60 | 60 | 40 | |
| **Minimum Marks required to achieve the Target** | | 5 | 6 | 5 | 6 | 15 | 15 | 15 | 40 | |
| **Number of students achieved the target** | | 20 | 22 | 28 | 18 | 19 | 15 | 27 | 20 | |
| **Total No. of Students** | | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | |
| **% of Number of students achieved the Target** | | 57 | 63 | 80 | 51 | 54 | 43 | 77 | 57 | |
| **Attainment Levels (To fill the values, refer following table)** | | **2.7** | **3.0** | **3.0** | **2.1** | **2.4** | **1.3** | **3.0** | **2.7** | |

| Attainment Levels | | |
|---|---|---|
| | 60% and more | 3 |
| **% of Number of Students achieved Target** | 50% and more | 2 |
| | 40 % and more | 1 |
| | Less than 40 % | 0 (if not applicable, type "-") |

| Instructions for the Teacher before filling the sheet: | |
|---|---|
| **Colour Codes:** | |
| | Not to be edited |
| | Subject Teacher needs to enter the marks from the source document |
| | Subject Teacher needs to edit entries as applicable |
| | Subject Teacher needs to edit the formula as applicable |
| **Steps to be followed while filling up this sheet:** | |
| Step 1 | Edit the header as applicable |
| Step 2 | Fill up the marks for each assessment tool from the corresponding source. |
| Step 3 | Set up the target for each assessment tool, target can be different for every tool. (% Target) |
| Step 4 | Edit the formula for "Number of students achieved the target" for each assessment tool for minimum marks |
| Step 5 | Insert "Total No. of Students" in only first cell of the row. |
| Step 6 | Fill up the "Attainment Levels" for each tool (Scale 1 to 3) as guided in the table of Attainment Levels |

# Sanghavi College of Engineering, Nashik
## Attainment Sheet- Part B - PO Attainment

**Department : Electrical Engineering**  **Class: TE**

**A.Y. 2022-23 Sem-I**  **Subject Teacher: Mr. R S. Bankar**

**Subject: Electrical Installation Design & Condition Based Maintenance**  **Subject Code:  303144**

| Attainment Levels | | |
|---|---|---|
| **% of Number of Students achieved Target** | **60% and more** | **3** |
| | **50% and more** | **2** |
| | **40 % and more** | **1** |
| | **Less than 40 %** | **0 or -** |

| CO Attainment | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sr. No. | Type of Assessment | CO1 | CO1 | CO2 | CO3 | CO4 | CO5 |
| 1 | Internal Assessment | 2.7 | 3.0 | 3.0 | 2.1 | 2.4 | 1.3 |
| 2 | External Assessment (Oral) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| 3 | External Assessment (Theory Exam) | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 |
| | Average of External Assessment | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 |
| | Average (30 % Internal + 70 % External) | 2.81 | 2.90 | 2.90 | 2.63 | 2.72 | 2.39 |
| | CO Attainment Average | 2.72 | | | | | |

**Note: Internal Assessment has given 30 % weightage and External Assessment has given 70 % weightage**

## Course Articulation Matrix

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 2 | 1 | 2 | 1 | - | 1 | - | - | - | - | 1 | - | - |
| CO3 | 3 | 3 | 2 | 3 | 3 | - | - | - | 2 | - | - | - | - | - |
| CO4 | 3 | 1 | 1 | 1 | 3 | 2 | 1 | - | 2 | - | - | - | - | - |
| CO5 | 3 | - | - | - | 3 | 3 | 1 | - | - | - | - | 1 | - | - |
| | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO-PO Articulation Average** | **3.0** | **2.0** | **1.3** | **2.0** | **2.5** | **2.5** | **1.0** | **-** | **2.0** | **-** | **-** | **1.0** | **-** | **-** |

## PO Attainment

| Subject Code | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **303144** | 2.72 | 1.81 | 1.21 | 1.81 | 2.27 | 2.27 | 0.91 | - | 1.81 | - | - | 0.91 | - | - |

| Note: PO Attainment is calculated using following rule, |
|---|
| **PO Attainment = (CO Attainment Average/3) x (CO-PO Articulation Average)** |

| Instructions for the Teacher before filling the sheet: | |
|---|---|
| **Colour Codes:** | |
| | **Not to be edited** |
| | **Subject Teacher needs to edit entries as applicable** |
| Step 1 | **Fill up the Course Articulation Matrix to map the POs to the COs on the scale of 1 to 3** |

# Sanghavi College of Engineering, Nashik

## Attainment Sheet- Part A - CO Attainment

Department : Computer Engineering

A.Y. 2022-23 Sem-I

Subject: Internet of Things and Embedded Systems

Class: TE

Subject Teacher: Mr. Sandeep R. Jadhav

Subject Code:     310245(A)

| Sr. No. | Seat No. | Name of student | Internal Assessment Tools | | | | | | External Assessment Tools | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unit test-I | | Unit test-II | | Assignment | | Oral Exam | University Exam |
| | | | 12 | 13 | 12 | 13 | 25 | 25 | 25 | 100 |
| | | | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | All COs | All COs |
| 1 | T191174201 | AMRUTKAR ANUSHA MOHAN | 6 | 8 | 8 | 9 | 18 | 17 | 19 | 33 |
| 2 | T191174202 | ANDHALE MAYURI GOVIND | 5 | 7 | 10 | 11 | 20 | 20 | 22 | 29 |
| 3 | T191174203 | ASHWINI PRAKASH PATIL | 7 | 9 | 12 | 11 | 20 | 19 | 21 | 44 |
| 4 | T191174204 | ASJAD SAMDANI | 11 | 10 | 8 | 11 | 18 | 16 | 18 | 52 |
| 5 | T191174205 | ATHARE SHITAL VILAS | 11 | 13 | 10 | 12 | 20 | 19 | 21 | 75 |
| 6 | T191174206 | BAGADE NISHA SITARAM | 5 | 9 | 8 | 12 | 21 | 16 | 18 | 41 |
| 7 | T191174207 | BAGUL GOVARDHAN PANDURANG | 10 | 12 | 8 | 11 | 18 | 16 | 18 | 50 |
| 8 | T191174208 | BARKUL SAKSHI SHRIRANG | 3 | 4 | 10 | 12 | 20 | 16 | 18 | 11 |
| 9 | T191174209 | BARMAN SURANJAN SUKUMAR | 6 | 8 | 8 | 12 | 21 | 13 | AB | 31 |
| 10 | T191174210 | BHADANE SAYALI MANOJ | 5 | 7 | 10 | 10 | 16 | 18 | 20 | 23 |
| 11 | T191174211 | BHAVAR AMOL SHANTARAM | 7 | 9 | 10 | 11 | 18 | 18 | 20 | 39 |
| 12 | T191174212 | BHONDVE ROHAN RAJU | 5 | 7 | 10 | 10 | 20 | 17 | 19 | 25 |
| 13 | T191174213 | BIRARI LINA PRAVIN | 6 | 8 | 10 | 9 | 18 | 19 | 21 | 34 |
| 14 | T191174214 | BORASTE GAURAV UTTAM | 7 | 11 | 9 | 7 | 14 | 14 | 22 | 34 |
| 15 | T191174215 | DARADE DHANANJAY DNYANESHWAR | 4 | 5 | 4 | 6 | 13 | 15 | 20 | 40 |
| 16 | T191174216 | DARADE KARAN SITARAM | 9 | 11 | 10 | 8 | 12 | 14 | 19 | 42 |
| 17 | T191174217 | DAS ANKUSH ANIL | 9 | 10 | 9 | 8 | 15 | 17 | 18 | 35 |
| 18 | T191174218 | DEORE NAYANA VILAS | 11 | 10 | 6 | 4 | 13 | 14 | 21 | 50 |
| 19 | T191174219 | DESHMUKH AADESH BHARAT | 4 | 5 | 7 | 5 | 15 | 17 | 18 | 18 |
| 20 | T191174220 | GAIKWAD SAHIL MAHENDRA | 9 | 9 | 9 | 7 | 18 | 20 | 22 | 37 |
| 21 | T191174221 | GAIKWAD TEJASHREE DEVIDAS | 10 | 8 | 9 | 7 | 19 | 19 | 21 | 36 |
| 22 | T191174222 | GANGURDE DIKSHA ANIL | 5 | 11 | 8 | 6 | 13 | 15 | 21 | 27 |
| 23 | T191174223 | GANGURDE GANESH CHHABUDAS | 0 | 0 | 4 | 6 | 12 | 12 | AB | 0 |
| 24 | T191174224 | GANGURDE NITIN VYANKAT | 2 | 3 | 8 | 6 | 13 | 14 | AB | 0 |
| 25 | T191174225 | GUJARATHI KHUSHI PRANAY | 11 | 11 | 11 | 9 | 19 | 21 | 19 | 34 |
| 26 | T191174226 | INAMDAR KASHISH NADEEM | 3 | 4 | 4 | 2 | 15 | 17 | 19 | 31 |
| 27 | T191174227 | JADHAV PRIYANKA SUNIL | 10 | 11 | 5 | 9 | 18 | 20 | 21 | 50 |
| 28 | T191174228 | KALE MITESH CHANGDEV | 5 | 7 | 4 | 2 | 13 | 15 | 19 | 32 |
| 29 | T191174229 | KALYANI SOPAN PAWAR | 7 | 5 | 6 | 6 | 18 | 20 | 20 | 44 |
| 30 | T191174230 | KATHE SAKSHI SUNIL | 11 | 10 | 7 | 5 | 12 | 14 | 20 | 50 |
| 31 | T191174231 | KEDAR GAYATRI SUNIL | 8 | 5 | 5 | 6 | 18 | 20 | 21 | 33 |
| 32 | T191174232 | KHAIRNAR KRUTIKA KISHOR | 5 | 4 | 4 | 2 | 14 | 14 | 19 | 41 |
| 33 | T191174233 | KHAIRNAR SANKET NITIN | 6 | 6 | 5 | 4 | 15 | 17 | 20 | 30 |
| 34 | T191174234 | KHARE APURVA SAHEBRAO | 5 | 4 | 5 | 3 | 16 | 18 | 19 | 45 |
| 35 | T191174235 | KUMAVAT SAKSHI BHAUSAHEB | 8 | 7 | 5 | 6 | 20 | 18 | 19 | 42 |
| 36 | T191174236 | KUMAWAT ANJALI KIRAN | 6 | 4 | 4 | 6 | 13 | 15 | 21 | 45 |
| 37 | T191174237 | KUMBHAR RINA SAMADHAN | 9 | 9 | 5 | 7 | 13 | 14 | 20 | 48 |
| 38 | T191174238 | LOKHANDE SEJAL NITIN | 4 | 6 | 5 | 3 | 12 | 14 | 22 | 40 |
| 39 | T191174239 | MALI PRATIK PRAKASH | 10 | 11 | 5 | 8 | 18 | 20 | 19 | 53 |
| 40 | T191174240 | MANDAL SIMRAN RANJEET | 4 | 5 | 4 | 4 | 13 | 15 | 19 | 17 |
| 41 | T191174241 | MARATHE SRUSHTI HEMANT | 8 | 5 | 7 | 5 | 13 | 14 | 19 | 36 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 42 | T191174242 | MAULE VISARVA SHAILENDRA | 5 | 11 | 5 | 7 | 14 | 14 | 21 | 44 |
| 43 | T191174243 | MISTRI GAURI HARISH | 11 | 10 | 4 | 6 | 13 | 15 | 22 | 57 |
| 44 | T191174244 | NAVGHIRE GAYATRI RAMDAS | 9 | 11 | 10 | 8 | 12 | 14 | 21 | 47 |
| 45 | T191174245 | PATHADE PRANJAL SURESH | 9 | 10 | 10 | 8 | 15 | 17 | 20 | 40 |
| 46 | T191174246 | PATIL ARTHIKESH HIMMAT | 8 | 4 | 6 | 4 | 13 | 14 | 19 | 42 |
| 47 | T191174247 | PATIL VAIBHAV MUKTYARSING | 4 | 4 | 5 | 5 | 15 | 17 | 20 | 21 |
| 48 | T191174248 | PATKAR SOHAM YOGESH | 5 | 9 | 5 | 7 | 18 | 20 | 19 | 26 |
| 49 | T191174249 | PAWAR JAY KACHESHWAR | 10 | 8 | 9 | 7 | 19 | 19 | 19 | 23 |
| 50 | T191174250 | PAWAR MOHIT ANIL | 5 | 11 | 8 | 6 | 13 | 15 | 19 | 32 |
| 51 | T191174251 | PAWAR SNEHAL SAYABU | 4 | 4 | 4 | 6 | 12 | 14 | 19 | 44 |
| 52 | T191174253 | SAHALE USHA NAVNATH | 3 | 5 | 8 | 6 | 13 | 14 | 19 | 22 |
| 53 | T191174254 | SANGALE VAISHNAVI SANJAY | 11 | 11 | 11 | 9 | 19 | 21 | 22 | 63 |
| 54 | T191174255 | SANKET SADASHIV JAMDHADE | 3 | 4 | 5 | 2 | 15 | 17 | 20 | 35 |
| 55 | T191174256 | SANSARE KALYANI ARJUN | 10 | 11 | 11 | 9 | 18 | 20 | 21 | 40 |
| 56 | T191174257 | SAPTE LALITA BHAUSAHEB | 5 | 7 | 4 | 2 | 13 | 15 | 21 | 49 |
| 57 | T191174258 | SHAIKH SAMIR HASAN | 10 | 11 | 6 | 6 | 18 | 20 | 21 | 50 |
| 58 | T191174259 | SHARMA SHIVAM KAUSHAL | 5 | 6 | 7 | 5 | 12 | 14 | 19 | 35 |
| 59 | T191174260 | SHINDE RAJASHREE RAJENDRA | 8 | 5 | 5 | 6 | 18 | 20 | 19 | 28 |
| 60 | T191174261 | SHINGADE YADNYESH DATTATRAY | 6 | 4 | 4 | 2 | 14 | 14 | 21 | 24 |
| 61 | T191174262 | SHIRSATH AKSHAY MADHUKAR | 5 | 6 | 5 | 4 | 15 | 17 | 19 | 32 |
| 62 | T191174263 | SOMWANSHI RITESH SANDEEP | 5 | 5 | 5 | 3 | 16 | 18 | 20 | 42 |
| 63 | T191174264 | SONAWANE AKSHADA BALASAHEB | 8 | 7 | 8 | 6 | 20 | 18 | 22 | 43 |
| 64 | T191174266 | SONAWANE GAYATRI PRABHAKAR | 6 | 4 | 4 | 6 | 13 | 15 | 21 | 31 |
| 65 | T191174267 | SONAWANE TOSHIL GIRISH | 9 | 9 | 9 | 7 | 13 | 14 | 16 | 35 |
| 66 | T191174268 | TAKSAL JYOTI CHANDRAKANT | 4 | 6 | 5 | 3 | 12 | 14 | 21 | 48 |
| 67 | T191174269 | THOMBAL PRAVIN BALASAHEB | 9 | 10 | 9 | 8 | 18 | 20 | 21 | 41 |
| 68 | T191174270 | VADALKAR DARSHANA NILESH | 4 | 5 | 4 | 4 | 13 | 15 | 21 | 40 |
| 69 | T191174271 | VAIBHAV KRISHNAA CHANDUKUMAR | 8 | 5 | 7 | 5 | 13 | 14 | 20 | 40 |
| 70 | T191174272 | VISPUTE AJAY KAMALAKAR | 6 | 8 | 5 | 11 | 18 | 19 | 21 | 37 |
| 71 | T191174273 | WAJE KANCHAN NAMDEO | 7 | 9 | 8 | 10 | 10 | 17 | 19 | 42 |
| | | % Target | 50 | 50 | 50 | 50 | 60 | 60 | 50 | 40 |
| | | Minimum Marks required to achieve the Target | 6 | 7 | 6 | 7 | 15 | 15 | 13 | 40 |
| | | Number of students achieved the target | 42 | 43 | 41 | 33 | 40 | 50 | 68 | 35 |
| | | Total No. of Students | 71 | 71 | 71 | 71 | 71 | 71 | 71 | 71 |
| | | % of Number of students achieved the Target | 59 | 61 | 58 | 46 | 56 | 70 | 96 | 49 |
| | | Attainment Levels (To fill the values, refer following table) | 2.9 | 3.0 | 2.8 | 1.6 | 2.6 | 3.0 | 3.0 | 1.9 |

| Attainment Levels | | |
|---|---|---|
| % of Number of Students achieved Target | 60% and more | 3 |
| | 50% and more | 2 |
| | 40 % and more | 1 |
| | Less than 40 % | 0 (type dash "-") |

| Instructions for the Teacher before filling the sheet: |
|---|
| Colour Codes: |
| Not to be edited |
| Subject Teacher needs to enter the marks from the source document |
| Subject Teacher needs to edit entries as applicable |

| | Subject Teacher needs to edit the formula as applicable |
|---|---|
| **Steps to be followed while filling up this sheet:** | |
| Step 1 | **Edit the header as applicable** |
| Step 2 | **Fill up the marks for each assessment tool from the corresponding source.** |
| Step 3 | **Set up the target for each assessment tool, target can be different for every tool. (% Target)** |
| Step 4 | **Edit the formula for "Number of students achieved the target" for each assessment tool for minimum marks** |
| Step 5 | **Insert "Total No. of Students" in only first cell of the row.** |
| Step 6 | **Fill up the "Attainment Levels" for each tool (Scale 1 to 3) as guided in the table of Attainment Levels** |

# Sanghavi College of Engineering, Nashik
## Attainment Sheet- Part B - PO Attainment

**Department : Computer Engineering**                          **Class: TE**

**A.Y. 2022-23 Sem-I**                          **Subject Teacher: Mr. Sandeep R. Jadhav**

**Subject: Internet of Things and Embedded Systems**          **Subject Code:          310245(A)**

| Attainment Levels | | |
|---|---|---|
| **% of Number of Students achieved Target** | **60% and more** | **3** |
| | **50% and more** | **2** |
| | **40 % and more** | **1** |
| | **Less than 40 %** | **0 (Dash)** |

| CO Attainment | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sr. No. | Type of Assessment | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | |
| 1 | Internal Assessment | 2.9 | 3.0 | 2.8 | 1.6 | 2.6 | 3.0 | |
| 2 | External Assessment (Oral) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| 3 | External Assessment (Theory Exam) | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | |
| | Average of External Assessment | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | |
| | Average (30 % Internal + 70 % External) | 2.59 | 2.62 | 2.56 | 2.20 | 2.50 | 2.62 | |
| | CO Attainment Average | 2.51 | | | | | | |

**Note: Internal Assessment has given 30 % weightage and External Assessment has given 70 % weightage**

## Course Articulation Matrix

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 2 | - | - | - | - | 1 | - | 1 | - | - | - |
| CO2 | 3 | 2 | 1 | 2 | 1 | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | 3 | 3 | 3 | 1 | 2 | - | - | 1 | - | - | - | - | - |
| CO4 | 1 | 2 | 2 | 2 | - | 2 | - | - | - | 1 | 2 | 1 | - | - |
| CO5 | 2 | 2 | 2 | 1 | 2 | 1 | - | - | - | 1 | 2 | 1 | - | - |
| CO6 | 2 | 2 | 1 | 1 | 1 | 1 | - | - | 1 | - | 1 | - | - | - |
| CO-PO Articulation Average | 2.2 | 2.0 | 1.7 | 1.8 | 1.3 | 1.5 | - | 1.0 | 1.0 | 1.0 | 1.5 | 1.0 | - | - |

| PO Attainment | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subject Code | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 | PSO1 | PSO2 |
| **310245(A)** | 1.81 | 1.67 | 1.39 | 1.53 | 1.05 | 1.26 | - | 0.84 | 0.84 | 0.84 | 1.26 | 0.84 | - | - |

| Note: PO Attainment is calculated using following rule, |
|---|
| **PO Attainment = (CO Attainment Average/3) x (CO-PO Articulation Average)** |

| Instructions for the Teacher before filling the sheet: | |
|---|---|
| **Colour Codes:** | |
| | **Not to be edited** |
| | **Subject Teacher needs to edit entries as applicable** |
| Step 1 | **Fill up the Course Articulation Matrix to map the POs to the COs on the scale of 1 to 3** |

# Sanghavi College of Engineering, Nashik
## Attainment Sheet- Part A - CO Attainment

Department : Electrical Engineering  Class: SE

A.Y. 2022-23 Sem-I  Subject Teacher: Mr. A. K. Sonawane

Subject: Material Science  Subject Code:  203142

| Sr. No. | Seat No. | Name of student | Internal Assessment Tools | | | | | | External Assessment Tools | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unit test-I | | Unit test-II | | Assignment | | Oral Exam | University Exam |
| | | | 12 | 13 | 12 | 13 | 25 | 25 | 25 | 100 |
| | | | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | All COs | All COs |
| 1 | S191172501 | APSUNDE SHUBHAM SUNIL | 5 | 4 | 5 | 5 | 19 | 20 | 19 | 19 |
| 2 | S191172502 | BAGUL DNYANESHWAR BHASKAR | 3 | 6 | 5 | 7 | 8 | 11 | 12 | AB |
| 3 | S191172503 | BAGUL KALIDAS ASHOK | 7 | 6 | 7 | 8 | 20 | 20 | 18 | 37 |
| 4 | S191172504 | CHAURE AMIT SANTOSH | 8 | 7 | 8 | 8 | 16 | 14 | 16 | 41 |
| 5 | S191172505 | CHAVAN KARTIK SUBHASH | 4 | 5 | 5 | 6 | 18 | 18 | 18 | 29 |
| 6 | S191172506 | CHAVAN NILESH SOMNATH | 6 | 5 | 6 | 5 | 15 | 15 | 13 | 22 |
| 7 | S191172507 | DINDE YASH KAKASAHEB | 4 | 4 | 4 | 5 | 13 | 14 | 15 | 20 |
| 8 | S191172508 | DIPAK YASHWANT RATHODE | 3 | 6 | 5 | 7 | 19 | 21 | 20 | 0 |
| 9 | S191172509 | EMIL DEVIDAS BAGUL | 4 | 3 | 4 | 4 | 15 | 14 | 14 | 5 |
| 10 | S191172510 | GAWALI NILESH KANTILAL | 6 | 5 | 6 | 6 | 12 | 16 | 15 | 27 |
| 11 | S191172511 | GAWARE SANKET YUVRAJ | 7 | 6 | 7 | 8 | 22 | 19 | 19 | 33 |
| 12 | S191172512 | GHODE GUNJAN DNYANESHWAR | 8 | 10 | 9 | 11 | 20 | 21 | 20 | 68 |
| 13 | S191172513 | GHULE OMKAR KAILAS | 4 | 5 | 5 | 6 | 16 | 16 | 16 | 24 |
| 14 | S191172514 | INGLE AKASH LALCHAND | 3 | 2 | 3 | 3 | 15 | 14 | 13 | AB |
| 15 | S191172515 | JADHAV HARSHAD VISHNU | 4 | 3 | 4 | 5 | 8 | 17 | 15 | 12 |
| 16 | S191172516 | KAVTHEKAR ABHISHEK RAJU | 8 | 7 | 8 | 8 | 16 | 16 | 15 | 45 |
| 17 | S191172517 | KHALKAR SAYALI PUNDLIK | 4 | 5 | 4 | 5 | 18 | 19 | 20 | 29 |
| 18 | S191172518 | KHIRADI SONALI VIJAY | 9 | 8 | 9 | 9 | 19 | 20 | 21 | 53 |
| 19 | S191172519 | KUMAWAT LALIT EKNATH | 4 | 5 | 7 | 6 | 11 | 10 | 12 | 21 |
| 20 | S191172520 | LOKHANDE AKSHAY SANJAY | 3 | 2 | 3 | 3 | 11 | 14 | 16 | 0 |
| 21 | S191172521 | MOHAMMAD ALI IQBALBAIG | 9 | 8 | 9 | 9 | 21 | 21 | 20 | 49 |
| 22 | S191172522 | MUKANE PRASHANT RAMESH | 3 | 2 | 3 | 3 | 12 | 15 | 16 | 0 |
| 23 | S191172523 | MUKANE RAJASHRI RAMESH | 5 | 4 | 5 | 5 | 10 | 16 | 14 | 19 |
| 24 | S191172524 | NIKAM RUSHIKESH VISHNU | 8 | 7 | 8 | 8 | 20 | 21 | 22 | 38 |
| 25 | S191172525 | NILKANTH HANUMANT KHANDVI | 5 | 6 | 6 | 7 | 16 | 18 | 15 | 15 |
| 26 | S191172526 | PADAVI AKSHAY MAVANJI | 4 | 4 | 4 | 5 | 8 | 17 | 13 | 18 |
| 27 | S191172527 | PAGAR UJJWAL BHAUSAHEB | 9 | 8 | 9 | 9 | 18 | 17 | 17 | 54 |
| 28 | S191172528 | PATIL GITESH GANPAT | 7 | 6 | 6 | 7 | 13 | 14 | 15 | 32 |
| 29 | S191172529 | PRADNYA RAJU BEHEDE | 7 | 6 | 7 | 5 | 21 | 20 | 22 | 30 |
| 30 | S191172530 | PRATIK RAJENDRA SURYAVANSHI | 8 | 7 | 8 | 8 | 16 | 15 | 15 | 38 |
| 31 | S191172531 | RATHODE SHAILESH KALIDAS | 8 | 7 | 8 | 8 | 16 | 15 | 15 | 41 |
| 32 | S191172532 | ROHIT RAJENDRA CHAUDHARI | 6 | 6 | 6 | 7 | 12 | 14 | 14 | 24 |
| 33 | S191172533 | TIDAKE GIRISH SHAMRAO | 6 | 5 | 6 | 6 | 16 | 14 | 13 | 26 |
| 34 | S191172534 | VADOLA RUSHIKESH LILADHAR | 4 | 6 | 5 | 7 | 15 | 15 | 14 | 13 |
| 35 | S191172535 | WAGH ROSHAN RAMDAS | 3 | 2 | 3 | 3 | 17 | 19 | 19 | 0 |
| 36 | | | | | | | | | | |
| 37 | | | | | | | | | | |
| 38 | | | | | | | | | | |
| 39 | | | | | | | | | | |
| 40 | | | | | | | | | | |
| 41 | | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 42 | | | | | | | | | | |
| 43 | | | | | | | | | | |
| 44 | | | | | | | | | | |
| 45 | | | | | | | | | | |
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| 57 | | | | | | | | | | |
| 58 | | | | | | | | | | |
| 59 | | | | | | | | | | |
| 60 | | | | | | | | | | |
| **% Target** | 40 | 40 | 40 | 40 | 60 | 60 | 60 | 30 | | |
| **Minimum Marks required to achieve the Target** | 5 | 6 | 5 | 6 | 15 | 15 | 15 | 30 | | |
| **Number of students achieved the target** | 20 | 19 | 26 | 22 | 24 | 25 | 25 | 13 | | |
| **Total No. of Students** | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | | |
| **% of Number of students achieved the Target** | 57 | 54 | 74 | 63 | 69 | 71 | 71 | 37 | | |
| **Attainment Levels (To fill the values, refer following table)** | **2.7** | **2.4** | **3.0** | **3.0** | **3.0** | **3.0** | **3.0** | **0.0** | | |

| Attainment Levels | | |
|---|---|---|
| **% of Number of Students achieved Target** | 60% and more | 3 |
| | 50% and more | 2 |
| | 40 % and more | 1 |
| | Less than 40 % | 0 (if not applicable, type "-") |

| Instructions for the Teacher before filling the sheet: | |
|---|---|
| **Colour Codes:** | |
| | Not to be edited |
| | Subject Teacher needs to enter the marks from the source document |
| | Subject Teacher needs to edit entries as applicable |
| | Subject Teacher needs to edit the formula as applicable |
| **Steps to be followed while filling up this sheet:** | |
| Step 1 | Edit the header as applicable |
| Step 2 | Fill up the marks for each assessment tool from the corresponding source. |
| Step 3 | Set up the target for each assessment tool, target can be different for every tool. (% Target) |
| Step 4 | Edit the formula for "Number of students achieved the target" for each assessment tool for minimum marks |
| Step 5 | Insert "Total No. of Students" in only first cell of the row. |
| Step 6 | Fill up the "Attainment Levels" for each tool (Scale 1 to 3) as guided in the table of Attainment Levels |

# Sanghavi College of Engineering, Nashik
## Attainment Sheet- Part B - PO Attainment

**Department : Electrical Engineering**  **Class: SE**

**A.Y. 2022-23 Sem-I**  **Subject Teacher: Mr. A. K. Sonawane**

**Subject: Material Science**  **Subject Code:        203142**

| Attainment Levels | | |
|---|---|---|
| **% of Number of Students achieved Target** | **60% and more** | **3** |
| | **50% and more** | **2** |
| | **40 % and more** | **1** |
| | **Less than 40 %** | **0 or -** |

| CO Attainment | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sr. No.** | **Type of Assessment** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** | **CO6** | |
| 1 | **Internal Assessment** | 2.7 | 2.4 | 3.0 | 3.0 | 3.0 | 3.0 | |
| 2 | **External Assessment (Oral)** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| 3 | **External Assessment (Theory Exam)** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | **Average of External Assessment** | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | |
| | **Average (30 % Internal + 70 % External)** | 1.86 | 1.77 | 1.95 | 1.95 | 1.95 | 1.95 | |
| | **CO Attainment Average** | **1.91** | | | | | | |

**Note: Internal Assessment has given 30 % weightage and External Assessment has given 70 % weightage**

## Course Articulation Matrix

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 2 | 2 | 1 | 2 | 1 | - | - | - | - | - | - | - | - |
| CO3 | 3 | 3 | 3 | 2 | 2 | 1 | - | - | 1 | - | - | - | - | - |
| CO4 | 3 | 1 | 2 | 3 | 2 | 1 | 1 | - | 1 | - | - | 1 | - | - |
| CO5 | 3 | 2 | 3 | 2 | 2 | 1 | 1 | - | 1 | - | - | - | - | - |
| CO6 | 3 | 1 | 1 | 1 | 1 | - | - | - | - | - | 1 | 1 | - | - |
| **CO-PO Articulation Average** | **3.0** | **1.8** | **2.2** | **1.8** | **1.8** | **1.0** | **1.0** | **-** | **1.0** | **-** | **1.0** | **1.0** | **-** | **-** |

| PO Attainment | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **P10** | **P11** | **P12** | |
| **203142** | 1.91 | 1.14 | 1.40 | 1.14 | 1.14 | 0.64 | 0.64 | - | 0.64 | - | 0.64 | 0.64 | - | - |

| Note: PO Attainment is calculated using following rule, |
|---|
| **PO Attainment = (CO Attainment Average/3) x (CO-PO Articulation Average)** |

| Instructions for the Teacher before filling the sheet: | |
|---|---|
| **Colour Codes:** | |
| | **Not to be edited** |
| | **Subject Teacher needs to edit entries as applicable** |
| Step 1 | **Fill up the Course Articulation Matrix to map the POs to the COs on the scale of 1 to 3** |

# Sanghavi College of Engineering, Nashik
## Attainment Sheet- Part A - CO Attainment

Department : Computer Engineering  Class: SE

A.Y. 2022-23 Sem-I  Subject Teacher: Mr. Sandeep R. Jadhav

Subject: Digital Electronics and Logic Design  Subject Code:  210245

| Sr. No. | Seat No. | Name of student | Internal Assessment Tools | | | | | | External Assessment Tools | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unit test-I | | Unit test-II | | Assignment | | Oral Exam | University Exam |
| | | | 12 | 13 | 12 | 13 | 25 | 25 | 25 | 100 |
| | | | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | All COs | All COs |
| 1 | S191174201 | THUBE SANIKA SUHAS | 7 | 11 | 9 | 7 | 14 | 14 | NA | 18 |
| 2 | S191174202 | AKHADE RITESH SANKET | 4 | 5 | 4 | 6 | 13 | 15 | NA | 23 |
| 3 | S191174203 | ARTI MOTIRAM THAKARE | 9 | 11 | 10 | 8 | 12 | 14 | NA | 53 |
| 4 | S191174204 | BARHATE TEKCHAND LILADHAR | 9 | 10 | 10 | 8 | 15 | 17 | NA | 46 |
| 5 | S191174205 | BEDADE PRASHANT UDAY | 8 | 4 | 6 | 4 | 13 | 14 | NA | 42 |
| 6 | S191174206 | BHALERAO KUNAL KAILAS | 8 | 6 | 7 | 5 | 15 | 17 | NA | 42 |
| 7 | S191174207 | BHERE JAGRUTI DATTATRAY | 9 | 9 | 9 | 7 | 18 | 20 | NA | 48 |
| 8 | S191174208 | BHOR NUTAN TANHAJI | 10 | 8 | 9 | 7 | 19 | 19 | NA | 56 |
| 9 | S191174209 | BORHADE ANIKET JAGDISH | 5 | 11 | 8 | 6 | 13 | 15 | NA | 17 |
| 10 | S191174210 | BOSE SNEHA SUNIL | 4 | 4 | 4 | 6 | 12 | 14 | NA | 25 |
| 11 | S191174211 | BUNGE ANUJA NANA | 8 | 5 | 8 | 6 | 13 | 14 | NA | 42 |
| 12 | S191174212 | CHAKOR SIDDHESH SACHIN | 11 | 11 | 11 | 9 | 19 | 21 | NA | 67 |
| 13 | S191174213 | CHAVAN BHAGYASHREE SUNIL | 3 | 4 | 4 | 2 | 15 | 17 | NA | 22 |
| 14 | S191174214 | DARADE CHETAN POPAT | 10 | 11 | 11 | 9 | 18 | 20 | NA | 55 |
| 15 | S191174215 | DARSHAN YOGESH DIGHE | 5 | 7 | 4 | 2 | 13 | 15 | NA | 33 |
| 16 | S191174216 | DEOKAR ADITI SANJEEV | 7 | 5 | 6 | 6 | 18 | 20 | NA | 26 |
| 17 | S191174217 | DESHMUKH ANJALI GAJANAN | 8 | 6 | 7 | 5 | 12 | 14 | NA | 43 |
| 18 | S191174218 | DESHMUKH PRASAD RAJENDRA | 8 | 5 | 8 | 6 | 18 | 20 | NA | 41 |
| 19 | S191174219 | DHONDGE ANANT VIJAY | 6 | 4 | 4 | 2 | 14 | 14 | NA | 33 |
| 20 | S191174220 | GAIKWAD PRAJWAL POPAT | 6 | 6 | 6 | 4 | 15 | 17 | NA | 32 |
| 21 | S191174221 | GAIKWAD SAYUKTA DEVIDAS | 5 | 5 | 5 | 3 | 16 | 18 | NA | 37 |
| 22 | S191174222 | GANGURDE DEVENDRA ANIL | 8 | 7 | 8 | 6 | 20 | 18 | NA | 43 |
| 23 | S191174223 | GHADUSE ATHARV VINAYAK | 6 | 4 | 4 | 6 | 13 | 15 | NA | 34 |
| 24 | S191174224 | GORHE SAMRUDDHI RAJESH | 9 | 9 | 9 | 7 | 13 | 14 | NA | 54 |
| 25 | S191174225 | HANDGE NIKITA BALASAHEB | 4 | 6 | 5 | 3 | 12 | 14 | NA | 34 |
| 26 | S191174226 | JADHAV KAVERI KESHAV | 9 | 10 | 10 | 8 | 18 | 20 | NA | 52 |
| 27 | S191174227 | JADHAV CHETAN VILAS | 4 | 5 | 4 | 4 | 13 | 15 | NA | 31 |
| 28 | S191174228 | JADHAV GAURAV CHHAGANRAO | 8 | 5 | 7 | 5 | 13 | 14 | NA | 39 |
| 29 | S191174229 | JAGTAP SIDDHANT NARENDRA | 5 | 5 | 4 | 2 | 16 | 18 | NA | 36 |
| 30 | S191174230 | KALE AMOL NANA | 6 | 5 | 4 | 6 | 20 | 21 | NA | 31 |
| 31 | S191174231 | KALE PIYUSH BALASAHEB | 5 | 6 | 6 | 4 | 13 | 15 | NA | 33 |
| 32 | S191174232 | KALE SAMARTH SOMNATH | 7 | 5 | 6 | 4 | 13 | 15 | NA | 36 |
| 33 | S191174233 | KALEKAR PRAKASH LALUMAN | 5 | 6 | 4 | 4 | 21 | 18 | NA | 26 |
| 34 | S191174234 | KALEKAR TUKARAM RAMDAS | 6 | 5 | 6 | 4 | 13 | 14 | NA | 34 |
| 35 | S191174235 | KANADE BOBBY SHARAD | 5 | 4 | 5 | 3 | 21 | 21 | NA | 30 |
| 36 | S191174236 | KHODE SAKSHI NANDKUMAR | 9 | 11 | 10 | 8 | 20 | 19 | NA | 49 |
| 37 | S191174237 | LAHANE VISHAL PANDIT | 10 | 8 | 9 | 7 | 12 | 14 | NA | 55 |
| 38 | S191174238 | MAIND PAYAL DIPAK | 8 | 6 | 4 | 5 | 15 | 17 | NA | 40 |
| 39 | S191174239 | MANKAR SANSKAR SUBHASH | 7 | 5 | 6 | 4 | 13 | 15 | NA | 30 |
| 40 | S191174240 | MARTAND GAURAV SHARAD | 9 | 11 | 10 | 8 | 16 | 18 | NA | 49 |
| 41 | S191174241 | MEDHE ADITI NITIN | 8 | 4 | 6 | 6 | 22 | 19 | NA | 40 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 42 | S191174242 | MOKSH KANTHALIYA | 8 | 7 | 8 | 6 | 14 | 16 | NA | 38 |
| 43 | S191174243 | NAIK DEEP RAMESH | 5 | 4 | 4 | 2 | 22 | 18 | NA | 31 |
| 44 | S191174244 | NAIK SAKSHI PRAMOD | 8 | 5 | 4 | 5 | 21 | 22 | NA | 39 |
| 45 | S191174245 | NAVALE SUREKHA SAHEBRAO | 10 | 10 | 10 | 8 | 20 | 22 | NA | 55 |
| 46 | S191174246 | NIIKAM SUDHIR NANDKISHOR | 6 | 5 | 6 | 4 | 21 | 18 | NA | 26 |
| 47 | S191174247 | NIKAM NIKITA JIBHAU | 4 | 5 | 5 | 6 | 12 | 14 | NA | 16 |
| 48 | S191174248 | NIKAM RIYA SHANTILAL | 10 | 11 | 11 | 9 | 17 | 19 | NA | 62 |
| 49 | S191174249 | OHAL NISHANT VISHWAJIT | 8 | 4 | 4 | 2 | 14 | 14 | NA | 43 |
| 50 | S191174250 | PADEWAR SNEHA TATYARAO | 4 | 7 | 6 | 6 | 20 | 18 | NA | 26 |
| 51 | S191174251 | PAGAR VINAYAK SUNIL | 3 | 4 | 4 | 2 | 12 | 14 | NA | 0 |
| 52 | S191174252 | PANSARE SAKSHI RAJENDRA | 11 | 11 | 11 | 9 | 18 | 20 | NA | 70 |
| 53 | S191174253 | PATIL MANISH NARENDRA | 7 | 5 | 7 | 4 | 14 | 16 | NA | 37 |
| 54 | S191174254 | PATIL MAYURI PRAVIN | 12 | 11 | 12 | 10 | 16 | 18 | NA | 74 |
| 55 | S191174255 | PATIL MITESH CHANDRAKANT | 4 | 4 | 4 | 2 | 13 | 14 | NA | 18 |
| 56 | S191174256 | PATIL TEJASHRI RAOSAHEB | 3 | 5 | 4 | 6 | 19 | 21 | NA | 4 |
| 57 | S191174257 | PATIL VISHAKHA SANJAY | 12 | 10 | 11 | 9 | 19 | 18 | NA | 71 |
| 58 | S191174258 | PAWAR DIVYA PRASHNAT | 12 | 8 | 10 | 8 | 16 | 18 | NA | 74 |
| 59 | S191174259 | PAWAR HARSHDA SHIVAJI | 4 | 6 | 4 | 2 | 14 | 16 | NA | 24 |
| 60 | S191174260 | PAWAR VISHAL HEMRAJ | 4 | 5 | 5 | 5 | 13 | 15 | NA | 17 |
| 61 | S191174261 | PELMAHALE AJAY EKNATH | 7 | 7 | 7 | 5 | 14 | 14 | NA | 37 |
| 62 | S191174262 | PHAD DHANASHRI PANDIT | 9 | 8 | 9 | 7 | 18 | 20 | NA | 48 |
| 63 | S191174263 | PILGAR LEENA GORAKSHANATH | 3 | 4 | 4 | 5 | 13 | 15 | NA | 0 |
| 64 | S191174264 | PINGALE YASH RAJARAM | 4 | 3 | 4 | 2 | 14 | 14 | NA | 20 |
| 65 | S191174265 | PRAVEEN PATIRAM VERMA | 7 | 5 | 7 | 5 | 16 | 18 | NA | 27 |
| 66 | S191174266 | PURKAR RAJESHWARI SANJAY | 8 | 5 | 4 | 5 | 14 | 16 | NA | 41 |
| 67 | S191174267 | RATHOD NIRANJAN SANJAY | 8 | 5 | 7 | 5 | 13 | 15 | NA | 45 |
| 68 | S191174268 | SARODE RUSHIKESH KISHOR | 9 | 7 | 8 | 6 | 20 | 19 | NA | 50 |
| 69 | S191174269 | SHAIKH SAQLAIN RAZA ALAUDDIN | 8 | 6 | 7 | 5 | 19 | 20 | NA | 41 |
| 70 | S191174270 | SHEWALE BHUSHAN KEDA | 10 | 5 | 9 | 7 | 22 | 18 | NA | 60 |
| 71 | S191174271 | SHEWALE CHETAN PANDIT | 9 | 11 | 10 | 8 | 13 | 14 | NA | 52 |
| 72 | S191174272 | SHIMPI PRITI RAJENDRA | 10 | 7 | 9 | 7 | 19 | 19 | NA | 59 |
| 73 | S191174273 | SONAWANE DAMINI RAMRAO | 8 | 6 | 7 | 6 | 22 | 19 | NA | 42 |
| 74 | S191174274 | SONAWANE SNEHA ANANDA | 11 | 10 | 11 | 9 | 21 | 21 | NA | 69 |
| 75 | S191174275 | SONAWANE SWAROOP MAHESH | 5 | 5 | 4 | 2 | 14 | 16 | NA | 30 |
| 76 | S191174276 | WAGH ASHUTOSH VIJAY | 9 | 11 | 10 | 8 | 20 | 22 | NA | 51 |
| 77 | S191174278 | ZOLEKAR YASH RAMHARI | 6 | 5 | 6 | 4 | 13 | 15 | NA | 35 |
| % Target | | | 40 | 40 | 40 | 40 | 60 | 60 | 40 | 35 |
| Minimum Marks required to achieve the Target | | | 4.8 | 5.2 | 4.8 | 5.2 | 15 | 15 | 10 | 35 |
| Number of students achieved the target | | | 63 | 41 | 55 | 40 | 41 | 58 | 0 | 45 |
| Total No. of Students | | | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 |
| % of Number of students achieved the Target | | | 82 | 53 | 71 | 52 | 53 | 75 | 0 | 58 |
| Attainment Levels (To fill the values, refer following table) | | | 3.0 | 2.3 | 3.0 | 2.2 | 2.3 | 3.0 | - | 2.8 |

| Attainment Levels | | |
|---|---|---|
| % of Number of Students achieved Target | 60% and more | 3 |
| | 50% and more | 2 |
| | 40 % and more | 1 |
| | Less than 40 % | 0 (type dash "-") |

| | Instructions for the Teacher before filling the sheet: |
|---|---|
| **Colour Codes:** | |
| | **Not to be edited** |
| | **Subject Teacher needs to enter the marks from the source document** |
| | **Subject Teacher needs to edit entries as applicable** |
| | **Subject Teacher needs to edit the formula as applicable** |
| **Steps to be followed while filling up this sheet:** | |
| Step 1 | **Edit the header as applicable** |
| Step 2 | **Fill up the marks for each assessment tool from the corresponding source.** |
| Step 3 | **Set up the target for each assessment tool, target can be different for every tool. (% Target)** |
| Step 4 | **Edit the formula for "Number of students achieved the target" for each assessment tool for minimum marks** |
| Step 5 | **Insert "Total No. of Students" in only first cell of the row.** |
| Step 6 | **Fill up the "Attainment Levels" for each tool (Scale 1 to 3) as guided in the table of Attainment Levels** |

# Sanghavi College of Engineering, Nashik
## Attainment Sheet- Part B - PO Attainment

**Department : Computer Engineering**　　　　　　　　**Class: SE**

**A.Y. 2022-23 Sem-I**　　　　　　　　　　　　　　　**Subject Teacher: Mr. Sandeep R. Jadhav**

**Subject: Digital Electronics and Logic Design**　　　**Subject Code:　　210245**

| Attainment Levels | | |
|---|---|---|
| **% of Number of Students achieved Target** | **60% and more** | **3** |
| | **50% and more** | **2** |
| | **40 % and more** | **1** |
| | **Less than 40 %** | **0 (Dash)** |

| CO Attainment | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sr. No. | Type of Assessment | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | |
| 1 | Internal Assessment | 3.0 | 2.3 | 3.0 | 2.2 | 2.3 | 3.0 | |
| 2 | External Assessment (Oral) | - | - | - | - | - | - | |
| 3 | External Assessment (Theory Exam) | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | |
| | Average of External Assessment | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | |
| | Average (30 % Internal + 70 % External) | 2.86 | 2.65 | 2.86 | 2.62 | 2.65 | 2.86 | |
| | CO Attainment Average | 2.75 | | | | | | |

**Note: Internal Assessment has given 30 % weightage and External Assessment has given 70 % weightage**

## Course Articulation Matrix

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 1 | 3 | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | 1 | 3 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 3 | - | 2 | 1 | - | - | - | - | - | - | - | - | - | - |
| CO5 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO6 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO-PO Articulation Average | 3.0 | 1.3 | 2.5 | 1.0 | - | - | - | - | - | - | - | - | - | - |

## PO Attainment

| Subject Code | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 210245 | 2.75 | 1.22 | 2.29 | 0.92 | - | - | - | - | - | - | - | - | - | - |

| Note: PO Attainment is calculated using following rule, |
|---|
| **PO Attainment = (CO Attainment Average/3) x (CO-PO Articulation Average)** |

| Instructions for the Teacher before filling the sheet: | |
|---|---|
| **Colour Codes:** | |
| | **Not to be edited** |
| | **Subject Teacher needs to edit entries as applicable** |
| Step 1 | **Fill up the Course Articulation Matrix to map the POs to the COs on the scale of 1 to 3** |

# Sanghavi College of Engineering, Nashik Attainment

## Sheet- Part A - CO Attainment

**Department : Electrical Engineering**  **Class: BE**

**A.Y. 2022-23 Sem-II**  **Subject Teacher:Ms.Snehal S. Uphade**
**Subject: Advance Electrical Drives and Control**  **Subject Code:** 403148

| Sr. No. | Seat No. | Name of student | Internal Assessment Tools | | | | | | External Assessment Tools | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unit test-I | | Unit test-II | | Assignment | | Practical Exam | University Exam |
| | | | 12 | 13 | 12 | 13 | 25 | 25 | 50 | 100 |
| | | | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | All COs | All COs |
| 1 | B191172501 | AARTI KISHOR WAGHCHAURE | 6 | 6 | 4 | 7 | 17 | 15 | 38 | 56 |
| 2 | B191172502 | ANKUSH RAMAN SHEWALE | 6 | 9 | 8 | 10 | 13 | 11 | 0 | 0 |
| 3 | B191172503 | ASHUTOSH DNYANESHWAR DUSANE | 8 | 9 | 8 | 9 | 13 | 12 | 40 | 41 |
| 4 | B191172504 | BARDE RUPALI BHAGAWAN | 10 | 10 | 10 | 13 | 16 | 17 | 39 | 41 |
| 5 | B191172505 | BHALERAO JAYESH RAJU | 8 | 7 | 8 | 11 | 14 | 13 | 0 | 0 |
| 6 | B191172506 | BHAMARE LALIT NILESH | 10 | 9 | 8 | 11 | 17 | 17 | 36 | 60 |
| 7 | B191172507 | BHAVSAR RUSHIKESH MAHESH | 10 | 11 | 10 | 12 | 19 | 20 | 39 | 54 |
| 8 | B191172508 | CHAUDHARI HRUSHIKESH SUBHASH | 8 | 13 | 10 | 12 | 18 | 19 | 41 | 59 |
| 9 | B191172509 | CHAUDHARI PANKAJ RATAN | 10 | 12 | 10 | 11 | 17 | 18 | 38 | 59 |
| 10 | B191172510 | CHAUDHARI VIJAY LAXMAN | 12 | 12 | 12 | 13 | 20 | 19 | 40 | 65 |
| 11 | B191172511 | GAIKWAD CHAITANYA SHIRISH | 4 | 3 | 4 | 8 | 12 | 11 | 41 | 47 |
| 12 | B191172512 | GAIKWAD GAYATRI DIGAMBAR | 6 | 6 | 8 | 8 | 16 | 18 | 37 | 52 |
| 13 | B191172513 | GAIKWAD MOHAN MOTIRAM | 4 | 7 | 4 | 8 | 15 | 16 | 45 | 46 |
| 14 | B191172514 | GAIKWAD YADNYESH VISHNU | 4 | 6 | 6 | 5 | 16 | 18 | 42 | 52 |
| 15 | B191172515 | GORE PRANJAL DNYANESHWAR | 6 | 3 | 4 | 4 | 18 | 16 | 35 | 57 |
| 16 | B191172516 | GUNJAL VICKY PRAKASH | 2 | 3 | 2 | 4 | 10 | 8 | 0 | 13 |
| 17 | B191172517 | KALE SURAJ KIRAN | 6 | 8 | 10 | 9 | 12 | 11 | 33 | 0 |
| 18 | B191172518 | KATKADE AISHWARYA RAOSAHEB | 10 | 9 | 8 | 11 | 17 | 14 | 40 | 61 |
| 19 | B191172519 | KOLHE KRUNAL SUPADA | 8 | 12 | 8 | 11 | 14 | 16 | 37 | 52 |
| 20 | B191172520 | LOKHANDE SURAJ MADHUKAR | 6 | 7 | 4 | 7 | 11 | 11 | 40 | 53 |
| 21 | B191172521 | MAHALE PAVAN SHANTARAM | 8 | 5 | 4 | 5 | 13 | 13 | 45 | 64 |
| 22 | B191172522 | MALI VAIBHAV MAHESH | 10 | 11 | 8 | 10 | 16 | 17 | 45 | 61 |
| 23 | B191172523 | MULANE TEJAS VIJAY | 8 | 9 | 10 | 11 | 18 | 19 | 45 | 52 |
| 24 | B191172524 | NIKAM BHAVESH VILAS | 6 | 9 | 6 | 8 | 17 | 16 | 42 | 43 |
| 25 | B191172525 | PALVE PRAVIN ARJUN | 2 | 5 | 4 | 5 | 13 | 12 | 0 | 0 |
| 26 | B191172526 | PAWAR GANESH SURESH | 12 | 12 | 12 | 13 | 17 | 16 | 41 | 48 |
| 27 | B191172527 | PAWAR MANOHAR HEMARAJ | 6 | 5 | 4 | 5 | 15 | 15 | 43 | 56 |
| 28 | B191172528 | PAWAR ROHINI MOHAN | 4 | 5 | 4 | 3 | 14 | 16 | 38 | 62 |
| 29 | B191172529 | ROHIT ARUN TAJANE | 8 | 12 | 8 | 11 | 15 | 14 | 39 | 63 |
| 30 | B191172530 | SARONE SHWETA PRAMOD | 10 | 13 | 8 | 13 | 18 | 17 | 37 | 64 |
| 31 | B191172531 | SHARDUL DHARMARAJ PANDURANG | 6 | 7 | 8 | 7 | 12 | 11 | 40 | 46 |
| 32 | B191172532 | TANK JAHANVI RAJESH | 12 | 11 | 12 | 13 | 18 | 19 | 44 | 62 |
| 33 | B191172533 | VIDHATE VIRAJ HARISHCHANDRA | 6 | 7 | 2 | 5 | 14 | 15 | 35 | 62 |
| 34 | B191172534 | VRUSHABH DIPAK ZOPE | 8 | 11 | 8 | 12 | 17 | 16 | 35 | 63 |
| 35 | B191172535 | ZOLE ARTI GOVIND | 8 | 12 | 8 | 11 | 18 | 17 | 35 | 45 |
| | | **% Target** | 40 | 40 | 40 | 40 | 55 | 55 | 40 | 40 |
| | | **Minimum Marks required to achieve the Target** | 5 | 6 | 5 | 6 | 14 | 14 | 20 | 40 |

| Number of students achieved the target | 29 | 28 | 24 | 27 | 26 | 25 | 31 | 30 |
|---|---|---|---|---|---|---|---|---|
| Total No. of Students | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| % of Number of students achieved the Target | 83 | 80 | 69 | 77 | 74 | 71 | 89 | 86 |
| Attainment Levels (To fill the values, refer following table) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

| Attainment Levels | | |
|---|---|---|
| % of Number of Students achieved Target | 60% and more | 3 |
| | 50% and more | 2 |
| | 40 % and more | 1 |
| | Less than 40 % | 0 (type dash "-") |

| Instructions for the Teacher before filling the sheet: | |
|---|---|
| Colour Codes: | |
| | Not to be edited |
| | Subject Teacher needs to enter the marks from the source document |
| | Subject Teacher needs to edit entries as applicable |
| | Subject Teacher needs to edit the formula as applicable |
| Steps to be followed while filling up this sheet: | |
| Step 1 | Edit the header as applicable |
| Step 2 | Fill up the marks for each assessment tool from the corresponding source. |
| Step 3 | Set up the target for each assessment tool, target can be different for every tool. (% Target) |
| Step 4 | Edit the formula for "Number of students achieved the target" for each assessment tool for minimum marks |
| Step 5 | Insert "Total No. of Students" in only first cell of the row. |
| Step 6 | Fill up the "Attainment Levels" for each tool (Scale 1 to 3) as guided in the table of Attainment Levels |

**Attainment Sheet- Part B - PO Attainment**

**Department : Electrical Engineering**        **Class: BE**

**A.Y. 2022-23 Sem-II**        **Subject Teacher:Ms.Snehal S. Uphade**

**Subject: Advance Electrical Drives and Control**        **Subject Code:**     **403148**

| **Attainment Levels** | | |
|---|---|---|
| **% of Number of Students achieved Target** | **60% and more** | 3 |
| | **50% and more** | 2 |
| | **40 % and more** | 1 |
| | **Less than 40 %** | 0 (Dash) |

**CO Attainment**

| Sr. No. | Type of Assessment | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | |
|---|---|---|---|---|---|---|---|---|
| 1 | **Internal Assessment** | **3.0** | **3.0** | **3.0** | **3.0** | **3.0** | **3.0** | |
| 2 | **External Assessment (Oral)** | **3.0** | **3.0** | **3.0** | **3.0** | **3.0** | **3.0** | |
| 3 | **External Assessment (Theory Exam)** | **3.0** | **3.0** | **3.0** | **3.0** | **3.0** | **3.0** | |
| | **Average of External Assessment** | **3.0** | **3.0** | **3.0** | **3.0** | **3.0** | **3.0** | |
| | **Average (30 % Internal + 70 % External)** | **3.00** | **3.00** | **3.00** | **3.00** | **3.00** | **3.00** | |
| | **CO Attainment Average** | **3.00** | | | | | | |

**Note: Internal Assessment has given 30 % weightage and External Assessment has given 70 % weightage**

**Course Articulation Matrix**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | 3 | 2 | 3 | 2 | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 2 | 2 | 1 | 2 | 1 | - | - | - | - | - | 2 | - | - |
| CO3 | 3 | 2 | 2 | 1 | 2 | - | - | - | - | - | - | 2 | - | - |
| CO4 | 3 | 2 | 1 | 3 | 1 | - | - | - | - | - | - | 2 | - | - |
| CO5 | 3 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | 1 | - | - |
| CO6 | 3 | - | 3 | - | 1 | 2 | - | - | - | - | 1 | 3 | - | - |
| CO-PO Articulation Average | 3.0 | 2.0 | 2.2 | 1.8 | 1.8 | 1.7 | - | - | - | - | 1.0 | 2.2 | - | - |

**PO Attainment**

| Subject Code | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **403148** | 3.00 | 2.00 | 2.17 | 1.80 | 1.83 | 1.67 | - | - | - | - | 1.00 | 2.17 | - | - |

| Note: PO Attainment is calculated using following rule, |
|---|
| PO Attainment = (CO Attainment Average/3) x (CO-PO Articulation Average) |

| Instructions for the Teacher before filling the sheet: | |
|---|---|
| **Colour Codes:** | |
| | **Not to be edited** |
| | **Subject Teacher needs to edit entries as applicable** |
| Step 1 | **Fill up the Course Articulation Matrix to map the POs to the COs on the scale of 1 to 3** |

# Sanghavi College of Engineering, Nashik

## Attainment Sheet- Part A - CO Attainment

**Department : Computer Engineering**      **Class: BE**

**A.Y. 2022-23 Sem-II**      **Subject Teacher: Mr. Bajirao S. Shirole**

**Subject: HIGH PERFORMANCE COMPUTING**      **Subject Code:**    **410250**

| Sr. No. | Seat No. | Name of student | Internal Assessment Tools | | | | | | External Assessment Tools | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unit test-I | | Unit test-II | | Assignment | | PR Exam | University Exam |
| | | | 12 | 13 | 12 | 13 | 25 | 25 | 50 | 100 |
| | | | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | All COs | All COs |
| 1 | B191174201 | BADGUJAR SONALI KANTILAL | 4 | 5 | 10 | 9 | 16 | 18 | 43 | 57 |
| 2 | B191174202 | BHAMARE DIVYA GANESH | 4 | 3 | 6 | 1 | 9 | 11 | 42 | 44 |
| 3 | B191174203 | BHANGARE UNNATI DATTATRAY | 10 | 3 | 4 | 3 | 17 | 17 | 41 | 48 |
| 4 | B191174204 | BHASKAR RAJDEV RAJESHKUMAR | 8 | 7 | 4 | 10 | 13 | 16 | 44 | 52 |
| 5 | B191174205 | BHOIR SAYALI DHIRAJ | 6 | 3 | 8 | 5 | 11 | 18 | 41 | 63 |
| 6 | B191174206 | BHOJ HARSHAL TANAJI | 8 | 9 | 8 | 7 | 17 | 18 | 41 | 49 |
| 7 | B191174207 | CHAVHAN MAYUR KAILAS | 12 | 11 | 10 | 10 | 23 | 18 | 37 | 33 |
| 8 | B191174208 | DAPKE ATUL VALMIK | 10 | 7 | 10 | 7 | 19 | 15 | 42 | 65 |
| 9 | B191174209 | DESALE KALYANI DEVIDAS | 8 | 6 | 10 | 7 | 15 | 14 | 44 | 65 |
| 10 | B191174210 | DHAGE ADITYA SUNIL | 10 | 12 | 10 | 8 | 21 | 20 | 40 | 53 |
| 11 | B191174211 | GAIKWAD AJAY BALASAHEB | 4 | 4 | 8 | 3 | 8 | 14 | 41 | 48 |
| 12 | B191174212 | GULDAGAD OMSHREE BABASAHEB | 8 | 7 | 8 | 6 | 13 | 17 | 43 | 51 |
| 13 | B191174213 | JADHAV PRANAV NARAYAN | 4 | 6 | 6 | 8 | 18 | 17 | 39 | 48 |
| 14 | B191174214 | JADHAV PRATIK YOGESH | 4 | 9 | 8 | 7 | 15 | 19 | 43 | 46 |
| 15 | B191174215 | JADHAV SHUBHAM CHANDRABHAN | 6 | 5 | 10 | 6 | 16 | 14 | 40 | 51 |
| 16 | B191174216 | JAGTAP SARIKA KRUSHNA | 6 | 3 | 6 | 4 | 11 | 12 | 41 | 52 |
| 17 | B191174217 | KHAIRNAR LALIT BHARAT | 6 | 4 | 6 | 8 | 11 | 18 | 40 | 40 |
| 18 | B191174218 | MAHALE AARTI DHANANJAY | 6 | 6 | 6 | 4 | 11 | 12 | 40 | 50 |
| 19 | B191174219 | MOHITE PRATHMESH SOMNATH | 10 | 4 | 8 | 9 | 19 | 19 | 41 | 54 |
| 20 | B191174220 | MULANE PRATHAMESH KAILAS | 8 | 4 | 6 | 2 | 17 | 20 | 40 | 43 |
| 21 | B191174221 | NEHRE ASHA DINKAR | 8 | 9 | 6 | 10 | 15 | 18 | 37 | 32 |
| 22 | B191174222 | NIKAM PRASANNA ARVIND | 8 | 7 | 6 | 6 | 17 | 11 | 42 | 47 |
| 23 | B191174223 | NIRGHUDE PRITAM KAILAS | 6 | 9 | 10 | 6 | 16 | 21 | 41 | 43 |
| 24 | B191174224 | PINGAL PRASHANT ABASAHEB | 8 | 5 | 10 | 5 | 18 | 15 | 41 | 57 |
| 25 | B191174225 | RANDIVE ROHAN SHANKAR | 4 | 5 | 4 | 7 | 10 | 14 | 40 | 62 |
| 26 | B191174226 | SHILAWAT VARSHARANI SUNIL | 5 | 8 | 8 | 10 | 10 | 13 | 39 | 47 |
| 27 | B191174227 | SONAWANE AKSHAY RAKESH | 10 | 3 | 8 | 4 | 17 | 17 | 44 | 52 |
| 28 | B191174228 | SONAWANE ROHIT UDDHAV | 8 | 4 | 6 | 9 | 12 | 14 | 43 | 56 |
| 29 | B191174229 | TANK KEYUR KISHOR | 6 | 6 | 8 | 6 | 19 | 16 | 43 | 52 |
| 30 | B191174230 | VENKATESH SANJAY NIKAM | 8 | 9 | 6 | 7 | 16 | 22 | 42 | 55 |
| 31 | B191174231 | WAGH LINESH SADASHIV | 6 | 3 | 6 | 4 | 13 | 16 | 42 | 57 |
| 32 | B191174232 | YERWAL DIKSHANT NAMDEO | 10 | 8 | 6 | 6 | 19 | 17 | 42 | 59 |
| | | **% Target** | 40 | 40 | 40 | 40 | 60 | 60 | 40 | 30 |
| | | **Minimum Marks required to achieve the Target** | 5 | 6 | 5 | 6 | 15 | 15 | 20 | 30 |
| | | **Number of students achieved the target** | 25 | 18 | 29 | 21 | 20 | 22 | 32 | 32 |
| | | **Total No. of Students** | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 |
| | | **% of Number of students achieved the Target** | 78 | 56 | 91 | 66 | 63 | 69 | 100 | 100 |
| | | **Attainment Levels (To fill the values, refer following table)** | **3.0** | **2.6** | **3.0** | **3.0** | **3.0** | **3.0** | **3.0** | **3.0** |

| Attainment Levels | | |
|---|---|---|
| **% of Number of Students achieved Target** | 60% and more | 3 |
| | 50% and more | 2 |
| | 40 % and more | 1 |
| | Less than 40 % | 0 (type dash "-") |

| Instructions for the Teacher before filling the sheet: | |
|---|---|
| **Colour Codes:** | |
| | Not to be edited |
| | Subject Teacher needs to enter the marks from the source document |
| | Subject Teacher needs to edit entries as applicable |
| | Subject Teacher needs to edit the formula as applicable |
| **Steps to be followed while filling up this sheet:** | |
| Step 1 | **Edit the header as applicable** |
| Step 2 | **Fill up the marks for each assessment tool from the corresponding source.** |
| Step 3 | **Set up the target for each assessment tool, target can be different for every tool. (% Target)** |
| Step 4 | **Edit the formula for "Number of students achieved the target" for each assessment tool for minimum marks** |
| Step 5 | **Insert "Total No. of Students" in only first cell of the row.** |
| Step 6 | **Fill up the "Attainment Levels" for each tool (Scale 1 to 3) as guided in the table of Attainment Levels** |

# Sanghavi College of Engineering, Nashik
## Attainment Sheet- Part B - PO Attainment

**Department : Computer Engineering**       **Class: BE**

**A.Y. 2022-23 Sem-II**       **Subject Teacher: Mr. Bajirao S. Shirole**

**Subject: HIGH PERFORMANCE COMPUTING**       **Subject Code:**     **410250**

| Attainment Levels | | |
|---|---|---|
| **% of Number of Students achieved Target** | 60% and more | 3 |
| | 50% and more | 2 |
| | 40 % and more | 1 |
| | Less than 40 % | 0 (Dash) |

**CO Attainment**

| Sr. No. | Type of Assessment | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | |
|---|---|---|---|---|---|---|---|---|
| 1 | Internal Assessment | 3.0 | 2.6 | 3.0 | 3.0 | 3.0 | 3.0 | |
| 2 | External Assessment (Oral) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| 3 | External Assessment (Theory Exam) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| | Average of External Assessment | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| | Average (30 % Internal + 70 % External) | 3.00 | 2.88 | 3.00 | 3.00 | 3.00 | 3.00 | |
| | CO Attainment Average | 2.98 | | | | | | |

**Note: Internal Assessment has given 30 % weightage and External Assessment has given 70 % weightage**

## Course Articulation Matrix

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 2 | 1 | - | 1 | - | - | - | 1 | - | - | - | - |
| CO2 | 1 | 2 | 1 | 2 | 1 | 1 | - | - | - | - | - | - | - | - |
| CO3 | 2 | 1 | - | 1 | 2 | 1 | - | - | 1 | - | - | 1 | - | - |
| CO4 | 1 | - | 1 | 1 | 1 | 2 | 1 | - | - | - | - | - | - | - |
| CO5 | - | 1 | 1 | 1 | - | 1 | - | - | - | - | - | - | - | - |
| CO6 | 1 | 2 | 1 | - | 1 | 1 | - | - | - | - | 1 | 1 | - | - |
| CO-PO Articulation Average | 1.2 | 1.4 | 1.2 | 1.2 | 1.3 | 1.2 | 1.0 | - | 1.0 | 1.0 | 1.0 | 1.0 | - | - |

**PO Attainment**

| Subject Code | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **410250** | 1.19 | 1.39 | 1.19 | 1.19 | 1.24 | 1.16 | 0.99 | - | 0.99 | 0.99 | 0.99 | 0.99 | - | - |

| |
|---|
| **Note: PO Attainment is calculated using following rule,** |
| **PO Attainment = (CO Attainment Average/3) x (CO-PO Articulation Average)** |

| Instructions for the Teacher before filling the sheet: | |
|---|---|
| **Colour Codes:** | |
| | **Not to be edited** |
| | **Subject Teacher needs to edit entries as applicable** |
| Step 1 | **Fill up the Course Articulation Matrix to map the POs to the COs on the scale of 1 to 3** |

# Sanghavi College of Engineering, Nashik

## Attainment Sheet- Part A - CO Attainment

**Department : Electrical Engineering**  **Class: TE**

**A.Y. 2022-23 Sem-II**  **Subject Teacher:Ms. P.S. Bhavar**

**Subject: Control System Engineering**  **Subject Code:**  **303150**

| Sr. No. | Seat No. | Name of student | Internal Assessment Tools | | | | | | External Assessment Tools | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unit test-I | | Unit test-II | | Assignment | | Oral Exam | University Exam |
| | | | 12 | 13 | 12 | 13 | 25 | 25 | 25 | 100 |
| | | | CO1 | CO2 | CO2 | CO3 | CO4 | CO5 | All COs | All COs |
| 1 | T191172501 | RENIWAL ABHISHEK VINOD | 10 | 5 | 8 | 8 | 22 | 17 | 17 | 0 |
| 2 | T191172504 | BAGUL VIKRAM ANNASAHEB | 8 | 5 | 8 | 7 | 18 | 13 | 0 | 45 |
| 3 | T191172505 | BHADKE CHAINTAYA NILKHANTHA | 8 | 6 | 10 | 6 | 16 | 20 | 16 | 0 |
| 4 | T191172506 | BHADKE RUTIK SHAM | 6 | 5 | 8 | 9 | 19 | 16 | 15 | 52 |
| 5 | T191172507 | BHAGWAT SUNNY BHARAT | 2 | 5 | 6 | 8 | 13 | 20 | 22 | 0 |
| 6 | T191172509 | BHOYE PALLAVI VISHNU | 4 | 5 | 4 | 8 | 12 | 17 | 20 | 0 |
| 7 | T191172510 | BHUSARE MAYUR TANAJI | 8 | 7 | 8 | 5 | 15 | 15 | 19 | 0 |
| 8 | T191172511 | CHAUDHARI VISHAL ASHOK | 8 | 6 | 8 | 5 | 14 | 16 | 19 | 0 |
| 9 | T191172512 | DEEP BALKRISHNA TUNGARE | 6 | 5 | 6 | 7 | 13 | 17 | 22 | 0 |
| 10 | T191172513 | DESHMUKH SWAJAL OMKARRO | 4 | 5 | 8 | 9 | 15 | 21 | 20 | 0 |
| 11 | T191172515 | GAVIT MIHIR SONIRAM | 8 | 9 | 8 | 7 | 18 | 15 | 20 | 0 |
| 12 | T191172518 | JAGTAP YADNESH DHARMARAJ | 8 | 7 | 10 | 9 | 12 | 15 | 19 | 55 |
| 13 | T191172519 | KADAM ABHISHEK RAMKRUSHNA | 6 | 5 | 10 | 9 | 17 | 17 | 21 | 0 |
| 14 | T191172520 | KALOGE ADITYA PUNDLIK | 2 | 8 | 8 | 6 | 12 | 18 | 18 | 0 |
| 15 | T191172521 | KEDARE SUBODH SATISH | 8 | 7 | 12 | 7 | 18 | 18 | 17 | 0 |
| 16 | T191172522 | KHANDAVE ARJUN DNYANESHWAR | 2 | 6 | 8 | 3 | 16 | 19 | 18 | 0 |
| 17 | T191172523 | KHODE YOGESH RAVINDRA | 8 | 9 | 10 | 7 | 16 | 16 | 19 | 0 |
| 18 | T191172524 | KORADKAR KUNAL SUNIL | 2 | 8 | 6 | 5 | 12 | 13 | 16 | 0 |
| 19 | T191172525 | KUMAVAT AKASH EKNATH | 8 | 7 | 8 | 5 | 15 | 15 | 19 | 0 |
| 20 | T191172526 | KUNAL ABHIMAN GOLAIT | 8 | 6 | 8 | 5 | 14 | 16 | 15 | 0 |
| 21 | T191172528 | NIKAM KANCHANMALA ASHOK | 6 | 5 | 6 | 7 | 13 | 17 | 14 | 0 |
| 22 | T191172529 | NIKHIL PANDURANG JADHAV | 4 | 5 | 8 | 9 | 15 | 21 | 17 | 0 |
| 23 | T191172530 | PAGARE LALIT NANDU | 8 | 9 | 8 | 7 | 18 | 15 | 20 | 45 |
| 24 | T191172531 | PAGARE POOJA SANDIP | 8 | 6 | 8 | 5 | 14 | 16 | 0 | 35 |
| 25 | T191172532 | PAWAR RISHABH RAJESH | 2 | 7 | 6 | 9 | 10 | 14 | 16 | 45 |
| 26 | T191172533 | PAWAR SHUBHAM CHANDRAKANT | 2 | 5 | 8 | 2 | 12 | 15 | 18 | 0 |
| 27 | T191172534 | PENDHARKAR SNEHA ANIL | 6 | 5 | 10 | 9 | 17 | 17 | 17 | 48 |
| 28 | T191172535 | RAJOLE SHIVAM SURESH | 12 | 13 | 10 | 13 | 12 | 18 | 17 | 0 |
| 29 | T191172536 | RAMAYANE DEEPAK DEVCHAND | 6 | 5 | 10 | 9 | 17 | 15 | 20 | 0 |
| 30 | T191172539 | SHINDE AKSHAY VILAS | 2 | 8 | 8 | 6 | 12 | 17 | 18 | 0 |
| 31 | T191172540 | SHUBHAM DASHRATH JAGZAP | 8 | 7 | 12 | 7 | 18 | 21 | 17 | 0 |
| 32 | T191172541 | SURYAWANSHI MAHESH KESHAV | 2 | 6 | 8 | 3 | 16 | 16 | 16 | 46 |
| 33 | T191172542 | TANGTODE VRUSHALI RAJENDRA | 8 | 9 | 10 | 7 | 16 | 16 | 18 | 0 |
| 34 | T191172543 | WAGH NIKITA PANDURANG | 4 | 3 | 3 | 5 | 8 | 15 | 19 | 0 |
| | | % Target | 45 | 45 | 45 | 45 | 60 | 60 | 40 | 40 |
| | | Minimum Marks required to achieve the Target | 6 | 6 | 6 | 6 | 15 | 15 | 10 | 40 |
| | | Number of students achieved the target | 22 | 20 | 32 | 24 | 19 | 31 | 32 | 7 |
| | | Total No. of Students | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 |
| | | % of Number of students achieved the Target | 67 | 61 | 97 | 73 | 58 | 94 | 97 | 21 |
| | | Attainment Levels (To fill the values, refer following table) | 2.8 | 2.5 | 3.0 | 3.0 | 2.8 | 3.0 | 3.0 | 0.0 |

| Attainment Levels | | |
|---|---|---|
| | 60% and more | 3 |
| % of Number of Students achieved Target | 50% and more | 2 |
| | 40 % and more | 1 |
| | Less than 40 % | 0 (type dash "-") |

| Instructions for the Teacher before filling the sheet: | |
|---|---|
| **Colour Codes:** | |
| | Not to be edited |
| | Subject Teacher needs to enter the marks from the source document |
| | Subject Teacher needs to edit entries as applicable |
| | Subject Teacher needs to edit the formula as applicable |
| **Steps to be followed while filling up this sheet:** | |
| Step 1 | Edit the header as applicable |
| Step 2 | Fill up the marks for each assessment tool from the corresponding source. |
| Step 3 | Set up the target for each assessment tool, target can be different for every tool. (% Target) |
| Step 4 | Edit the formula for "Number of students achieved the target" for each assessment tool for minimum marks |
| Step 5 | Insert "Total No. of Students" in only first cell of the row. |
| Step 6 | Fill up the "Attainment Levels" for each tool (Scale 1 to 3) as guided in the table of Attainment Levels |

# Sanghavi College of Engineering, Nashik
## Attainment Sheet- Part B - PO Attainment

**Department : Electrical Engineering**                      **Class: TE**

**A.Y. 2022-23 Sem-II**                                      **Subject Teacher:Ms.P.S.Bhavar**

**Subject: Control System Engineering**                      **Subject Code:          303150**

| Attainment Levels | | |
|---|---|---|
| **% of Number of Students achieved Target** | 60% and more | 3 |
| | 50% and more | 2 |
| | 40 % and more | 1 |
| | Less than 40 % | 0 (Dash) |

| CO Attainment | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sr. No.** | **Type of Assessment** | **CO1** | **CO2** | **CO2** | **CO3** | **CO4** | **CO5** | |
| 1 | Internal Assessment | 2.8 | 2.5 | 3.0 | 3.0 | 2.8 | 3.0 | |
| 2 | External Assessment (Oral) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| 3 | External Assessment (Theory Exam) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | Average of External Assessment | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | |
| | Average (30 % Internal + 70 % External) | 1.89 | 1.80 | 1.95 | 1.95 | 1.89 | 1.95 | |
| | CO Attainment Average | 1.91 | | | | | | |

**Note: Internal Assessment has given 30 % weightage and External Assessment has given 70 % weightage**

### Course Articulation Matrix

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | - | 1 | - | 1 | - | - | - | - | - | 2 | - | - |
| CO2 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | - | - | - | - | 1 | - | - |
| CO3 | 3 | 1 | - | 2 | 1 | 1 | 1 | - | - | - | - | 1 | - | - |
| CO4 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | - | - | - | - | 1 | - | - |
| CO5 | 3 | 2 | 3 | 3 | 2 | 1 | 1 | - | - | - | - | 1 | - | - |
| CO6 | 3 | 1 | 2 | - | 3 | - | - | - | 3 | - | 1 | 1 | - | - |
| CO-PO Articulation Average | 3.0 | 1.8 | 2.5 | 1.8 | 1.8 | 1.2 | 1.0 | - | 3.0 | - | 1.0 | 1.2 | - | - |

| PO Attainment | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **P10** | **P11** | **P12** | |
| **303150** | 1.91 | 1.14 | 1.59 | 1.14 | 1.14 | 0.76 | 0.64 | - | 1.91 | - | 0.64 | 0.74 | - | - |

| Note: PO Attainment is calculated using following rule, |
|---|
| PO Attainment = (CO Attainment Average/3) x (CO-PO Articulation Average) |

| Instructions for the Teacher before filling the sheet: | |
|---|---|
| **Colour Codes:** | |
| | Not to be edited |
| | Subject Teacher needs to edit entries as applicable |
| Step 1 | Fill up the Course Articulation Matrix to map the POs to the COs on the scale of 1 to 3 |

# Sanghavi College of Engineering, Nashik

## Attainment Sheet- Part A - CO Attainment

**Department : Electrical Engineering**       **Class: SE**

**A.Y. 2022-23 Sem-II**       **Subject Teacher: Mr.Abhinav K. Sonawane**

**Subject: Power System-I**       **Subject Code:**    **203145**

| Sr. No. | Seat No. | Name of student | Internal Assessment Tools | | | | | | External Assessment Tools | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unit test-I | | Unit test-II | | Assignment | | Oral Exam | University Exam |
| | | | 12 | 13 | 12 | 13 | 25 | 25 | 25 | 100 |
| | | | CO1 | CO2 | CO3 | CO4 | CO4 | CO5 | All COs | All COs |
| 1 | S191172501 | APSUNDE SHUBHAM SUNIL | 6 | 3 | 6 | 9 | 15 | 17 | NA | 49 |
| 2 | S191172502 | BAGUL DNYANESHWAR BHASKAR | 4 | 4 | 8 | 3 | 16 | 12 | NA | 13 |
| 3 | S191172503 | BAGUL KALIDAS ASHOK | 8 | 5 | 2 | 9 | 18 | 16 | NA | 29 |
| 4 | S191172504 | CHAURE AMIT SANTOSH | 4 | 7 | 8 | 6 | 16 | 16 | NA | 50 |
| 5 | S191172505 | CHAVAN KARTIK SUBHASH | 6 | 6 | 8 | 7 | 14 | 18 | NA | 43 |
| 6 | S191172506 | CHAVAN NILESH SOMNATH | 2 | 3 | 10 | 2 | 18 | 8 | NA | 13 |
| 7 | S191172507 | DINDE YASH KAKASAHEB | 4 | 8 | 8 | 6 | 17 | 11 | NA | 42 |
| 8 | S191172508 | DIPAK YASHWANT RATHODE | 8 | 7 | 6 | 9 | 16 | 19 | NA | 45 |
| 9 | S191172510 | GAWALI NILESH KANTILAL | 2 | 3 | 4 | 3 | 14 | 10 | NA | 13 |
| 10 | S191172511 | GAWARE SANKET YUVRAJ | 6 | 7 | 6 | 5 | 16 | 17 | NA | 31 |
| 11 | S191172512 | GHODE GUNJAN DNYANESHWAR | 10 | 3 | 2 | 11 | 13 | 19 | NA | 59 |
| 12 | S191172513 | GHULE OMKAR KAILAS | 8 | 7 | 8 | 7 | 19 | 16 | NA | 49 |
| 13 | S191172516 | KAVTHEKAR ABHISHEK RAJU | 8 | 5 | 2 | 3 | 9 | 17 | NA | 47 |
| 14 | S191172517 | KHALKAR SAYALI PUNDLIK | 6 | 5 | 6 | 7 | 11 | 12 | NA | 40 |
| 15 | S191172518 | KHIRADI SONALI VIJAY | 8 | 3 | 6 | 3 | 8 | 11 | NA | 50 |
| 16 | S191172519 | KUMAWAT LALIT EKNATH | 4 | 6 | 2 | 9 | 15 | 12 | NA | 44 |
| 17 | S191172520 | LOKHANDE AKSHAY SANJAY | 6 | 5 | 10 | 8 | 15 | 17 | NA | 0 |
| 18 | S191172521 | MOHAMMAD ALI IQBAL BAIG | 10 | 6 | 2 | 8 | 18 | 10 | NA | 45 |
| 19 | S191172522 | MUKANE PRASHANT RAMESH | 8 | 9 | 2 | 2 | 21 | 11 | NA | 0 |
| 20 | S191172523 | MUKANE RAJASHRI RAMESH | 6 | 8 | 8 | 3 | 17 | 11 | NA | 30 |
| 21 | S191172524 | NIKAM RUSHIKESH VISHNU | 8 | 7 | 6 | 8 | 15 | 18 | NA | 19 |
| 22 | S191172527 | PAGAR UJJWAL BHAUSAHEB | 6 | 5 | 6 | 5 | 15 | 17 | NA | 46 |
| 23 | S191172528 | PATIL GITESH GANPAT | 4 | 8 | 6 | 6 | 15 | 16 | NA | 41 |
| 24 | S191172529 | PRADNYA RAJU BEHEDE | 8 | 7 | 10 | 6 | 21 | 14 | NA | 49 |
| 25 | S191172530 | PRATIK RAJENDRA SURYAWANSHI | 8 | 3 | 8 | 3 | 20 | 19 | NA | 41 |
| 26 | S191172531 | RATHOD SHAILESH KALIDAS | 6 | 4 | 4 | 5 | 15 | 10 | NA | 41 |
| 27 | S191172532 | ROHIT RAJENDRA CHAUDHARI | 8 | 11 | 8 | 6 | 17 | 16 | NA | 51 |
| 28 | S191172533 | TIDAKE GIRISH SHAMRAO | 10 | 9 | 8 | 9 | 17 | 13 | NA | 43 |
| 29 | S191172535 | WAGH ROSHAN RAMDAS | 6 | 8 | 6 | 5 | 16 | 20 | NA | 35 |
| 30 | | | | | | | | | | |
| 31 | | | | | | | | | | |
| 32 | | | | | | | | | | |
| | | **% Target** | 40 | 40 | 40 | 40 | 55 | 55 | 10 | 40 |
| | | **Minimum Marks required to achieve the Target** | 5 | 6 | 5 | 6 | 14 | 14 | 3 | 40 |
| | | **Number of students achieved the target** | 22 | 16 | 21 | 17 | 25 | 17 | 0 | 19 |
| | | **Total No. of Students** | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 29 |
| | | **% of Number of students achieved the Target** | 76 | 55 | 72 | 59 | 86 | 59 | 0 | 66 |
| | | **Attainment Levels** <br> **(To fill the values, refer following table)** | 3.0 | 2.5 | 3.0 | 2.9 | 3.0 | 2.9 | - | 3.0 |

| Attainment Levels | | |
|---|---|---|
| **% of Number of Students achieved Target** | **60% and more** | **3** |
| | **50% and more** | **2** |
| | **40 % and more** | **1** |
| | **Less than 40 %** | **0 (type dash "-")** |

| **Instructions for the Teacher before filling the sheet:** | |
|---|---|
| **Colour Codes:** | |
| | **Not to be edited** |
| | **Subject Teacher needs to enter the marks from the source document** |
| | **Subject Teacher needs to edit entries as applicable** |
| | **Subject Teacher needs to edit the formula as applicable** |
| **Steps to be followed while filling up this sheet:** | |
| Step 1 | **Edit the header as applicable** |
| Step 2 | **Fill up the marks for each assessment tool from the corresponding source.** |
| Step 3 | **Set up the target for each assessment tool, target can be different for every tool. (% Target)** |
| Step 4 | **Edit the formula for "Number of students achieved the target" for each assessment tool for minimum marks** |
| Step 5 | **Insert "Total No. of Students" in only first cell of the row.** |
| Step 6 | **Fill up the "Attainment Levels" for each tool (Scale 1 to 3) as guided in the table of Attainment Levels** |

## Sanghavi College of Engineering, Nashik
## Attainment Sheet- Part B - PO Attainment

**Department : Electrical Engineering**                    **Class: SE**

**A.Y. 2022-23 Sem-II**                    **Subject Teacher: Mr.Abhinav K. Sonawane**

**Subject: Power System-I**                    **Subject Code:          203145**

| Attainment Levels | | |
|---|---|---|
| **% of Number of Students achieved Target** | **60% and more** | **3** |
| | **50% and more** | **2** |
| | **40 % and more** | **1** |
| | **Less than 40 %** | **0 (Dash)** |

| CO Attainment | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sr. No.** | **Type of Assessment** | **CO1** | **CO2** | **CO3** | **CO4** | **CO4** | **CO5** | |
| 1 | **Internal Assessment** | 3.0 | 2.5 | 3.0 | 2.9 | 3.0 | 2.9 | |
| 2 | **External Assessment (Oral)** | - | - | - | - | - | - | |
| 3 | **External Assessment (Theory Exam)** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| | **Average of External Assessment** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| | **Average (30 % Internal + 70 % External)** | 3.00 | 2.85 | 3.00 | 2.97 | 3.00 | 2.97 | |
| | **CO Attainment Average** | **2.97** | | | | | | |

**Note: Internal Assessment has given 30 % weightage and External Assessment has given 70 % weightage**

### Course Articulation Matrix

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | - | 2 | 1 | 1 | - | - | - | - | - | 1 | - | - |
| CO2 | 3 | 2 | 1 | - | 2 | 2 | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 2 | 3 | 3 | 1 | 2 | 1 | - | - | - | - | 2 | - | - |
| CO4 | 3 | 3 | 2 | 1 | - | 1 | 1 | - | - | - | - | 2 | - | - |
| CO5 | 3 | 2 | 1 | 2 | - | 2 | - | - | - | - | - | 3 | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO-PO Articulation Average** | **3.0** | **2.3** | **1.8** | **2.0** | **1.3** | **1.6** | **1.0** | **-** | **-** | **-** | **-** | **2.2** | **-** | **-** |

| PO Attainment | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **P10** | **P11** | **P12** | | |
| **203145** | 2.97 | 2.22 | 1.73 | 1.98 | 1.32 | 1.58 | 0.99 | - | - | - | - | 2.17 | - | - |

| Note: PO Attainment is calculated using following rule, |
|---|
| PO Attainment = (CO Attainment Average/3) x (CO-PO Articulation Average) |

| Instructions for the Teacher before filling the sheet: | |
|---|---|
| **Colour Codes:** | |
| | **Not to be edited** |
| | **Subject Teacher needs to edit entries as applicable** |
| Step 1 | **Fill up the Course Articulation Matrix to map the POs to the COs on the scale of 1 to 3** |

# *Program Outcomes*

Shree Mahavir Education Society's

**Sanghavi College of Engineering, Nashik**

**Department of Civil Engineering**

**Program Outcomes**

| Program Outcome No. | Program Outcome | Program Outcome Statement |
|---|---|---|
| PO1 | Engineering knowledge | Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems. |
| PO2 | Problem analysis | Identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics natural sciences, and Engineering sciences. |
| PO3 | Design / Development of Solutions | Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations. |
| PO4 | Conduct Investigations of Complex Problems | Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| PO5 | Modern Tool Usage | Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations |
| PO6 | The Engineer and Society | Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| PO7 | Environment and Sustainability | Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |

| Program Outcome No. | Program Outcome | Program Outcome Statement |
|---|---|---|
| PO8 | Ethics | Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice. |
| PO9 | Individual and Team Work | Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings |
| PO10 | Communication Skills | Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions |
| PO11 | Project Management and Finance | Demonstrate knowledge and understanding of the Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary Environments. |
| PO12 | Life-long Learning | Recognize the need for, and have the preparation and ability to engage in independent and life long learning in the broadest context of technological change. |

# Sanghavi College of Engineering, Nashik

# Department of Computer Engineering

## Program Outcomes

| Program Outcome No. | Program Outcome | Program Outcome Statement |
|---|---|---|
| PO1 | Engineering knowledge | Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems. |
| PO2 | Problem analysis | Identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics natural sciences, and Engineering sciences. |
| PO3 | Design / Development of Solutions | Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations. |
| PO4 | Conduct Investigations of Complex Problems | Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| PO5 | Modern Tool Usage | Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations |
| PO6 | The Engineer and Society | Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| PO7 | Environment and Sustainability | Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |

| Program Outcome No. | Program Outcome | Program Outcome Statement |
|---|---|---|
| PO8 | Ethics | Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice. |
| PO9 | Individual and Team Work | Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings |
| PO10 | Communication Skills | Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions |
| PO11 | Project Management and Finance | Demonstrate knowledge and understanding of the Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary Environments. |
| PO12 | Life-long Learning | Recognize the need for, and have the preparation and ability to engage in independent and life long learning in the broadest context of technological change. |

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**Sanghavi College of Engineering, Nashik**

**Department of Electrical Engineering**

**Program Outcomes**

| Program Outcome No. | Program Outcome | Program Outcome Statement |
|---|---|---|
| PO1 | Engineering knowledge | Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems. |
| PO2 | Problem analysis | Identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics natural sciences, and Engineering sciences. |
| PO3 | Design / Development of Solutions | Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations. |
| PO4 | Conduct Investigations of Complex Problems | Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| PO5 | Modern Tool Usage | Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations |
| PO6 | The Engineer and Society | Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| PO7 | Environment and Sustainability | Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |

| Program Outcome No. | Program Outcome | Program Outcome Statement |
|---|---|---|
| PO8 | Ethics | Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice. |
| PO9 | Individual and Team Work | Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings |
| PO10 | Communication Skills | Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions |
| PO11 | Project Management and Finance | Demonstrate knowledge and understanding of the Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary Environments. |
| PO12 | Life-long Learning | Recognize the need for, and have the preparation and ability to engage in independent and life long learning in the broadest context of technological change. |

**Sanghavi College of Engineering, Nashik**

# Department of Mechanical Engineering

## Program Outcomes

| Program Outcome No. | Program Outcome | Program Outcome Statement |
|---|---|---|
| PO1 | Engineering knowledge | Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems. |
| PO2 | Problem analysis | Identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics natural sciences, and Engineering sciences. |
| PO3 | Design / Development of Solutions | Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations. |
| PO4 | Conduct Investigations of Complex Problems | Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. a. that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline as against problems given at the end of chapters in a typical text book that can be solved using simple engineering theories and techniques; b. that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions; c. that require consideration of appropriate constraints / requirements not explicitly given in the problem statement such as cost, power requirement, durability, product life, etc.; d. which need to be defined (modelled) within appropriate mathematical framework; and e. that often require use of modern computational concepts and tools, for example, in the design of an antenna or a DSP filter. |

| Program Outcome No. | Program Outcome | Program Outcome Statement |
|---|---|---|
| PO5 | Modern Tool Usage | Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations |
| PO6 | The Engineer and Society | Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| PO7 | Environment and Sustainability | Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |
| PO8 | Ethics | Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice. |
| PO9 | Individual and Team Work | Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings |
| PO10 | Communication Skills | Communicate effectively on complex Engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions |
| PO11 | Project Management and Finance | Demonstrate knowledge and understanding of the Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary Environments. |
| PO12 | Life-long Learning | Recognize the need for, and have the preparation and ability to engage in independent and life long learning in the broadest context of technological change. |

# Course Outcomes

**Course Outcomes**

**First Year (2019 Pattern) : Semester-I**

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 107001 | Engineering Mathematics – I | CO1: Mean value theorems and its generalizations leading to Taylors and Maclaurin's series useful in the analysis of engineering problems. <br> CO2: the Fourier series representation and harmonic analysis for design and analysis of periodic continuous and discrete systems. <br> CO3: to deal withderivative of functions of several variables that are essential in various branches of Engineering. <br> CO4: to apply the concept of Jacobian to find partial derivative of implicit function and functional dependence. Use of partial derivatives in estimating error and approximation and finding extreme values of the function. <br> CO5: the essential tool of matrices and linear algebra in a comprehensive manner for analysis of system of linear equations, finding linear and orthogonal transformations, Eigen values and Eigen vectors applicable to engineering problems |
| 107002 | Engineering Physics | CO1: Develop understanding of interference, diffraction and polarization; connect it to few engineering applications. <br> CO2: Learn basics of lasers and optical fibers and their use in some applications. <br> CO3: Understand concepts and principles in quantum mechanics. Relate them to some applications. <br> CO4: Understand theory of semiconductors and their applications in some semiconductor devices. <br> CO5: Summarize basics of magnetism and superconductivity. Explore few of their technological applications. <br> CO6: Comprehend use of concepts of physics for Non Destructive Testing. Learn some properties of nanomaterials and their application. |
| 102003 | Systems in Mechanical Engineering | CO1: Describe and compare the conversion of energy from renewable and non-renewable energy sources <br> CO2: Explain basic laws of thermodynamics, heat transfer and their applications <br> CO3: List down the types of road vehicles and their specifications <br> CO4: Illustrate various basic parts and transmission system of a road vehicle |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 102003 | Systems in Mechanical Engineering | CO5: Discuss several manufacturing processes and identify the suitable process<br>CO6: Explain various types of mechanism and its application |
| 103004 | Basic Electrical Engineering | CO1: Differentiate between electrical and magnetic circuits and derive mathematical relation for self and mutual inductance along with coupling effect.<br>CO2: Calculate series, parallel and composite capacitor as well as characteristics parameters of alternating quantity and phasor arithmetic<br>CO3: Derive expression for impedance, current, power in series and parallel RLC circuit with AC supply along with phasor diagram.<br>CO4: Relate phase and line electrical quantities in polyphase networks, demonstrate the operation of single phase transformer and calculate efficiency and regulation at different loading conditions<br>CO5: Apply and analyze the resistive circuits using star-delta conversion KVL, KCL and different network theorems under DC supply.<br>CO6: Evaluate work, power, energy relations and suggest various batteries for different applications, concept of charging and discharging and depth of charge. |
| 110005 | Programming and Problem Solving | CO1: Inculcate and apply various skills in problem solving.<br>CO2: Choose most appropriate programming constructs and features to solve the problems in diversified domains.<br>CO3: Exhibit the programming skills for the problems those require the writing of well-documented programs including use of the logical constructs of language, Python.<br>CO4: Demonstrate significant experience with the Python program development environment. |
| 111006 | Workshop Practice | CO1: Familiar with safety norms to prevent any mishap in workshop.<br>CO2: Able to handle appropriate hand tool, cutting tool and machine tools to manufacture a job.<br>CO3: Able to understand the construction, working and functions of machine tools and their parts.<br>CO4: Able to know simple operations (Turning and Facing) on a centre lathe. |
| 101007 | Audit Course 1- Environmental Studies-I | CO1:Demonstrate an integrative approach to environmental issues with a focus on sustainability. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 101007 | Audit Course 1- Environmental Studies-I | CO2: Explain and identify the role of the organism in energy transfers in different ecosystems.<br>CO3: Distinguish between and provide examples of renewable and nonrenewable resources & analyze personal consumption of resources.<br>CO4: Identify key threats to biodiversity and develop appropriate policy options for conserving biodiversity in different settings. |
| **First Year (2019 Pattern) : Semester-II** | | |
| 107008 | Engineering Mathematics – II | CCO1: the effective mathematical tools for solutions of first order differential equations that model physical processes such as Newton's law of cooling, electrical circuit, rectilinear motion, mass spring systems, heat transfer etc.<br>CO2: advanced integration techniques such as Reduction formulae, Beta functions, Gamma functions, Differentiation under integral sign and Error functions needed in evaluating multiple integrals and their applications.<br>CO3: to trace the curve for a given equation and measure arc length of various curves.<br>CO4: the concepts of solid geometry using equations of sphere, cone and cylinder in a comprehensive manner.<br>CO5: evaluation of multiple integrals and its application to find area bounded by curves, volume bounded by surfaces, Centre of gravity and Moment of inertia. |
| 107009 | Engineering Chemistry | CO1: Apply the different methodologies for analysis of water and techniques involved in softening of water as commodity.<br>CO2: Select appropriate electro-technique and method of material analysis.<br>CO3: Demonstrate the knowledge of advanced engineering materials for various engineering applications.<br>CO4: Analyze fuel and suggest use of alternative fuels.<br>CO5: Identify chemical compounds based on their structure.<br>CO6: Explain causes of corrosion and methods for minimizing corrosion. |
| 104010 | Basic Electronics Engineering | CO1: Explain the working of P-N junction diode and its circuits.<br>CO2: Identify types of diodes and plot their characteristics and also can compare BJT with MOSFET.<br>CO3: Build and test analog circuits using OPAMP and digital circuits using universal/basic gates and flip flops. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 104010 | Basic Electronics Engineering | CO4: Use different electronics measuring instruments to measure various electrical parameters.<br>CO5: Select sensors for specific applications<br>CO6: Describe basic principles of communication systems. |
| 101011 | Engineering Mechanics | CO1: Determine resultant of various force systems<br>CO2: Determine centroid, moment of inertia and solve problems related to friction<br>CO3:Determine reactions of beams, calculate forces in cables using principles of equilibrium<br>CO4: Solve trusses, frames for finding member forces and apply principles of equilibrium to forces in space<br>CO5: Calculate position, velocity and acceleration of particle using principles of kinematics<br>CO6: Calculate position, velocity and acceleration of particle using principles of kinetics and Work, Power, Energy |
| 102012 | Engineering Graphics | CO1: Draw the fundamental engineering objects using basic rules and able to construct the simple geometries.<br>CO2: Construct the various engineering curves using the drawing instruments.<br>CO3: Apply the concept of orthographic projection of an object to draw several 2D views and its sectional views for visualizing the physical state of the object.<br>CO4: Apply the visualization skill to draw a simple isometric projection from given orthographic views precisely using drawing equipment.<br>CO5: Draw the development of lateral surfaces for cut section of geometrical solids.<br>CO6: Draw fully-dimensioned 2D, 3D drawings using computer aided drafting tools. |
| 110013 | Project Based Learning | CO1: Project based learning will increase their capacity and learning through shared cognition.<br>CO2: Students able to draw on lessons from several disciplines and apply them in practical way.<br>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. |
| 101014 | Audit Course 2-Environmental Studies-II | CO1: Have an understanding of environmental pollution and the science behind those problems and potential solutions.<br>CO2: Have knowledge of various acts and laws and will be able to identify the industries that are violating these rules.<br>CO3: Assess the impact of ever increasing human population on the biosphere: social, economic issues and role of humans in conservation of natural resources. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 101014 | Audit Course 2-Environmental Studies-II | CO4: Learn skills required to research and analyze environmental issues scientifically and learn how to use those skills in applied situations such as careers that may involve environmental problems and/or issues. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 201001 | Building Technology and Architectural Planning | CO1: Identify types of building and basic requirements of building components.<br>CO2: Make use of Architectural Principles and Building byelaws for building construction.<br>CO3: Plan effectively various types of Residential Building forms according to their utility, functions with reference to National Building Code.<br>CO4: Plan effectively various types of Public Buildings according to their utility functions with reference to National Building Code.<br>CO5: Make use of Principles of Planning in Town Planning, Different Villages and Safety aspects.<br>CO6: Understand different services and safety aspects |
| 201002 | Mechanics of Structures | CO1: Understand concept of stress-strain and determine different types of stress, strain in determinate, indeterminate homogeneous and composite structures.<br>CO2: Calculate shear force and bending moment in determinate beams for different loading conditions and illustrate shear force and bending moment diagram.<br>CO3: Explain the concept of shear and bending stresses in beams and demonstrate shear and bending stress distribution diagram.<br>CO4: Use theory of torsion to determine the stresses in circular shaft and understand concept of Principal stresses and strains.<br>CO5: Analyze axially loaded and eccentrically loaded column.<br>CO6:  Determine the slopes and deflection of determinate beams and trusses. |
| 201003 | Fluid Mechanics | CO1. Understand the use of Fluid Properties, concept of Fluid statics, basic equation of Hydrostatics, measurement of fluid pressure, buoyancy & floatation and its application for solving practical problems.<br>CO2. Understand the concept of fluid kinematics with reference to Continuity equation and fluid dynamics with reference to Modified Bernoulli's equation and its application to practical problems of fluid flow<br>CO3. Understand the concept of Dimensional analysis using Buckingham's π theorem, Similarity & Model Laws and boundary layer theory and apply it for solving practical problems of fluid flow. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 201003 | Fluid Mechanics | CO4. Understand the concept of laminar and turbulent flow and flow through pipes and its application to determine major and minor losses and analyze pipe network using Hardy Cross method.<br>CO5. Understand the concept of open channel flow, uniform flow and depth-Energy relationships in open channel flow and make the use of Chezy's and Manning's formulae for uniform flow computation and design of most economical channel section.<br>CO6. Understand the concept of gradually varied flow in open channel and fluid flow around submerged objects, compute GVF profile and calculate drag and lift force on fully submerged body. |
| 207001 | Engineering Mathematics III | CO1. Solve Higher order linear differential equations and its applications to modelling and analysing Civil engineering problems such as bending of beams, whirling of shafts and mass spring systems.<br>CO2. Solve System of linear equations using direct & iterative numerical techniques and develop solutions for ordinary differential equations using single step & multistep methods applied to hydraulics, geotechnics and structural systems.<br>CO3. Apply Statistical methods like correlation, regression and probability theory in data analysis and predictions in civil engineering.<br>CO4. Perform Vector differentiation &integration, analyze the vector fields and apply to fluid flow problems.<br>CO5. Solve Partial differential equations such as wave equation, one and two dimensional heat flow equations. |
| 207009 | Engineering Geology | CO1. Explain about the basic concepts of engineering geology, various rocks, and minerals both in lab and on the fields and their inherent characteristics and their uses in civil engineering constructions.<br>CO2. Exploring the importance of mass wasting processes and various tectonic processes that hampers the design of civil engineering projects and its implications on environment and sustainability.<br>CO3. Recognize effect of plate tectonics, structural geology and their significance and utility in civil engineering activities.<br>CO4. Incorporate the various methods of survey, to evaluate and interpret geological nature of the rocks present at the foundations of the dams, percolation tanks, tunnels and to infer site / alignment/ level free from geological defects.<br>CO5. Assess the Importance of geological nature of the site, precautions and treatments to improve the site conditions for dams, reservoirs, and tunnels.<br>CO6. Explain geological hazards and importance of ground water and uses of common building stones. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 201007 | Audit Course I- Awareness to Civil Engineering Practices | CO1. Describe functioning/working of different types of industries/sectors in Civil Engineering.<br>CO2. Describe drawings and documents required and used in different Civil Engineering works.<br>CO3. Understand the importance of Code of Ethics to be practiced by a Civil Engineer and also understand the duties and responsibilities as a Civil Engineer.<br>CO4. Understand different health and safety practices on the site |
| 201007 | Audit Course I- Road Safety Management | CO1:Summarize the existing road transport scenario of our country<br>CO2:Explain the method of road accident investigation<br>CO3:Describe the regulatory provisions needed for road safety<br>CO4: Identify the safety issues for a road and make use of IRC's road safety manual for<br>conducting road safety audit. |
| **Second Year (2019 Pattern) : Semester-II** | | |
| 201008 | Geotechnical Engineering | CO1. Identify and classify the soil based on the index properties and its formation process<br>CO2. Explain permeability and seepage analysis of soil by construction of flow net.<br>CO3. Illustrate the effect of compaction on soil and understand the basics of stress distribution.<br>CO4. Express shear strength of soil and its measurement under various drainage conditions.<br>CO5. Evaluate the earth pressure due to backfill on retaining structures by using different theories.<br>CO6. Analysis of stability of slopes for different types of soils. |
| 201009 | Survey | CO1. Define and Explain basics of plane surveying and differentiate the instruments used for it.<br>CO2. Express proficiency in handling surveying equipment and analyse the surveying data from these equipment.<br>CO3. Describe different methods of surveying and find relative positions of points on the surface of earth.<br>CO4. Execute curve setting for civil engineering projects such as roads, railways etc.<br>CO5. Articulate advancements in surveying such as space based positioning systems<br>CO6. Differentiate map and aerial photographs, also interpret aerial photographs. |
| 201010 | Concrete Technology | CO1. Able to select the various ingredients of concrete and its suitable proportion to achieved desired strength.<br>CO2. Able to check the properties of concrete in fresh and |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 201010 | Concrete Technology | hardened state.<br>CO3. Get acquainted to concreting equipments, techniques and different types of special concrete.<br>CO4. Able to predict deteriorations in concrete and get acquainted to various repairing methods and techniques. |
| 201011 | Structural Analysis | CO1. Understand the basic concept of static and kinematic indeterminacy and analysis of indeterminate beams.<br>CO2. Analyze redundant trusses and able to perform approximate analysis of multi-story multi-bay frames.<br>CO3. Implement application of the slope deflection method to beams and portal frames.<br>CO4. Analyze beams and portal frames using moment distribution method.<br>CO5. Determine response of beams and portal frames using structure approach of stiffness matrix method.<br>CO6. Apply the concepts of plastic analysis in the analysis of steel structures. |
| 201012 | Project Management | CO1. Describe project life cycle and the domains of Project Management.<br>CO2. Explain networking methods and their applications in planning and management<br>CO3. Categorize the materials as per their annual usage and also Calculate production rate of construction equipment<br>CO4. Demonstrates resource allocation techniques and apply it for manpower planning.<br>CO5. Understand economical terms and different laws associated with project management<br>CO6. Apply the methods of project selection and recommend the best economical project.. |
| 201017 | Project Based Learning | CO1. Identify the community/ practical/ societal needs and convert the idea into a product/ process/ service.<br>CO2. Analyse and design the physical/ mathematical/ ICT model in order to solve identified problem/project.<br>CO3. Create, work in team and applying the solution in practical way to specific problem. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 301001 | Hydrology and Water Resource Engineering | CO1. Understand government organizations, apply & analyze precipitation & its abstractions.<br>CO2. Understand, apply & analyze runoff, runoff hydrographs and gauging of streams.<br>CO3. Understand, apply & analyze floods, hydrologic routing & Q-GIS software in hydrology.<br>CO4. Understand, apply & analyze reservoir planning, capacity of reservoir & reservoir economics.<br>CO5. Understand water logging & water management, apply & analyze ground water hydrology<br>CO6. Understand irrigation, piped distribution network and canal revenue, apply and analyze crop water requirement. |
| 301002 | Water Supply Engineering | CO1. Define identify, describe reliability of water sources, estimate water requirement for various sectors<br>CO2. Ascertain and interpret water treatment method required to be adopted with respect tosource and raw water characteristics<br>CO3. Design various components of water treatment plant and distribution system.<br>CO4. Understand and compare contemporary issues and advanced treatment operations and process available in the market, including packaged water treatmentplants.<br>CO5. Design elevated service reservoir capacity and understand the rainwater harvesting.<br>CO6. Understand the requirement of water treatment plant for infrastructure and Government scheme. |
| 301003 | Design of Steel Structures | CO1. Demonstrate knowledge about the types of steel structures, steel code provisions and design of the adequate steel section subjected to tensile force.<br>CO2. Determine the adequate steel section subjected to compression load and design of built up columns along with lacing and battening.<br>CO3. Design eccentrically loaded column for section strength and column bases for axial load and uniaxial bending.<br>CO4. Design of laterally restrained and unrestrained beam with and without flange plate using rolled steel section.<br>CO5. Analyze the industrial truss for dead, live and wind load and design of gantry girder for moving load. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 301003 | Design of Steel Structures | CO6. Understand the role of components of welded plate girder and design cross section for welded plate girder including stiffeners and its connections. |
| 301004 | Engineering Economics and Financial Management | CO1. Understand basics of construction economics.<br>CO2. Develop an understanding of financial management in civil engineering projects.<br>CO3. Prepare and analyze the contract account.<br>CO4. Decide on right source of fund for construction projects.<br>CO5. Understand working capital and its estimation for civil engineering projects.<br>CO6. Illustrate the importance of tax planning & understand role of financial regulatory bodies |
| 301005 a | Elective I- Advanced Fluid Mechanics and Hydraulic Machines | CO1: Determine discharge using notches and weirs, and energy loss in hydraulic jump in open channel flow.<br>CO2: Describe simple superpositions of basic ideal fluid flows; and determine velocity and shear stress distribution for laminar flow between parallel plates.<br>CO3: Understand flow through openings under varying head, and determine rise in pressure due to water hammer effect in pipe flow.<br>CO4: Calculate force exerted by free jet on stationary and moving, flat and curved vanes using impulse momentum principle.<br>CO5: Design Pelton wheel and Francis turbines and predict their performance characteristics.<br>CO6: Estimate performance characteristics of Centrifugal pump |
| 301005 b | Elective-I Research Methodology and IPR | CO1: Understand a research problem for civil engineering domain.<br>CO2: Analyze the available literature for given research problem and illustrate different techniques of literature survey thereby gap identification.<br>CO3: Recognize the importance of data collection and investigate the statistical and reliability methods of preliminary data analysis.<br>CO4: Explain the important concept of interpretation and develop technical writing and presentation skills.<br>CO5: Comprehend the various forms of the intellectual property, its relevance and business impact in the changing global business environment.<br>CO6: Realize the importance of patents, trademark and copyright and follow research ethics. |
| 301005 c | Elective I: Construction Management | CO1. Understand the overview of construction sector.<br>CO2. Illustrate construction scheduling, work study and work measurement.<br>CO3. Acquaint various labor laws and financial aspects of |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 301005 c | Elective I: Construction Management | construction projects.<br>CO4. Explain elements of risk management and value engineering.<br>CO5. State material and human resource management techniques in construction.<br>CO6. Understand basics of artificial intelligence techniques in civil engineering. |
| 301005 d | Elective I: Advanced Concrete Technology | CO1: Understand the chemistry of cement and its effect on properties of concrete<br>CO2: Apply the knowledge of supplementary cementitious materials to produce sustainable concretes<br>CO3:Understand the mechanism of working of admixtures and their effect on properties of concrete<br>CO4: Evaluate the characteristic properties of fiber reinforced concrete<br>CO5: Understand the durability properties of concrete<br>CO6: Interpret the properties of concrete through advance testing methods |
| 301005 e | Elective I: Matrix Methods of Structural Analysis | CO1: To understand the structural behavior of bars and trusses and analyze it by using flexibility method of analysis.<br>CO2: To understand the structural behavior of beams and plane frames and analyze it by using flexibility method of analysis.<br>CO3: To analyze bars, springs and truss by member approach of stiffness matrix method.<br>CO4: To analyze beams by member approach of stiffness matrix method and to develop transformation matrix and global/structure stiffness matrix for plane frame and thereby<br>analyze it by member approach of stiffness matrix method.<br>CO5: To develop transformation matrix and global/structure stiffness matrix for grid and analyze the grid by structure and member approach of stiffness matrix method.<br>CO6: To develop the member stiffness matrix of space truss and space frame and develop the flow chart /algorithm to write the program for analysis of skeletal structures with reference to computer application. |
| 301005 f | Elective I: Advanced Mechanics of Structures | CO1: Apply moment area and conjugate method to find slope and deflection.<br>CO2: Evaluate stresses and strain in thin and thick cylinder.<br>CO3: Analyze the beam and trusses by influence line diagram.<br>CO4: Analyze the beam for moving load by influence line diagram.<br>CO5: Understand and analyze beam curved in plan and elevation.<br>CO6: Analyze three and two hinged arches for axial thrust, shear and moment |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 301006 | Seminar | CO1. Appraise the current civil engineering research / techniques / developments / interdisciplinary areas.<br>CO2. Review and organize literature survey utilizing technical resources, journals etc.<br>CO3. Evaluate and draw conclusions related to technical content studied.<br>CO4. Demonstrate the ability to perform critical writing by preparing a technical report.<br>CO5. Develop technical writing and presentation skills. |
| 301011 a | Audit Course I: Professional Ethics and Etiquettes | CO1: Understand the basic perception of profession, professional ethics, various moral issues and uses of ethical theories<br>CO2: Understand various social issues, industrial standards, code o ethics and role of professional ethics in engineering field.<br>CO3:  Follow ethics as an engineering professional and adopt good standards and norms of engineering practice.<br>CO4: Apply ethical principles to resolve situations that arise in their professional lives |
| 301011 b | Audit Course I: Sustainable Energy Systems | CO1: To demonstrate an overview of the main sources of renewable energy.<br>CO2:  To understand benefits of renewable and sustainable energy systems |
| **Third Year (2019 Pattern) : Semester-II** | | |
| 301012 | Waste Water Engineering | CO1. Recall sanitation infrastructure, quantification and characterization of wastewater, natural purification of streams<br>CO2. Design preliminary and primary unit operations in waste water treatment plant<br>CO3. Understand theory and mechanism of aerobic biological treatment system and to design activated sludge process<br>CO4. Understand and design suspended and attached growth wastewater treatment systems<br>CO5. Explain and apply concept of contaminant removal by anaerobic, tertiary and emerging wastewater treatment systems<br>CO6. Compare various sludge management systems and explain the potential of recycle and reuse of wastewater treatment |
| 301013 | Design of Reinforced Concrete Structures | CO1. Apply relevant IS provisions to ensure safety and serviceability of structures, understand the design philosophies and behavior of materials: steel & concrete.<br>CO2. Recognize mode of failure as per LSM and evaluate moment of resistance for singly, doubly rectangular, and flanged sections.<br>CO3. Design & detailing of rectangular one way and two-way slab with different boundary conditions |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 301013 | Design of Reinforced Concrete Structures | CO4. Design & detailing of dog legged and open well staircase<br>CO5. Design & detailing of singly/doubly rectangular/flanged beams for flexure, shear, bond and torsion.<br>CO6. Design & detailing of short columns subjected to axial load, uni-axial/bi-axial bending and their footings. |
| 301014 | Remote Sensing and Geographic Information System | CO1. Articulate fundamentals and principles of RS techniques.<br>CO2. Demonstrate the knowledge of remote sensing and sensor characteristics.<br>CO3. Distinguish working of various spaces-based positioning systems.<br>CO4. Analyze the RS data and image processing to utilize in civil engineering<br>CO5. Explain fundamentals and applications of RS and GIS<br>CO6. Acquire skills of data processing and its applications using GIS |
| 301015 a | Elective II: Advanced Engineering Geology with Rock Mechanics | CO1: Illustrate seismic zones, plate tectonics and civil engineering significance of major rock formations of India with their characteristics.<br>CO2: Explain soil profile, geo-hydrological characters of various rock formations and necessity of geological studies in water conservation.<br>CO3: Apply knowledge of geology in Infrastructural, Urban development and demonstrate importance of national wealth.<br>CO4: Validate the suitability of rocks based on mechanical properties, R.Q.D. and geophysical exploration.<br>CO5: Explore subsurface Geology for civil engineering projects to suggest foundation treatments for various geological defects and channel erosion.<br>CO6: Illustrate the suitability of proposed alignments for tunnels and bridges on the basis of Geological investigations |
| 301015 b | Elective II: Soft Computing Techniques | CO1:Understand AI techniques, soft computing techniques and basic concepts Artificial Neural Network<br>CO2: Understand components of ANN, training algorithms and implement the back propagation algorithm<br>CO3: Design the feed forward back propagation neural network.<br>CO4: Understand types of neural networks and their applications<br>CO5: Understand working of genetic algorithm, support vector regressions, model tree and random forest along with their applications<br>CO6: Develop models for time series applications using support vector regressions, model tree and random forest. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 301015 c | Elective II: Advanced Surveying | CO1: Recognize the concept of triangulation for fixing the ground control points.<br>CO2:  Differentiate most probable values for different measurement and adjust those in a given figure.<br>CO3: Summarize the concepts of astronomical and hydrographic surveying.<br>CO4: Demonstrate the use of aerial photographs for mapping.<br>CO5: Analyze use of modern surveying instruments in the field.<br>CO6: Execute GPS and the associated software for different applications in civil engineering. |
| 301015 d | Elective II: Advanced Geotechnical Engineering | CO1; Classify the soil and understand the soil structure and role of water in clay.<br>CO2: Calculate lateral pressure on retaining structures and carry out design the retaining structures.<br>CO3: Interpret the results of triaxial tests under different drainage conditions.<br>CO4: Draw the stress paths for different conditions.<br>CO5: Select and implement soil stabilization techniques based on field conditions.<br>CO6: Explain different ground improvement techniques |
| 301015 e | Elective II: Architecture and Town Planning | CO1: Apply the principles of architectural planning and landscaping for improving quality of life<br>CO2:Understand the confronting issues of the area and apply the acts.<br>CO3: Evaluate and defend the proposals.<br>CO4: Appraise the existing condition and to develop the area for betterment. |
| 301015 f | Elective II: Solid Waste Management | CO1. Outline solid waste management systems with respect to its generation rate (quantity), sampling, characteristics and regulatory/legal requirements.<br>CO2. Explain and suggest relevant method of storage, collection and transportation of solid waste for the given site condition with justification.<br>CO3. Develop understanding of technological applications for processing and material recovery from solid waste with its economics and design composting system for organic waste.<br>CO4. Describe the fundamental and technological aspects of waste to energy systems from solid waste and to design anaerobic digester and incineration system.<br>CO5. Outline the design, operation, and maintenance of sanitary landfill and management of legacy waste.<br>CO6. Explain the functional element for management of special |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 301015 f | Elective II: Solid Waste Management | waste and suggest the relevant method of reuse and recycling for the given type of waste in the given situation. |
| 301016 | Internship | CO1. To develop professional competence through industry internship<br>CO2. To apply academic knowledge in a personal and professional environment<br>CO3. To build the professional network and expose students to future employees<br>CO4. Apply professional a societal ethics in their day to day life<br>CO5. To become a responsible professional having social, economic and administrativeconsiderations<br>CO6. To make own career goals and personal aspirations |
| 301021 a | Audit Course II: Leadership and Personality Development | CO1. Enhanced holistic development of students and improve their employability skills |
| 301021 b | Audit Course II: Industrial Safety | CO1. Analyze the safety problem with its solution |

**Final Year (2019 Pattern) : Semester-I**

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 401001 | Foundation Engineering | CO1. Perform subsurface investigations for foundations using different methods. <br> CO2. Estimate the bearing capacity of shallow foundations. <br> CO3. Calculate immediate and primary consolidation settlement of shallow foundations. <br> CO4. Decide the capacity of a pile and pile group. <br> CO5. Understand the steps in geotechnical design of shallow foundations and well foundations. <br> CO6. Analyze problems related to expansive soil and overcome them using design principles, construction techniques in black cotton soil. |
| 401002 | Transportation Engineering | CO1. Understand principles and practices of transportation planning. <br> CO2. Demonstrate knowledge of traffic studies, analysis and their interpretation. <br> CO3. Design Geometric Elements of road pavement. <br> CO4. Evaluate properties of highway materials as a part of road pavement. <br> CO5. Appraise different types of pavements and their design. <br> CO6. Understand the fundamentals of Bridge Engineering and Railway Engineering |
| 401003 a | Elective III: Coastal Engineering | CO1. Understand basic of ocean waves including wave generation, classification, propagation, wave theories, wave diffraction, wave refection and wave breaking. <br> CO2. Understand and apply short term and long-term wave analysis. <br> CO3. Understand basic characteristics of tides, tide producing forces, dynamic theory of tides. <br> CO4. Understand coastal process of erosion/accretion due to waves, bed forms, long shore transport (Littoral drift) and estimation of wave induced sediment quantity. <br> CO5. Understand the coastal structures and shore protection methods. <br> CO6. Understand coastal zone management activities, issues related to integrated coastal zone management and regulation of coastal zone. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 401003 b | Elective III: Advanced Design of Concrete Structures | CO1:Understand yield line theory and apply it to analyze and design slabs of different shapes having different edge conditions.<br>CO2: Understand the concepts of ductile detailing<br>CO3: Analyze and design of flat slab.<br>CO4: Analyze and design of retaining walls.<br>CO5: Analyze and design of liquid retaining structures.<br>CO6:Analyze and design of RC frames and shear walls |
| 401003 c | Elective III: Integrated Water Resources Planning and Management | CO1: Understand concerned organizations, IWRP & M objectives, principles, challenges, application & analysis of IWRP&M approaches & principles in a case study.<br>CO2: Understand PIM, WDS, WALMI, agriculture in the concept of integrated water resources, apply and analyse water requirements for food production<br>CO3: Understand assessment of surface and ground water quality, EIA, CPCB regulations, application & analysis of effluent quality standards as per CPCB<br>CO4: Understand water economics and funding, application & analysis of planning for a sustainable water future<br>CO5: Understand legal regulatory settings of IWRP & M, application & analysis of inter-basin water transfers and IWRP & M<br>CO6: Understand flood control & power generation for IWRP & M, application QIGIS for analysis of a basin for IWRP & M |
| 401003 d | Elective III: Finite Element Method | CO1: To understand the basics of solid mechanics prior to learn finite element analysis.<br>CO2: Solve simple Engineering problems using 1D, 2D and 3D elements<br>CO3: Write shape functions of 1D, 2D and 3D elements<br>CO4: Determine the stresses in three dimensional finite elements using isoparametric formulation.<br>CO5:Analyze the truss and beam elements using stiffness matrix and finite element procedure.<br>CO6: Evaluate the forces and stresses in rigid jointed portal frame and grid elements using stiffness matrix and finite element procedure. |
| 401003 e | Elective III: Data Analytics | CO1: Understand the basic concepts of Statistics and its analysis and applications<br>CO2: Solve the problems related to probability and various probability distributions. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 401003 e | Elective III: Data Analytics | CO3: Apply the concept of sampling and distribution and interpret problems using correlation<br>CO4: Analyze and test of hypothesis<br>CO5: Examine and prepare the data and use develop regression<br>CO6: Understand and Apply machine learning algorithms for Regression, Classification and Clustering |
| 401003 f | Elective III: Operation Research | CO1: correlate applications of Operations Research in Civil Engineering field<br>CO2: Solve the problems related to stochastic programming<br>CO3: Optimize transportation and assignment problems<br>CO4: Optimize linear problems<br>CO5: Optimize non-linear problems<br>CO6: Suggest solution for the problems related to dynamic models, games theory and replacement of items |
| 401004 a | Elective IV: Air Pollution and Control | CO1: Recall air pollution, legislation and regulations.<br>CO2: Evaluate air pollutant concentrations as a function of meteorology.<br>CO3: Interpret sampling results with prescribed standards.<br>CO4: Assess emission inventory and air quality models.<br>CO5: Compare the air pollution control equipments.<br>CO6: Infer indoor air pollution and its mitigation. |
| 401004 b | Elective IV: Advanced Design of Steel Structures | CO1: Understand the behavior and design of members subjected to combined forces<br>CO2: Design moment resisting connection<br>CO3: Design component / structure using cold form light gauge section<br>CO4: Design members of truss and scaffolding using tubular section<br>CO5: Design castellated beam<br>CO6: Analyze and design components of industrial structure such as Portal frame and gable frame |
| 401004 c | Elective IV: Statistical Analysis and Computational Methods | CO1: Understand the basic concepts of Statistics and perform statistical data analysis<br>CO2: Understand the concept of probability and fit Binomial, or Poisson or Normal distribution to the given data<br>CO3: Understand concept of sampling and perform chi-square test, z test, Student T test<br>CO4: Perform hypothesis test<br>CO5: Carry out correlation and regression analysis for the given data<br>CO6: Calculate variance and perform K-S test for goodness of fit |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 401004 d | Elective IV: Airport and Bridge Engineering | CO1. Understand the fundamental of airport.<br>CO2. Understand and design the runway and taxiway and drainage systems.<br>CO3. Understand the BIM, AR and VR in airport planning and pavement design.<br>CO4. Plan the lighting and marking of airport and heliport.<br>CO5. Estimate various components of bridge and loads on bridges.<br>CO6. Study and design of bridge structures. |
| 401004 e | Elective IV: Design of Prestressed Concrete Structures | CO1: Know the prestressed members.<br>CO2: Determining the stresses and various losses in prestressed concrete members.<br>CO3: Design the prestressed concrete structures<br>CO4: Design the prestressed concrete slab<br>CO5: Design the prestressed concrete flat slab<br>CO6: Analysis and design the prestressed continuous beams |
| 401004 f | Elective IV: Formwork and Plumbing Engineering | CO1: Select appropriate material and type of formwork<br>CO2: Analyze the formwork for various loadings.<br>CO3: Illustrate the design aspects of formwork under various requirements.<br>CO4: Understand requirement of plumbing in a building.<br>CO5: Understand plumbing hydraulics and its components in plumbing system.<br>CO6: Illustrate the design aspects as per the requirement of Indian Standards. |
| 401005 | Project Stage I | CO1. Appraise the current Civil Engineering research/techniques/developments/interdisciplinary areas.<br>CO2. Review and organize literature survey utilizing technical resources, journals etc.<br>CO3. Evaluate and draw conclusions related to technical content studied.<br>CO4. Demonstrate the ability to perform critical writing by preparing a technical report.<br>CO5. Develop technical writing and presentation skills. |
| 401009 | Computer Programming in Civil Engineering | CO1. Understand basics of Python Programming<br>CO2. Write Python codes for variety of problems in civil Engineering |
| 401010 | Audit Course I a: Stress Management by Yoga | CO1. Develop understanding of Yoga and its impact on human body and mind.<br>CO2. Learn different Yogasans<br>CO3. Develop an understanding of meditation through pranayama<br>CO4. Learn different techniques of Pranayam |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 401010 | Audit Course I b: Communication Etiquette in Workplaces | CO1. Develop an understanding of workplace codes, professionalism at workplace<br>CO2. Learn the workplace ethics<br>CO3. Develop an understanding of Business ethics, workplace privacy and ethics<br>CO4. Learn teamwork at workplace |
| **Final Year (2019 Pattern) : Semester-II** | | |
| 401011 | Dams and Hydraulics Structures | CO1. Understand types of dams and instrumentation working<br>CO2. Execute stability analysis of Gravity Dam<br>CO3. Understand types of spillways & Design of Ogee spillway<br>CO4. Illustrate the failures and analyze stability of earthen dam<br>CO5. Design Canals and understand the canal structures<br>CO6. Analysis of the Diversion headwork and Cross Drainage work |
| 401012 | Quantity Surveying, Contracts and Tenders | CO1. Understand concept of estimates and prepare approximate estimate for various for Civil Engineering works.<br>CO2. Describe tendering process, construction contracts, and aspects of Arbitration and prepare tender documents.<br>CO3. Prepare detailed estimate of various items of work by different methods and calculate quantity of steel from Bar bending schedule.<br>CO4. Apply engineering knowledge to prepare estimate for roads, culverts, and water tank (Elevated storage tank)<br>CO5. Apply concepts of specification to draft brief specification, detailed specification and prepare detailed rate analysis report.<br>CO6. Evaluate depreciation and valuation of property on the basis of present condition, specifications and market trend. |
| 401013 a | Elective V: Earthquake Engineering | CO1:Define the concepts of earthquakes, seismology and vibrations.<br>CO2: Model physical structures and develop equations of motion.<br>CO3: Solve the equations of motion for SDOF systems.<br>CO4: Solve the equations of motion for MDOF systems.<br>CO5: Perform static seismic analysis for buildings.<br>CO6:  Perform dynamic seismic analysis for buildings. |
| 401013 b | Elective V: Structural Design of Bridges | CO1:Identify loads on bridges and selection of type of bridge for the site condition as per Indian standards.<br>CO2:Design the reinforced concrete deck slab, culvert slab and T beam deck slab for highway bridges.<br>CO3: Analysis and design of reinforced concrete and post tension prestressed concrete girders.<br>CO4: Classify the types of rail bridges and design the plate girder |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 401013 b | Elective V: Structural Design of Bridges | steel bridges<br>CO5: Analyse and design the steel trussed bridges.<br>CO6: Study different types of bearing and thereby design the bearings for reinforced concrete highway bridges. |
| 401013 c | Elective V: Irrigation and Drainage | CO1: Summarize types of irrigation methods.<br>CO2: Estimate evapotranspiration and crop-water requirement.<br>CO3: Understand component parts and their design considerations of lift irrigation system.<br>CO4: Design drip and sprinkler irrigation systems.<br>CO5: Understand basics of salt affected soils and estimate leaching requirement.<br>CO6: Design surface and subsurface drainage systems. |
| 401013 d | Elective V: Design of Precast and Composite Structures | CO1: Achieve knowledge of design and development of problem solving skills.<br>CO2: Explore the concept of precast construction.<br>CO3: Learn the principles and design of precast structures<br>CO4: Understand the need, advantages and limitations of composite material.<br>CO5: Apply basic mechanical principles in analysis of composite structures like beams, columns, floors, shear connectors.<br>CO6: Understand and apply various provisions as per Indian standards in design of structural components using composite materials |
| 401013 e | Elective V: Hydropower Engineering | CO1. Understand the classification of power resources & trends in energy use patterns.<br>CO2. Identify the components of hydro power plant.<br>CO3. Analyze the load assessment for turbines.<br>CO4. Prepare the layout of power house based on the various structures need for it.<br>CO5. Design the turbines and surge tanks.<br>CO6. Understand the laws and regulatory aspects of hydroelectric power. |
| 401013 f | Elective V: Structural Audit and Retrofitting of Structures | CO1: Identify causes of deterioration in RC and steel structures.<br>CO2: Explore entire process of structural audit.<br>CO3: Explore necessity and methods of structural health monitoring.<br>CO4: Explain method of retrofitting for RC, steel and historical structures.<br>CO5: Design retrofitting using FRP for RC column.<br>CO6: Design retrofitting using FRP for RC beams. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 401014 a | Elective VI: TQM and MIS | CO1. Recognize quality and contribution of quality gurus for evaluation of best practices<br>CO2. Relate the functioning and application of TQM & Six Sigma in the domain of construction sector<br>CO3. Recommend ISO 9001 principles in preparation of quality manual to construction business<br>CO4. Apply management control & certification systems for construction industry<br>CO5. Choose TQM process implementation and various quality awards for construction sector<br>CO6. Propose MIS for allied fields in construction sector |
| 401014 b | Elective VI: Advanced Transportation Engineering | CO1: Analyze travel demand model and forecasting.<br>CO2: Evaluate relative importance of various modes and their capacities.<br>CO3: Design facilities required for non-motorized transportation and pedestrians.<br>CO4: Estimate basic characteristics of traffic stream and signal design.<br>CO5: Design flexible pavements.<br>CO6: Design rigid pavements and overlays. |
| 401014 c | Elective VI: Geo-Synthetic Engineering | CO1: Explain types of Geo-synthetic material and its application in construction industry<br>CO2: Define physical and engineering properties of geo-synthetics material<br>CO3: Describe function of geo-synthetics material and its application in geo environment engineering<br>CO4: Analyse effect of geo-synthetics in design of flexible pavements<br>CO5: Design the reinforced soil retaining structures<br>CO6: Explain mechanism of soil reinforcement to improve bearing capacity of soil |
| 401014 d | Elective VI: Structural Design of Foundations | CO1: Judge suitable type of shallow foundation based on the available soil category.<br>CO2: Decide suitable type of pile foundation for different soil stratum and evaluation of group capacity by formulation.<br>CO3: Design Raft foundations.<br>CO4: Design well and caissons Foundations.<br>CO5: Design different types of Machine foundations.<br>CO6: Design Retaining Structures. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 401014 e | Elective VI: Green Structures and Smart Cities | CO1: Students should be able to describe the importance of energy and minimization by altering the building materials.<br>CO2:Students should be able to understand the importance green construction and green rating system<br>CO3: Students should be able to introduce the applications of energy conservation and efficiency practices in buildings.<br>CO4: Students should be able to understand phases and approval involved in smart city project.<br>CO5: Students should be able to assess the national and global experience of smart cities.<br>CO6:Students should be able to understand the importance of sustainable development and current Protocol of sustainable development goals. |
| 401014 f | Elective VI: Rural Water Supply Engineering | CO1: Understand issues related to rural water supply with respect to source, water related issues in rural areas.<br>CO2:Understand role of various government departments and importance of participatory approach.<br>CO3: Understand various types of rural water supply scheme and infrastructure requirements therein<br>CO4: Understand interdisciplinary requirements in RWS including Software<br>CO5: Understand Automation requirements for a Water Supply Project<br>CO6:Understand Documentation and O and M issues related Water Supply Project including Leak Detection. |
| 401015 | Project Stage II | CO1. Appraise the current Civil Engineering research/techniques/developments/interdisciplinary areas.<br>CO2. Review and organize literature survey utilizing technical resources, journals etc.<br>CO3. Evaluate and draw conclusions related to technical content studied.<br>CO4. Demonstrate the ability to perform critical writing by preparing a technical report.<br>CO5. Develop technical writing and presentation skills. |
| 401019 | Audit Course II a: Social Responsibility | CO1. Develop understanding of social responsibility<br>CO2. Learn the International framework for Social Responsibility<br>CO3. Know the drivers of social responsibility in India<br>CO4. Identify the key stakeholders of social responsibility |
| 401019 | Audit Course II b: Human Rights | CO1. Gather Knowledge about Human rights and Human rights Movement<br>CO2. Develop understanding of Human rights and Indian Constitution<br>CO3. Discuss Human Rights of the Different Sections and |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 401019 | Audit Course II b: Human Rights | contemporary issues<br>CO4. Discuss International scenario towards human rights with reference to engineering Industry |

## Sanghavi College of Engineering, Nashik

## Department of Computer Engineering

## Course Outcomes

## Second Year (2019 Pattern) : Semester-I

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 210241 | Discrete Mathematics | CO1: Formulate problems precisely, solve the problems, apply formal proof techniques, and explain the reasoning clearly.<br>CO2: Apply appropriate mathematical concepts and skills to solve problems in both familiar and unfamiliar situations including those in real-life contexts.<br>CO3: Design and analyze real world engineering problems by applying set theory, propositional logic and to construct proofs using mathematical induction.<br>CO4: Specify, manipulate and apply equivalence relations; construct and use functions and apply these concepts to solve new problems.<br>CO5: Calculate numbers of possible outcomes using permutations and combinations; to model and analyze computational processes using combinatorics.<br>CO6: Model and solve computing problem using tree and graph and solve problems using appropriate algorithms.<br>CO7: Analyze the properties of binary operations, apply abstract algebra in coding theory and evaluate the algebraic structures. |
| 210242 | Fundamentals of Data Structures | CO1: Design the algorithms to solve the programming problems, identify appropriate algorithmic strategy for specific application, and analyze the time and space complexity.<br>CO2: Discriminate the usage of various structures, Design/Program/Implement the appropriate data structures; use them in implementations of abstract data types and Identity the appropriate data structure in approaching the problem solution.<br>CO3: Demonstrate use of sequential data structures- Array and Linked lists to store and process data.<br>CO4: Understand the computational efficiency of the principal algorithms for searching and sorting and choose the most efficient one for the application.<br>CO5: Compare and contrast different implementations of data structures (dynamic and static).<br>CO6: Understand, Implement and apply principles of data structures-stack and queue to solve computational problems. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 210243 | Object Oriented Programming | CO1: Apply constructs- sequence, selection and iteration; classes and objects, inheritance, use of predefined classes from libraries while developing software. <br> CO2: Design object-oriented solutions for small systems involving multiple objects. <br> CO3: Use virtual and pure virtual function and complex programming situations. <br> CO4: Apply object-oriented software principles in problem solving. <br> CO5: Analyze the strengths of object-oriented programming. <br> CO6: Develop the application using object oriented programming language(C++). |
| 210244 | Computer Graphics | CO1: Identify the basic terminologies of Computer Graphics and interpret the mathematical foundation of the concepts of computer graphics. <br> CO2: Apply mathematics to develop Computer programs for elementary graphic operations. <br> CO3: Illustrate the concepts of windowing and clipping and apply various algorithms to fill and clip polygons. <br> CO4: Understand and apply the core concepts of computer graphics, including transformation in two and three dimensions, viewing and projection. <br> CO5: Understand the concepts of color models, lighting, shading models and hidden surface elimination. <br> CO6: Create effective programs using concepts of curves, fractals, animation and gaming. |
| 210245 | Digital Electronics and Logic Design | CO1: Simplify Boolean Expressions using K Map. CO2: Design and implement combinational circuits. CO3: Design and implement sequential circuits. <br> CO4: Develop simple real-world application using ASM and PLD. <br> CO5: Differentiate and Choose appropriate logic families IC packages as per the given design specifications. <br> CO6: Explain organization and architecture of computer system |
| 210246 | Data Structures Laboratory | CO1: Use algorithms on various linear data structure using sequential organization to solve real life problems. <br> CO2: Analyze problems to apply suitable searching and sorting algorithm to various applications. <br> CO3: Analyze problems to use variants of linked list and solve various real life problems. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 210246 | Data Structures Laboratory | CO4: Designing and implement data structures and algorithms for solving different kinds of problems. |
| 210247 | OOP and Computer Graphics Laboratory | CO1: Understand and apply the concepts like inheritance, polymorphism, exception handling and generic structures for implementing reusable programming codes.<br>CO2: Analyze the concept of file and apply it while storing and retrieving the data from secondary storages.<br>CO3: Analyze and apply computer graphics algorithms for line-circle drawing, scan conversion and filling with the help of object oriented programming concepts.<br>CO4: Understand the concept of windowing and clipping and apply various algorithms to fill and clip polygons.<br>CO5: Apply logic to implement, curves, fractals, animation and gaming programs. |
| 210248 | Digital Electronics Laboratory | CO1: Understand the working of digital electronic circuits.<br>CO2: Apply the knowledge to appropriate IC as per the design specifications.<br>CO3: Design and implement Sequential and Combinational digital circuits as per the specifications. |
| 210249 | Business Communication Skills | CO1: Express effectively through verbal/oral communication and improve listening skills<br>CO2: Write precise briefs or reports and technical documents.<br>CO3: Prepare for group discussion / meetings / interviews and presentations.<br>CO4: Explore goal/target setting, self-motivation and practicing creative thinking.<br>CO5: Operate effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership qualities. |
| 210250 | Humanity and Social Science | CO1: Aware of the various issues concerning humans and society.<br>CO2: Aware about their responsibilities towards society.<br>CO3: Sensitized about broader issues regarding the social, cultural, economic and human aspects, involved in social changes.<br>CO4: Able to understand the nature of the individual and the relationship between self and the community.<br>CO5: Able to understand major ideas, values, beliefs, and experiences that have shaped human history and cultures. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 210251 | Audit Course 3- I: Green Construction and Design | CO1: Understand the importance of environment friendly society.<br>CO2: Apply primary measures to reduce carbon emissions from their surroundings.<br>CO3: Learn role of IT solutions in design of green buildings.<br>CO4: Understand the use of software systems to complete statutory compliances involved in the design of a new home or office building through green construction |
| 210251 | Audit Course 3 -II: Social Awareness and Governance Program | CO1: Understand social issues and responsibilities as member of society.<br>CO2: Apply social values and ethics in decision making at social or organizational level CO3:Promote obstacles in national integration and role of youth for National Integration CO4: Demonstrate basic features of Indian Constitution. |
| 210251 | Audit Course 3- III: Environmental Studies | CO1: Comprehend the importance of ecosystem and biodiversity<br>CO2: Correlate the human population growth and its trend to the environmental degradation and develop the awareness about his/her role towards environmental protection and prevention<br>CO3: Identify different types of environmental pollution and control measures<br>CO4: Correlate the exploitation and utilization of conventional and non-conventional resources |
| 210251 | Audit Course 3 -IV: Smart Cities | CO1: Understand the dynamic behavior of the urban system by going beyond the physical appearance and by focusing on representations, properties and impact factors<br>CO2: Explore the city as the most complex human-made organism with a metabolism that can be modeled in terms of stocks and flows<br>CO3: Knowledge about data-informed approaches for the development of the future city, based on crowd sourcing and sensing<br>CO4: Knowledge about the latest research results in for the development and management of future cities<br>CO5: Understand how citizens can benefit from data-informed design to develop smart and responsive cities |
| 210251 | Audit Course 3-V:Foreign Language- Japanese(Module 1) | CO1: Will have ability of basic communication. CO2: Will have the knowledge of Japanese script.<br>CO3: Will get introduced to reading , writing and listening skills<br>CO4: Will develop interest to pursue professional Japanese Language course. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| **Second Year (2019 Pattern) : Semester-II** | | |
| 207003 | Engineering Mathematics III | CO1: Solve Linear differential equations, essential in modelling and design of computer-based systems.<br>CO2: Apply concept of Fourier transform and Z-transform and its applications to continuous and discrete systems and image processing.<br>CO3: Apply Statistical methods like correlation and regression analysis and probability theory for data analysis and predictions in machine learning.<br>CO4: Solve Algebraic and Transcendental equations and System of linear equations using numerical techniques.<br>CO5: Obtain Interpolating polynomials, numerical differentiation and integration, numerical solutions of ordinary differential equations used in modern scientific computing. |
| 210252 | Data Structures and Algorithms | CO1: Identify and articulate the complexity goals and benefits of a good hashing scheme for real- world applications.<br>CO2: Apply non-linear data structures for solving problems of various domain.<br>CO3: Design and specify the operations of a nonlinear-based abstract data type and implement them in a high-level programming language.<br>CO4: Analyze the algorithmic solutions for resource requirements and optimization<br>CO5: Use efficient indexing methods and multiway search techniques to store and maintain data.<br>CO6: Use appropriate modern tools to understand and analyze the functionalities confined to the secondary storage. |
| 210253 | Software Engineering | CO1: Analyze software requirements and formulate design solution for a software.<br>CO2: Design applicable solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal and economic concerns.<br>CO3: Apply new software models, techniques and technologies to bring out innovative and<br>novelistic solutions for the growth of the society in all aspects and evolving into their continuous professional development.<br>CO4: Model and design User interface and component-level.<br>CO5: Identify and handle risk management and software configuration management.<br>CO6: Utilize knowledge of software testing approaches, approaches to verification and validation.<br>CO7: Construct software of high quality – software that is reliable, and that is reasonably easy to understand, modify and |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 210253 | Software Engineering | maintain efficient, reliable, robust and cost-effective software solutions. |
| 210254 | Microprocessor | CO1: Exhibit skill of assembly language programming for the application. CO2: Classify Processor architectures. CO3: Illustrate advanced features of 80386 Microprocessor. CO4: Compare and contrast different processor modes. CO5: Use interrupts mechanism in applications CO6: Differentiate between Microprocessors and Microcontrollers. CO7: Identify and analyze the tools and techniques used to design, implement, and debug microprocessor-based systems. |
| 210255 | Principles of Programming Languages | CO1: Make use of basic principles of programming languages. CO2: Develop a program with Data representation and Computations. CO3: Develop programs using Object Oriented Programming language : Java. CO4: Develop application using inheritance, encapsulation, and polymorphism. CO5: Demonstrate Multithreading for robust application development. CO6: Develop a simple program using basic concepts of Functional and Logical programming paradigm. |
| 210256 | Data Structures and Algorithms Laboratory | CO1: Understand the ADT/libraries, hash tables and dictionary to design algorithms for a specific problem. CO2: Choose most appropriate data structures and apply algorithms for graphical solutions of the problems. CO3: Apply and analyze non linear data structures to solve real world complex problems. CO4: Apply and analyze algorithm design techniques for indexing, sorting, multi-way searching, file organization and compression. CO5: Analyze the efficiency of most appropriate data structure for creating efficient solutions for engineering design situations. |
| 210257 | Microprocessor Laboratory | CO1. Understand and apply various addressing modes and instruction set to implement assembly language programs CO2. Apply logic to implement code conversion CO3. Analyze and apply logic to demonstrate processor mode of operation |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 210258 | Project Based Learning II | CO1: Identify the real life problem from societal need point of view<br>CO2: Choose and compare alternative approaches to select most feasible one<br>CO3: Analyze and synthesize the identified problem from technological perspective<br>CO4: Design the reliable and scalable solution to meet challenges<br>CO5: Evaluate the solution based on the criteria specified<br>CO6: Inculcate long life learning attitude towards the societal problems |
| 210259 | Code of Conduct | CO1: Understand the basic perception of profession, professional ethics, various moral and social issues, industrial standards, code of ethics and role of professional ethics in engineering field.<br>CO2: Aware of professional rights and responsibilities of an engineer, responsibilities of an engineer for safety and risk benefit analysis.<br>CO3: Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development.<br>CO4: Acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives. |
| 210260 | Audit Course 4-I: Water Management | CO1: Understand the global water cycle and its various processes<br>CO2: Understand climate change and their effects on water systems<br>CO3: Understand Drinking treatment and quality of groundwater and surface water<br>CO4: Understand the Physical, chemical, and biological processes involved in water treatment and distribution. |
| 210260 | Audit Course 4-II: Intellectual Property Rights and Patents | CO1: Understand the fundamental legal principles related to confidential information, copyright, patents, designs, trademarks and unfair competition<br>CO2: Identify, apply and assess principles of law relating to each of these areas of intellectual property<br>CO3: Apply the appropriate ownership rules to intellectual property you have been involved in creating |
| 210260 | Audit Course 4-III: The Science of Happiness | CO1: Understand what happiness is and why it matters to you<br>CO2: Learn how to increase your own happiness<br>CO3: Understand of the power of social connections and the science of empathy |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 210260 | Audit Course 4-III: The Science of Happiness | CO4: Understand what is mindfulness and its real world applications |
| 210260 | Audit Course 4-IV: Yoga and Meditation | CO1: Understand philosophy and religion as well as daily life issues will be challenged and enhanced.<br>CO2: Enhances the immune system.<br>CO3: Intellectual and philosophical understanding of the theory of yoga and basic related Hindu scriptures will be developed.<br>CO4: Powers of concentration, focus, and awareness will be heightened. |
| 210260 | Audit Course 4-V: Foreign Language ( Japanese) Module 2 | CO1. have ability of basic communication.<br>CO2. have the knowledge of Japanese script.<br>CO3. get introduced to reading , writing and listening skills<br>CO4. develop interest to pursue professional Japanese Language course |

**Sanghavi College of Engineering, Nashik**

**Department of Computer Engineering**

**Course Outcomes**

**Third Year (2019 Pattern) : Semester-I**

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 310241 | Database Management Systems | CO1: Analyze and design Database Management System using ER model<br>CO2: Implement database queries using database languages<br>CO3: Normalize the database design using normal forms<br>CO4: Apply Transaction Management concepts in real-time situations<br>CO5: Use NoSQL databases for processing unstructured data<br>CO6: Differentiate between Complex Data Types and analyze the use of appropriate data types |
| 310242 | Theory of Computation | CO1: Understand formal language, translation logic, essentials of translation, alphabets, language representation and apply it to design Finite Automata and its variants<br>CO2: Construct regular expression to present regular language and understand pumping lemma for RE CO3: Design Context Free Grammars and learn to simplify the grammar<br>CO4: Construct Pushdown Automaton model for the Context Free Language<br>CO5: Devise Turing Machine for the different requirements outlined by theoretical computer science<br>CO6: Analyze different classes of problems, and study concepts of NP completeness |
| 310243 | Systems Programming and Operating System | CO1: Analyze and synthesize basic System Software and its functionality.<br>CO2: Identify suitable data structures and Design & Implement various System Software<br>CO3: Compare different loading schemes and analyze the performance of linker and loader<br>CO4: Implement and Analyze the performance of process scheduling algorithms<br>CO5: Identify the mechanism to deal with deadlock and concurrency issues<br>CO6: Demonstrate memory organization and memory management policies |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 310244 | Computer Networks and Security | CO1: Summarize fundamental concepts of Computer Networks, architectures, protocols and technologies<br>CO2: Illustrate the working and functions of data link layer<br>CO3: Analyze the working of different routing protocols and mechanisms<br>CO4: Implement client-server applications using sockets<br>CO5: Illustrate role of application layer with its protocols, client-server architectures<br>CO6: Comprehend the basics of Network Security |
| 310245(A) | Elective-I Internet of Things and Embedded Systems | CO1: Understand the fundamentals and need of Embedded Systems for the Internet of Things<br>CO2: Apply IoT enabling technologies for developing IoT systems<br>CO3: Apply design methodology for designing and implementing IoT applications<br>CO4: Analyze IoT protocols for making IoT devices communication<br>CO5: Design cloud based IoT systems<br>CO6: Design and Develop secured IoT applications |
| 310245(B) | Elective-I Human Computer Interface | CO1: Design effective Human-Computer-Interfaces for all kinds of users<br>CO2: Apply and analyze the user-interface with respect to golden rules of interface<br>CO3: Analyze and evaluate the effectiveness of a user-interface design<br>CO4: Implement the interactive designs for feasible data search and retrieval<br>CO5: Analyze the scope of HCI in various paradigms like ubiquitous computing, virtual reality ,multi-media, World wide web related environments<br>CO6: Analyze and identify user models, user support, and stakeholder requirements of HCI systems |
| 310245C | Elective-I Distributed Systems | CO1: Analyze Distributed Systems types and architectural styles<br>CO2: Implement communication mechanism in Distributed Systems<br>CO3: Implement the synchronization algorithms in Distributed System applications<br>CO4: Develop the components of Distributed File System<br>CO5: Apply replication techniques and consistency model in Distributed Systems<br>CO6: Build fault tolerant Distributed Systems |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 310245(D) | Elective-I Software Project Management | CO1: Comprehend Project Management Concepts<br>CO2: Use various tools of Software Project Management<br>CO3: Schedule various activities in software projects<br>CO4: Track a project and manage changes<br>CO5: Apply Agile Project Management<br>CO6: Analyse staffing process for team building and decision making in Software Projects and Management |
| 310246 | Database Management Systems Laboratory | CO1: Design E-R Model for given requirements and convert the same into database tables<br>CO2: Design schema in appropriate normal form considering actual requirements<br>CO3: Implement SQL queries for given requirements, using different SQL concepts<br>CO4: Implement PL/SQL Code block for given requirements<br>CO5: Implement NoSQL queries using MongoDB<br>CO6: Design and develop application considering actual requirements and using database concepts |
| 310247 | Computer Networks and Security Laboratory | CO1: Analyze the requirements of network types, topology and transmission media<br>CO2: Demonstrate error control, flow control techniques and protocols and analyze them<br>CO3: Demonstrate the subnet formation with IP allocation mechanism and apply various routing algorithms<br>CO4: Develop Client-Server architectures and prototypes<br>CO5: Implement web applications and services using application layer protocols<br>CO6: Use network security services and mechanisms |
| 310248 | Laboratory Practice I | Systems Programming and Operating System<br>CO1: Implement language translators<br>CO2: Use tools like LEX and YACC<br>CO3: Implement internals and functionalities of Operating System<br>• Internet of Things and Embedded Systems<br>CO4: Design IoT and Embedded Systems based application<br>CO5: Develop smart applications using IoT<br>CO6: Develop IoT applications based on cloud environment OR<br>• Human Computer Interface<br>CO4:Implement the interactive designs for feasible data search and retrieval<br>CO5:Analyze the scope of HCI in various paradigms like ubiquitous computing, virtual Reality and ,multi-media, World wide web related environments<br>CO6:Analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems OR |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 310248 | Laboratory Practice I | • Distributed Systems<br>CO4: Demonstrate knowledge of the core concepts and techniques in Distributed Systems<br>CO5: Apply the principles of state-of-the-Art Distributed Systems in real time applications<br>CO6: Design, build and test application programs on Distributed Systems OR<br>• Software Project Management<br>CO4:Apply Software Project Management tools<br>CO5:Implement software project planning and scheduling<br>CO6:Analyse staffing in software project |
| 310249 | Seminar and Technical Communication | CO1: Analyze a latest topic of professional interest<br>CO2: Enhance technical writing skills<br>CO3: Identify an engineering problem, analyze it and propose a work plan to solve it<br>CO4:Communicate with professional technical presentation skills |
| 310250(A) | Audit Course 5 (A) :Cyber Security | CO 1: Understand and classify various cybercrimes<br>CO 2: Understand how criminals plan for the cybercrimes<br>CO 3: Apply tools and methods used in cybercrime<br>CO 4:Analyze the examples of few case studies of cybercrimes |
| 310250(B) | Audit Course 5 (B): Professional Ethics and Etiquette | CO1: Summarize the principles of proper courtesy as they are practiced in the workplace.<br>CO2:Apply proper courtesy in different professional situations.<br>CO3: Practice and apply appropriate etiquettes in the working environment and day to day life.<br>CO4:Build proper practices personal and business communications of Ethics and Etiquettes. |
| 310250© | Audit Course 5©: Learn New Skills -Full Stack Developer | CO1: Design and develop web application using frontend and backend technologies.<br>CO2: Design and develop dynamic and scalable web applications<br>CO3: Develop server side scripts<br>CO4:Design and develop projects applying various database techniques |
| 310250(D) | Audit Course 5: (D) Engineering Economics | CO1: Understand economics, the cost money and management in engineering<br>CO2: Analyze business economics and engineering assets evaluation<br>CO3: Evaluate project cost and its elements for business<br>CO4: Develop financial statements and make business decisions |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 310250 E | Audit Course 5: (E) Foreign Language ( Japanese )-Module 3 | CO1: Apply language to communicate confidently and clearly in the Japanese language<br>CO2: Understand and use Japanese script to read and write<br>CO3: Apply knowledge for next advance level reading, writing and listening skills<br>CO4: Develop interest to pursue further study, work and leisure |
| **Third Year (2019 Pattern) : Semester-II** | | |
| 310251 | Data Science and Big Data Analytics | CO1: Analyze needs and challenges for Data Science Big Data Analytics<br>CO2: Apply statistics for Big Data Analytics<br>CO3: Apply the lifecycle of Big Data analytics to real world problems<br>CO4: Implement Big Data Analytics using Python programming<br>CO5: Implement data visualization using visualization tools in Python programming<br>CO6: Design and implement Big Databases using the Hadoop ecosystem |
| 310252 | Web Technology | CO1: Implement and analyze behavior of web pages using HTML and CSS<br>CO2: Apply the client side technologies for web development<br>CO3: Analyze the concepts of Servlet and JSP<br>CO4: Analyze the Web services and frameworks<br>CO5: Apply the server side technologies for web development<br>CO6: Create the effective web applications for business functionalities using latest web development platforms |
| 310253 | Artificial Intelligence | CO1: Identify and apply suitable Intelligent agents for various AI applications<br>CO2: Build smart system using different informed search / uninformed search or heuristic approaches<br>CO3: Identify knowledge associated and represent it by ontological engineering to plan a strategy to solve given problem<br>CO4: Apply the suitable algorithms to solve AI problems<br>CO5: Implement ideas underlying modern logical inference systems<br>CO6: Represent complex problems with expressive yet carefully constrained language of representation |
| 310254(A) | Elective-II -Information Security | CO1: Model the cyber security threats and apply formal procedures to defend the attacks<br>CO2: Apply appropriate cryptographic techniques by learning symmetric and asymmetric key cryptography<br>CO3: Design and analyze web security solutions by deploying |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 310254(A) | Elective-II -Information Security | various cryptographic techniques along with data integrity algorithms<br>CO4: Identify and Evaluate Information Security threats and vulnerabilities in Information systems and apply security measures to real time scenarios<br>CO5: Demonstrate the use of standards and cyber laws to enhance Information Security in the development process and infrastructure protection |
| 310254(B) | Elective-II- Augmented and Virtual Reality | CO1: Understand the basics of Augmented and Virtual reality systems and list their applications<br>CO2: Describe interface to the Virtual World with the help of input and output devices<br>CO3: Explain representation and rendering system in the context of Virtual Reality<br>CO4: Analyze manipulation, navigation and interaction of elements in the virtual world<br>CO5: Summarize the basic concepts and hardware of Augmented Reality system<br>CO6: Create Mobile Augmented Reality using Augmented Reality techniques and software |
| 310254© | Elective-II- Cloud Computing | CO1: Understand the different Cloud Computing environment<br>CO2: Use appropriate data storage technique on Cloud, based on Cloud application<br>CO3: Analyze virtualization technology and install virtualization software<br>CO4: Develop and deploy applications on Cloud<br>CO5: Apply security in cloud applications<br>CO6: Use advance techniques in Cloud Computing |
| 310254(D) | Elective-II-Software Modeling and Architecture | CO1: Analyze the problem statement (SRS) and choose proper design technique for designing web-based/ desktop application<br>CO2: Design and analyze an application using UML modeling as fundamental tool<br>CO3: Evaluate software architectures<br>CO4: Use appropriate architectural styles and software design patterns<br>CO5: Apply appropriate modern tool for designing and modeling |
| 310255 | Internship | CO1: To demonstrate professional competence through industry internship.<br>CO2: To apply knowledge gained through internships to complete academic activities in a professional manner.<br>CO3: To choose appropriate technology and tools to solve given problem.<br>CO4: To demonstrate abilities of a responsible professional and use ethical practices in day to day life. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 310255 | Internship | CO5:Creating network and social circle, and developing relationships with industry people.<br>CO6: To analyze various career opportunities and decide carrier goals. |
| 310256 | Data Science and Big Data Analytics Laboratory | CO1: Apply principles of Data Science for the analysis of real time problems<br>CO2: Implement data representation using statistical methods<br>CO3: Implement and evaluate data analytics algorithms<br>CO4: Perform text preprocessing<br>CO5: Implement data visualization techniques<br>CO6: Use cutting edge tools and technologies to analyze Big Data |
| 310257 | Web Technology Laboratory | CO1: Understand the importance of website planning and website design issues<br>CO2: Apply the client side and server side technologies for web application development<br>CO3: Analyze the web technology languages, frameworks and services<br>CO4:Create three tier web based applications |
| 310258 | Laboratory Practice II | • Artificial Intelligence<br>CO1: Design a system using different informed search / uninformed search or heuristic approaches CO2: Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning<br>CO3: Design and develop an interactive AI application<br>• Information Security<br>CO4: Use tools and techniques in the area of Information Security<br>CO5: Use the cryptographic techniques for problem solving<br>CO6: Design and develop security solution OR<br>• Augmented and Virtual Reality<br>CO4: Use tools and techniques in the area of Augmented and Virtual Reality<br>CO5: Use the representing and rendering system for problem solving<br>CO6: Design and develop ARVR applications OR<br>• Cloud Computing<br>CO4: Use tools and techniques in the area of Cloud Computing<br>CO5: Use cloud computing services for problem solving<br>CO6: Design and develop applications on cloud OR<br>• Software Modeling and Architectures<br>CO4: Use tools and techniques in the area Software Modeling and Architectures<br>CO5: Use the knowledge of Software Modeling and Architectures for problem solving |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 310258 | Laboratory Practice II | CO6: Design and develop applications using UML as fundamental tool |
| 310259(A) | Audit Course- 6 (A):Digital and Social Media Marketing | CO1: Understand the fundamentals and importance of digital marketing<br>CO2: Use the power of social media for business marketing<br>CO3: Analyze the effectiveness of digital marketing and social media over traditional process |
| 310259(B) | Audit Course- 6 (B):Sustainable Energy Systems | CO1: Comprehend the importance of Sustainable Energy Systems<br>CO2: Correlate the human population growth and its trend to the natural resource degradation and develop the awareness about his/her role towards Sustainable Energy Systems protection<br>CO3: Identify different types of natural resource pollution and control measures<br>CO4: Correlate the exploitation and utilization of conventional and non-conventional resources |
| 310259(C) | Audit Course- 6 © :Leadership and Personality Development | CO1: Express effectively through communication and improve listening skills<br>CO2: Develop effective team leadership abilities.<br>CO3: Explore self-motivation and practicing creative/new age thinking.<br>CO4: Operate effectively in heterogeneous teams through the knowledge of team work, people skills and leadership qualities. |
| 310259(D) | Audit Course- 6 (D):Foreign Language ( Japanese ) Module 4 | CO1: Have the ability to communicate confidently and clearly in the Japanese language<br>CO2: Understand the nature of Japanese script<br>CO3: Get introduced to reading, writing and listening skills<br>CO4: Develop interest to pursue further study, work and leisure |
| 310259(E) | Audit Course- 6 (E):Learn New Skill- 'Software Development Using Agility Approach' | CO1: Illustrate the agility and principles<br>CO2: Understand the software development using agile methodology<br>CO3: Apply Dev Ops for the software product development<br>CO4: Develop software products for early delivery through continual feedback and learning |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 410241 | Design and Analysis of Algorithms | CO1: Formulate the problem<br>CO2: Analyze the asymptotic performance of algorithms<br>CO3: Decide and apply algorithmic strategies to solve given problem<br>CO4: Find optimal solution by applying various methods<br>CO5: Analyze and Apply Scheduling and Sorting Algorithms.<br>CO6: Solve problems for multi-core or distributed or concurrent environments |
| 410242 | Machine Learning | CO1: Identify the needs and challenges of machine learning for real time applications.<br>CO2: Apply various data pre-processing techniques to simplify and speed up machine learning algorithms.<br>CO3: Select and apply appropriately supervised machine learning algorithms for real timeapplications.<br>CO4: Implement variants of multi-class classifier and measure its performance.<br>CO5 :Compare and contrast different clustering algorithms.<br>CO6: Design a neural network for solving engineering problems. |
| 410243 | Blockchain Technology | CO1: Interpret the fundamentals and basic concepts in Blockchain<br>CO2: Compare the working of different blockchain platforms<br>CO3: Use Crypto wallet for cryptocurrency based transactions<br>CO4: Analyze the importance of blockchain in finding the solution to the real-world problems.<br>CO5: Illustrate the Ethereum public block chain platform<br>CO6: Identify relative application where block chain technology can be effectively used andimplemented. |
| 410244(A) | Elective-III-(A)Pervasive Computing | CO1.Demonstrate fundamental concepts in pervasive computing.<br>CO2.Explain pervasive devices and decide appropriate one as per the need of real timeapplications. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 410244(A) | Elective-III-(A)Pervasive Computing | CO3.Classify and analyze context aware systems for their efficiency in different ICT systems.<br>CO4.Illustrate intelligent systems and generic intelligent interactive applications.<br>CO5.Design HCI systems in pervasive computing environment.<br>CO6.Explore the security challenges and know the role of ethics in the context of pervasivecomputing. |
| 410244(B) | Elective-III-(B)Multimedia Techniques | CO1: Describe the media and supporting devices commonly associated with multimedia information andsystems.<br>CO2: Demonstrate the use of content-based information analysis in a multimedia information system.<br>CO3: Critique multimedia presentations in terms of their appropriate use of audio, video, graphics, color,and other information presentation concepts.<br>CO4: Implement a multimedia application using an authoring system.<br>CO5: Understanding of technologies for tracking, navigation and gestural control.<br>CO6: Implement Multimedia Internet of Things Architectures. |
| 410244© | Elective-III-(C)Cyber Security and Digital Forensics | CO1: Analyze threats in order to protect or defend it in cyberspace from cyber-attacks.<br>CO2: Build appropriate security solutions against cyber-attacks.<br>CO3:Underline the need of digital forensic and role of digital evidences.<br>CO4: Explain rules and types of evidence collection<br>CO5: Analyze, validate and process crime scenes<br>CO6: Identify the methods to generate legal evidence and supporting investigation reports. |
| 410244(D) | Elective-III-(D)Object oriented Modeling and Design | CO1: Describe the concepts of object-oriented and basic class modelling.<br>CO2: Draw class diagrams, sequence diagrams and interaction diagrams to solve problems.<br>CO3: Choose and apply a befitting design pattern for the given problem<br>CO4: To Analyze applications, architectural Styles & software control strategies<br>CO5: To develop Class design Models & choose Legacy Systems.<br>CO6:To Understand Design Patterns |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 4102244E | Elective-III-(E)Digital Signal Processing | CO1: Understand the mathematical models and representations of DT Signals and Systems<br>CO2: Apply different transforms like Fourier and Z-Transform from applications point of view.<br>CO3: Understand the design and implementation of DT systems as DT filters with filter structuresand different transforms.<br>CO4: Demonstrate the knowledge of signals and systems for design and analysis of systems<br>CO5: Apply knowledge and use the signal transforms for digital processing applications<br>CO6:To understand Filtering and Different Filter Structures |
| 410245(A | Elective-IV(A): Information Retrieval | CO1:Implement the concept of Information Retrieval<br>CO2:Generate quality information out of retrieved information<br>CO3:Apply techniques such as classification, clustering, and filtering over multimedia to analyzethe information<br>CO4:Evaluate and analyze retrieved information<br>CO5:Understand the data in various Application and Extensions of information retrieval<br>CO6: Understand Parallel information retrieving and web structure. |
| 410245(B) | Elective-IV(B):GPU Programming and Architecture | CO1: Describe GPU architecture<br>CO2: Write programs using CUDA, identify issues and debug them.<br>CO3: Implement efficient algorithms in GPUs for common application kernels, such as matrix multiplication<br>CO4: Write simple programs using OpenCL<br>CO5: Identify efficient parallel programming patterns to solve problems<br>CO6: Explore the modern GPUs architecture and it's Applications. |
| 410245(C ) | Elective-IV(C):Mobile Computing | CO1: Develop a strong grounding in the fundamentals of mobile Networks<br>CO2: Apply knowledge in MAC, Network, and Transport Layer protocols ofWireless Network<br>CO3: Illustrate Global System for Mobile Communications<br>CO4: Use the 3G/4G technology based network with bandwidth capacity planning,VLR and HLR identification algorithms<br>CO5: Classify network and transport layer of mobile communication<br>CO6: Design & development of various wireless network protocols using simulationtools |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 410245(D) | Elective-IV(D)Software Testing and Quality Assurance | CO1: Describe fundamental concepts in software testing such as manual testing, automation testingand software quality assurance.<br>CO2: Design and Develop project test plan, design test cases, test data, and conduct test operations.<br>CO3: Apply recent automation tool for various software testing for testing software.<br>CO4: Apply different approaches of quality management, assurance, and quality standard to softwaresystem.<br>CO5: Apply and analyze effectiveness Software Quality Tools.<br>CO6: Apply tools necessary for efficient testing framework. |
| 410245E | Elective-IV(E)Compilers | CO1: Design and implement a lexical analyzer using LEX tools<br>CO2: Design and implement a syntax analyzer using YACC tools<br>CO3:Understand syntax-directed translation and run-time environment<br>CO4 : Generate intermediate codes for high-level statements.<br>CO5 :Construct algorithms to produce computer code.<br>CO6: Analyze and transform programs to improve their time and memory efficiency |
| 410246: | Laboratory Practice III | CO1: Apply preprocessing techniques on datasets.<br>CO2: Implement and evaluate linear regression and random forest regression models.<br>CO3: Apply and evaluate classification and clustering techniques.<br>CO4: Analyze performance of an algorithm.<br>CO5: Implement an algorithm that follows one of the following algorithm design strategies: divide and conquer, greedy, dynamic programming, backtracking, branch and bound.<br>CO6: Interpret the basic concepts in Blockchain technology and its applications |
| 410247 | Laboratory Practice IV | CO1: Apply android application development for solving real life problems<br>CO2: Design and develop system using various multimedia components.<br>CO3: Identify various vulnerabilities and demonstrate using various tools.<br>CO4: Apply information retrieval tools for natural language processing<br>CO5: Develop an application using open source GPU programming languages<br>CO6: Apply software testing tools to perform automated testing |
| 410248 | Project Work Stage I | • Solve real life problems by applying knowledge.<br>• Analyze alternative approaches, apply and use most appropriate one for feasible solution. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 410248 | Project Work Stage I | • Write precise reports and technical documents in a nutshell.<br>• Participate effectively in multi-disciplinary and heterogeneous teams exhibiting team work<br>• Inter-personal relationships, conflict management and leadership quality. |
| 410249 | Audit Course 7: I: MOOC-learn New Skill | CO1: To acquire additional knowledge and skill. |
| 410249 | Audit Course 7: II:Entrepreneurship Development | CO1: Understand the legalities in product development<br>CO2: Undertake the process of IPR, Trademarks, Copyright and patenting<br>CO3: Understand and apply functional plans<br>CO4: Manage Entrepreneurial Finance<br>CO5: Inculcate managerial skill as an entrepreneur |
| 410249 | Audit Course 7: III:Botnet of Things | CO1: Implement security as a culture and show mistakes that make applications vulnerable to attacks.<br>CO2: Understand various attacks like DoS, buffer overflow, web specific, database specific, web-spoofing attacks.<br>CO3: Demonstrate skills needed to deal with common programming errors that lead to most securityproblems and to learn how to develop secure applications |
| 410249 | Audit Course 7: IV: 3D Printing | CO1: Understand the basic knowledge of Shop Floor Safety rules and regulations basics of Machinetools and 3D printing machines<br>CO2: Understand the concept of concept of technical sketching, multi-view drawings, Lettering,tolerance, and metric construction<br>CO3:Identify and Distinguish drafting terminologies and construction of geometrical figures using drawing instruments, procedure to prepare a drawing sheet as per SP-46:2003<br>CO4:Describe and Explain practical aspects to generate detailed and assembly views with dimensions,annotations, in 3D Modeling software.<br>CO5: Apply concepts and Fabricate the simple mechanical parts, prototype/ end use product for 3D Printing |
| 410249 | Audit Course 7:V: Industrial Safety and Environment Consciousness | CO1: Develop the plan for Safety performance<br>CO2: Demonstrate the action plan for accidents and hazards<br>CO3: Apply the safety and security norms in the industry<br>CO4: Evaluate the environmental issues of Industrialization |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| Final Year (2019 Pattern) : Semester-II |||
| 410250 | High Performance Computing | CO1: Understand various Parallel Paradigm<br>CO2: Design and Develop an efficient parallel algorithm to solve given problem<br>CO3: Illustrate data communication operations on various parallel architecture<br>CO4: Analyze and measure performance of modern parallel computing systems<br>CO5: Apply CUDA architecture for parallel programming<br>CO6: Analyze the performance of HPC applications |
| 410251 | Deep Learning | CO1: Understand the basics of Deep Learning and apply the tools to implement deep learningapplications<br>CO2: Evaluate the performance of deep learning models (e.g., with respect to the bias-variance tradeoff, overfitting and underfitting, estimation of test error).<br>CO3: To apply the technique of Convolution (CNN) and Recurrent Neural Network (RNN) forimplementing Deep Learning models<br>CO4: To implement and apply deep generative models.<br>CO5: Construct and apply on-policy reinforcement learning algorithms<br>CO6:To Understand Reinforcement Learning Process |
| 410252(A) | Elective V(A):Natural Language Processing | CO1: Describe the fundamental concepts of NLP, challenges and issues in NLP<br>CO2: Analyze Natural languages morphologically, syntactical and semantically OR Describe the concepts of morphology, syntax, semantics of natural language<br>CO3: Illustrate various language modelling techniques<br>CO4: Integrate the NLP techniques for the information retrieval task<br>CO5: Demonstrate the use of NLP tools and techniques for text-based processing of natural languages<br>CO6: Develop real world NLP applications |
| 410252 (B) | Elective V(B):Image Processing | CO1: Apply Relevant Mathematics Required for Digital Image Processing.<br>CO2: Apply Special and Frequency Domain Method for Image Enhancement.<br>CO3: Apply algorithmic approaches for Image segmentation.<br>CO4: Summarize the Concept of Image Compression and Object Recognition.<br>CO5: Explore the Image Restoration Techniques.<br>CO6: Explore the Medical and Satellite Image Processing Applications. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 410252© | Elective V(C):Software Defined Networks | CO1: Interpret the need of Software Defined networking solutions.<br>CO2: Analyze different methodologies for sustainable Software Defined Networkingsolutions.<br>CO3: Select best practices for design, deploy and troubleshoot of next generation networks.<br>CO4: Develop programmability of network elements.<br>CO5: Demonstrate virtualization and SDN Controllers using Open Flow protocol<br>CO6: Design and develop various applications of SDN |
| 410252(D) | Elective V(D):Advanced Digital Signal Processing | CO1: Understand and apply different transforms for the design of DT/Digital systems<br>CO2: Explore the knowledge of adaptive filtering and Multi-rate DSP<br>CO3: Design DT systems in the field/area of adaptive filtering, spectral estimation and multi-rateDSP<br>CO4: Explore use of DCT and WT in speech and image processing<br>CO5: Develop algorithms in the field of speech , image processing and other DSP applications<br>CO6:Identify Image Processing Techniques |
| 410253(A) | Elective VI(A):Pattern Recognition | CO1: Analyze various type of pattern recognition techniques<br>CO2: Identify and apply various pattern recognition and classification approaches to solvethe problems<br>CO3: Evaluate statistical and structural pattern recognition<br>CO4: Percept recent advances in pattern recognition confined to various applications<br>CO5:Implement Bellman's optimality principle and dynamic programming<br>CO6:Analyze Patterns using Genetic Algorithms & Pattern recognition applications. |
| 410253( B) | Elective VI(B):Soft Computing | CO1: Understand requirement of soft computing and be aware of various soft computing techniques.<br>CO2: Understand Artificial Neural Network and its characteristics and implement ANN algorithms.<br>CO3: Understand and Implement Evolutionary Computing Techniques.<br>CO4: Understand the Fuzzy logic and Implement fuzzy algorithms for solving real life problems.<br>CO5: Apply knowledge of Genetic algorithms for problem solving.<br>CO6: Develop hybrid systems for problem solving. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 410253© | Elective VI(C):Business Intelligence | CO1: Differentiate the concepts of Decision Support System & Business Intelligence<br>CO2:Use Data Warehouse & Business Architecture to design a BI system.<br>CO3:Build graphical reports<br>CO4:Apply different data preprocessing techniques on dataset<br>CO5:mplement machine learning algorithms as per business needs<br>CO6:Identify role of BI in marketing, logistics, and finance and telecommunication sector |
| 410253(D) | Elective VI(D):Quantum Computing | CO1: To understand the concepts of Quantum Computing<br>CO2: To understand and get exposure to mathematical foundation and quantum mechanics<br>CO3: To understand and implement buiding blocks of Quantum circuits<br>CO4: To understand quantum information, its processing and Simulation tools<br>CO5: To understand basic signal processing algorithms FT, DFT and FFT<br>CO6 : To study and solve examples of Quantum Fourier Transforms and their applications |
| 410254 | Laboratory Practice V | CO1: Analyze and measure performance of sequential and parallel algorithms.<br>CO2: Design and Implement solutions for multicore/Distributed/parallel environment.<br>CO3: Identify and apply the suitable algorithms to solve AI/ML problems.<br>CO4: Apply the technique of Deep Neural network for implementing Linear regression andclassification.<br>CO5: Apply the technique of Convolution (CNN) for implementing Deep Learning models.<br>CO6: Design and develop Recurrent Neural Network (RNN) for prediction. |
| 410255 | Laboratory Practice VI | CO1: Apply basic principles of elective subjects to problem solving and modeling.<br>CO2: Use tools and techniques in the area of software development to build mini projects<br>CO3: Design and develop applications on subjects of their choice.<br>CO4: Generate and manage deployment, administration & security. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 410256 | Project Work Stage II | CO1: Show evidence of independent investigation<br>CO2: Critically analyze the results and their interpretation.<br>CO3: Report and present the original results in an orderly way and placing the open questions in the right perspective.<br>CO4: Link techniques and results from literature as well as actual research and future research lines withthe research.<br>CO5: Appreciate practical implications and constraints of the specialist subject |
| 410257 | Audit Course 8-I-Usability Engineering | CO1: Describe the human centered design process and usability engineering process and theirroles in system design and development.<br>CO2: Discuss usability design guidelines, their foundations, assumptions, advantages, andweaknesses.<br>CO3: Design a user interface based on analysis of human needs and prepare a prototype system.<br>CO4: Assess user interfaces using different usability engineering techniques.<br>CO5: Present the design decisions |
| 410257 | Audit Course 8– II: Conversational Interfaces | CO1: Develop an effective interface for conversation<br>CO2: Explore advanced concepts in user interface |
| 410257 | Audit Course 8-III-Social Media And Analytics | CO1: Develop a far deeper understanding of the changing digital land scape.<br>CO2: Identify some of the latest digital marketing trends and skill sets needed for today's marketer.<br>CO3: Successful planning, prediction, and management of digital marketing campaigns<br>CO4:Assess user interfaces using different usability engineering techniques.<br>CO5: Implement smart management of different digital assets for marketing needs.<br>CO6: Assess digital marketing as a long term career opportunity. |
| 410257 | Audit Course 8-IV: MOOC-learn New Skill | CO1: To acquire additional knowledge and skill. |
| 410257 | Audit Course 8-V: Emotional Intelligence | CO1: Expand your knowledge of emotional patterns in yourself and others<br>CO2: Discover how you can manage your emotions, and positively influence yourself and others<br>CO3: Build more effective relationships with people at work and at home<br>CO4: Positively influence and motivate colleagues, team |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 410257 | Audit Course 8-V: Emotional Intelligence | members, managers<br>CO5: Increase the leadership effectiveness by creating an atmosphere that engages others |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 207006 | Engineering Mathematics-III | CO1:Solve higher order linear differential equation using appropriate techniques to model and analyze electrical circuits.<br>CO2: Apply Integral transforms such as Laplace transform, Fourier transform and Z-Transform to solve problems related to signal processing and control systems.<br>CO3: Apply Statistical methods like correlation, regression and Probability theory as applicable to analyze and interpret experimental data related to energy management, power systems, testing and quality control.<br>CO4: Perform Vector differentiation and integration, analyze the vector fields and apply to wave theory and electro-magnetic fields.<br>CO5: Analyze Complex functions, conformal mappings, and perform contour integration in the study of electrostatics, signal and image processing. |
| 203141 | Power Generation Technologies | CO1: Identify components and elaborate working principle of conventional power plants.<br>CO2: Recognize the importance and opportunities of renewable energies.<br>CO3: Calculate and control power output of wind solar, and hydro power plant.<br>CO4: Describe process of grid interconnection of distributed generation and requirements.<br>CO5: Interpret the environmental and social impact of various generation technologies |
| 203142 | Material Science | CO1: Discuss classification,properties and characteristics of different electrical engineering materials.<br>CO2: State various applicationsmeasuring methods for parameters of different classes of electrical engineering materials.<br>CO3: Solve simple problems based on dielectric, magnetic and conducting materials.<br>CO4: Apply knowledge of Nano-technology to electrical engineering.<br>CO5: Execute tests ondielectric, insulating, magnetic, conducting, resistive materials as per IS to decide the quality of thematerials. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 203142 | Material Science | CO6: Create learning resource material ethically to demonstrate self learning leading to lifelong learning skills and usage of ICT/ online technology through collaborative/active learning activities. |
| 203143 | Analog And Digital Electronics | CO1: Design logical, sequential and combinational digital circuit using K-Map.<br>CO2: Demonstrate different digital memories and programmable logic families.<br>CO3: Apply and analyze applications of OPAMP in open and closed loop condition.<br>CO4: Design uncontrolled rectifier with given specifications. |
| 203144 | Electrical Measurements and Instrumentation | CO1: Define various characteristic and classify measuring instruments along with range extension techniques.<br>CO2: Apply measurement techniques for measurement of resistance, inductance and capacitance.<br>CO3: Demonstrate construction, working principle of electrodynamo type and induction type instruments for measurement of power and energy.<br>CO4: Make use of CRO for measurement of voltage, current and frequency.<br>CO5: Classify transducer and apply it for measurement of physical parameters in real time. |
| 203150 | Applications of Mathematics in Electrical Engineering | CO1: Apply fundamentals of mathematics in solving electrical engineering problem<br>CO2: Analyze complex electrical engineering problem using mathematical techniques.<br>CO3: Implement program and simulation for problems in electrical engineering.<br>CO4: Demonstrate self lifelong learning skills with applications of mathematics in electrical engineering through software. |
| 203151 | Soft Skill | CO1: DoSWOC analysis.<br>CO2: Develop presentation and take part in group discussion.<br>CO3: Understand and implement etiquette in workplace and in society at large.<br>CO4: Work in team with team spirit.<br>CO5: Utilize the techniques for time management and stress management |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 203152(A) | Audit Course-III(A) : Solar Thermal System | CO1: Differentiate between types of solar Concentrators<br>CO2: Apply software tool for solar concentrators<br>CO3: Design different types of Solar collectors and balance of plant |
| 203152(B) | Audit Course-III(B) : C Language Programming | CO1: Elaborate data types, arithmetic, logical and conditional operators<br>CO2: Apply control and looping statements in C programming<br>CO3: Write programming using C language with functions, arrays and pointers |
| 203152© | Audit Course-III(C): Japanese Language-I | Will have ability of basic communication.<br>• Will have the knowledge of Japanese script.<br>• Will get introduced to reading , writing and listening skills<br>• Will develop interest to pursue professional Japanese Language course. |

## Second Year (2019 Pattern) : Semester-II

| | | |
|---|---|---|
| 203145 | Power System-I | CO1: Recognize different patterns of load curve and calculate associated different factors with it and tariff.<br>CO2: Draft specifications of electrical equipment in power station.<br>CO3: Design electrical and mechanical aspects in overhead transmission and underground cables.<br>CO4: Evaluate the inductance and capacitance of different transmission line configurations.<br>CO5: Analyse the performance of short and medium transmission lines |
| 203146 | Electrical Machines-I | CO1: Evaluate performance parameters of transformer with experimentation and demonstrate construction along with specifications as per standards.<br>CO2: Distinguish between various types of transformer connections as per vector groups with application and to perform parallel operation of single/three phase transformers.<br>CO3: Select and draft specifications of DC machines and Induction motors for various applications along with speed control methods.<br>CO4: Justify the need of starters in electrical machines with merits and demerits.<br>CO5: Test and evaluate performance of DC machines and Induction motors as per IS standard. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 203147 | Network Analysis | CO1: Calculate current/voltage in electrical circuits using simplification techniques, Mesh, Nodal analysis and network theorems. <br> CO2: Analyze the response of RLC circuit with electrical supply in transient and stead state. <br> CO3: Apply Laplace transform to analyze behaviour of an electrical circuit. <br> CO4: Derive formula and solve numerical of two port network and Design of filters <br> CO5: Applyknowledge of network theory to find transfer function, poles and zeroes location to perform stability analysis and parallel resonance |
| 203148 | Numerical Methods and Computer Programming | CO1:Demonstrate types of errors in computation and their causes of occurrence. <br> CO2: Calculate root of algebraic and transcendental equations using various methods. <br> CO3: Apply numerical methods for various mathematical problems such as interpolation, numerical differentiation, integration and ordinary differential equation. <br> CO4: Solve linear simultaneous equation using direct and indirect method. <br> CO5:Develop algorithms and write computer programs for various numerical methods. |
| 203149 | Fundamental of Microcontroller and Applications | CO1: Describe the architecture and features of various types of the microcontroller. <br> CO2: Illustrate addressing modes and execute programs in assembly language for the microcontroller. <br> CO3: Write programs in C language for microcontroller 8051. <br> CO4: Elaborate interrupt structure of 8051 and program to handle interrupt and ADC809 <br> CO5: Define the protocol for serial communication and understand the microcontroller development systems. <br> CO6: Interface input output devices and measure electrical parameters with 8051 in real time. |
| 203152 | Project Based Learning | CO1: Identify, formulate, and analyze the simple project problem. <br> CO2: Apply knowledge of mathematics, basic sciences, and electrical engineering fundamentals to develop solutions for the project. <br> CO3: Learn to work in teams, and to plan and carry out different tasks that are required during a project. <br> CO4: Understand their own and their team-mate's strengths and skills. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 203152 | Project Based Learning | CO5: Draw information from a variety of sources and be able to filter and summarize the relevant points.<br>CO6: Communicate to different audiences in oral, visual, and written forms. |
| 203153(A) | Audit Course-IV(A): Solar Photovoltaic Systems | CO1: design of Solar PV system for small and large installations<br>CO2: handle software tools for Solar PV systems |
| 203153(B) | Audit Course-IV(B) Installation & Maintenance of Electrical appliances | • Observing the safety precautions while working,<br>• Test line cord for continuity with test lamp/ multimeter<br>• Dismantle and reassemble an electric iron<br>• Heater, kettle, room heater, toaster, hair dryer, mixer grinder etc.<br>• Install a ceiling fan and the regulator<br>• Check a fluorescent lamp chock, starter and install it<br>• Domestic installation testing before energizing a domestic installation |
| 203153(C) | Audit Course-IV (C) Japanese Language-II | • Will have ability of basic communication.<br>• Will have the knowledge of Japanese script.<br>• Will get introduced to reading , writing and listening skills<br>• Will develop interest to pursue professional Japanese Language course |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 303141 | Industrial and Technology Management | CO1: Differentiate between different types of business organizations and discuss the fundamentals of economics and management.<br>CO2: Explain the importance of technology management and quality management.<br>CO3: Explain the importance of IPR and role of Human Resource Management.<br>CO4: Understand the importance of Quality and its significance.<br>CO5: Describe the characteristics of marketing & its types and overview of financial Management.<br>CO6: Discuss the qualities of a good leader and road map to Entrepreneurship |
| 303142 | Power Electronics | CO1: Develop characteristics of different power electronic switching devices.<br>CO2: Reproduce working principle of power electronic converters for different types of loads.<br>CO3: Choose the appropriate converter for different applications. |
| 303143 | Electrical Machines-II | CO1: Learn construction, working principle of three phase Synchronous Machines, Induction Motors, A.C. Series Motor and Special Purpose Motors.<br>CO2: Understand characteristics of three phase Synchronous Machines, Induction Motors, A.C. Series Motor and Special Purpose Motors.<br>CO3: Select the above machines in Power System, industrial, household & Military Engineering applications.<br>CO4: Testing of machines to evaluate the performance through experimentation. |
| 303144 | Electrical Installation, Design and Condition Based Maintenance | CO1: Classify different types of distribution supply system and determine economics of distribution system. compare and classify various substations, bus-bars and Earthing systems.<br>CO2: Demonstrate the importance and necessity of maintenance.<br>CO3: Analyse and test different condition monitoring methods.<br>CO4: Carry out estimation and costing of internal wiring for |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 303144 | Electrical Installation, Design and Condition Based Maintenance | residential and commercial installations.<br>CO5: Apply electrical safety procedures. |
| 303145A | Elective-I: Advanced Microcontroller and Embedded System | CO1: Explain architecture of PIC 18F458 microcontroller, its instructions and the addressing modes.<br>CO2: Use Ports and timers for peripheral interfacing and delay generation.<br>CO3: Interface special and generate events using CCP module.<br>CO4: Effectively use interrupt structure in internal and External interrupt mode.<br>CO5: Effectively use ADC for parameter measurement and also understand LCD interfacing.<br>CO6: Use Serial Communication and various serial communication protocols. |
| 303145B | Elective-I: Digital Signal Processing | CO1: Analyse discrete time signals and systems.<br>CO2: Construct frequency response of LTI system using Fourier Transform.<br>CO3: Design and realize IIR and FIR filters.<br>CO4: Apply concepts of DSP in applications of electrical engineering |
| 303146 | Seminar | CO1: Relate with the current technologies and innovations in Electrical engineering.<br>CO2: Improve presentation and documentation skill<br>CO3: Apply theoretical knowledge to actual industrial applications and research activity.<br>CO4: Communicate effectively. |
| 303147A | Audit Course V: Energy Storage System | CO1: Explain and differentiate various types of energy storage for suitable applications<br>CO2: Understand battery recycling techniques |
| 303147B | Audit Course V: Start-up and Disruptive Innovations | CO1: Describe role of incubation for Startup and recent national policy.<br>CO2: Identify various types of Startups.<br>CO3: Explain impacts of disruptive innovation and Differentiate between disruptive innovation and disruptive technology |

## Third Year (2019 Pattern) : Semester-II

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 303148 | Power System-II | CO1: Solve problems involving modelling, design and performance evaluation of HVDC and EHVAC power transmission lines.<br>CO2: Calculate per unit values and develop Y bus for solution power flow equations in power transmission networks |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 303148 | Power System-II | CO3: Calculate currents and voltages in a faulted power system under both symmetrical and asymmetrical faults, and relate fault currents to circuit breaker ratings. |
| 303149 | Computer Aided Design of Electrical Machines | CO1: Summarize temperature rise, methods of cooling of transformer and consider IS 2026 in transformer design.<br>CO2: Design the overall dimensions of the transformer.<br>CO3: Analyze the performance parameters of transformer.<br>CO4: Design overall dimensions of three phase Induction motor<br>CO5: Analyze the performance parameters of three phase Induction motor.<br>CO6: Implement and develop computer aided design of transformer and induction motor |
| 303150 | Control System Engineering | CO1: Construct mathematical model of Electrical and Mechanical system using differential equations and transfer function and develop analogy between Electrical and Mechanical systems.<br>CO2: Determine time response of systems for a given input and perform analysis of first and second order systems using time domain specifications.<br>CO3: Investigate closed loop stability of system in s-plane using Routh Hurwitz stability criteria and root locus.<br>CO4: Analyze the systems in frequency domain and investigate stability using Nyquist plot and Bode plot<br>CO5: Design PID controller for a given plant to meet desired time domain specifications |
| 303151A | Elective II: IoT and Its Applications in Electrical Engineering | CO1: Build circuits for signal acquisition and conditioning<br>CO2: Experiment with sensors and actuators and choose the right sensor for application<br>CO3: Determine the performance of IoT based automated process<br>CO4: Design and develop IoT based applications |
| 303151B | Elective-II: Electric Mobility | CO1: Analyze the concepts of Hybrid and Electric vehicles.<br>CO2: Describe the different types of energy storage systems<br>CO3: Comprehend the knowledge of the battery charging and management systems.<br>CO4: Classify the different mode of operation for hybrid vehicle.<br>CO5: Apply the different Charging standards used for electric vehicles.<br>CO6: Differentiate between Vehicle to home & Vehicle to grid concepts. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 303151C | Elective-II: Cybernetics Engineering | CO1: Define cybernetics in terms of control and how is it used in controlling technical, biological,and other processes.<br>CO2: Understand various matrix operations.<br>CO3: Describe different types of control system configurations and their applications.<br>CO4: Carry out mathematical modeling and simulation of simple processes.<br>CO5: Appreciate the essential requirements for computers and computer equipment that are intended to operate in dedicated applications and industrial environments.<br>CO6: Know intelligent optimization techniques. |
| 303151D | Elective-II Energy Management | CO1: Describe BEE Energy policies, Energy ACT.<br>CO2: List and apply demand side management measures for managing utility systems.<br>CO3: Explore and use simple data analytic tools.<br>CO4: Use various energy measurement and audit instruments.<br>CO5: Evaluate economic feasibility of energy conservation projects.<br>CO6: Identify appropriate energy conservations methods for electric and thermal utilities. |
| 303152 | Internship | CO1: Understand the working culture and environment of the Industry and get familiar with various departments and practices in the industry.<br>CO2: Operate various meters, measuring instruments, tools used in industry efficiently and develop technical competence.<br>CO3: Apply internship learning in other course completions and final year project management, i.e.<br>topic finalization, project planning, hardware development, result interpretations, report writing, etc.<br>CO4: Create a professional network and learn about ethical, safety measures, and legal practices.<br>CO5: Appreciate the responsibility of a professional towards society and the environment.<br>CO6: Identify career goals and personal aspirations. |
| 303153A | Audit Course VI: Ethical Practices for Engineers | CO1: Understand for their professional responsibilities as Engineers.<br>CO2: Recognize and think through ethically significant problem situations that are common in Engineering.<br>CO3: Evaluate the existing ethical standards for Engineering Practice |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 303153B | Audit Course VI: Project Management | CO1; Elaborate importance of project management and its process.<br>CO2: Learn about the role of high performance teams and leadership in project management. |

**Sanghavi College of Engineering, Nashik**

**Department of Electrical Engineering**

**Course Outcomes**

**Final Year (2019 Pattern) : Semester-I**

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 403141 | Power System Operation and Control | CO1: Summarize angle, voltage and frequency stability in the power system control (UN). <br> CO2: Illustrate various ways of interchange of power between interconnected utilities (AP). <br> CO3: Analyze stability and optimal load dispatch using different techniques (AN). <br> CO4: Select appropriate FACTS devices for stable operation of the system (EV). <br> CO5: Evaluate the stability of the system and suggest the methods to improve it (EV). |
| 403142 | Advanced Control System | CO1: Explain compensation networks, common nonlinearities, the concept of state, sampling and reconstruction, and concepts of advanced controls (Understanding) <br> CO2: Determine transfer function from state model (Applying) <br> CO3: Test controllability and observability properties of the system (Evaluating) <br> CO4: Design compensators, state feedback controls, and observers for the system (Creating) |
| 403143A | Elective-I PLC and SCADA | CO1:Develop and explain the working of a PLC with the help of a block diagram. <br> CO2:Classify input and output interfacing devices with PLC. <br> CO3:Design PLC based application by proper selection criteria, developing GUI and ladder program. <br> CO4:Execute, debug, and test the programs developed for digital and analog operations. <br> CO5:Develop the architecture of SCADA and explain the importance of SCADA in critical infrastructure. <br> CO6:Describe the SCADA protocols and digital control systems, along with their architecture for automation. |
| 403143B | Elective-I Power Quality Management | CO1: Understand power quality and attribute of power quality <br> CO2: Describe voltage flicker and mitigation of it <br> CO3: Analyze the effect of power system events on voltage sag and its characteristics. <br> CO4: Identify the sources of harmonics and harmonics produced <br> CO5: Select proper method for harmonic mitigation along with |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 403143B | Elective-I Power Quality Management | methods of power quality monitoring.<br>CO6: Carry out power quality monitoring using power quality analyzers. |
| 403143C | Elective-I High Voltage Engineering | CO1: Identify, describe and analyze the breakdown theories of gaseous, solid and liquid materials.<br>CO2: Analyze the occurrence of over voltage and to provide remedial solutions<br>CO3: Describe and use of various methods of generation of high AC, DC, impulse voltage and current.<br>CO4: Demonstrate the methods of measurement of high AC, DC, impulse voltage and current, tests on high voltage equipment and devices<br>CO5: Study design of high voltage laboratory with all safety measures. |
| 403143D | Elective-I Robotics and Automation | CO1: differentiate between types of robots based on configuration, method of control, types of drives, sensors used, etc.<br>CO2: apply mathematical modeling of a robot for a specific application with given specifications.<br>CO3: analyze the robot arm dynamics for calculation of torques and forces required for different joints of robots for control of the robot arm.<br>C04 : apply knowledge of Robot for their various applications |
| 403144A | Elective-II Alternate Energy System | CO1:Analyze the performance of solar thermal and photovoltaic systems.<br>CO2:Determine wind turbine performance.<br>CO3:Explain and evaluate biomass resources in an Indian context.<br>CO4:Illustrate the importance of storage systems.<br>CO5:Analyze the economics of renewable energy sources. |
| 403144B | Elective-II Electric and Hybrid Vehicle | CO1: Analyze the Life Cycle Assessment of Li-ion battery.<br>CO2 : Describe the different types of Li-ion charging methods<br>CO3 : Comprehend the knowledge of drivetrain hybridization.<br>CO4 : Evaluate EV motor sizing.<br>CO5 : Classify Battery Recycling methods. |
| 403144C | Elective-II Special-Purpose Machines | CO1:Reproduce principal of operation of PMSM, Stepper motor, SRM, Switch reluctance and linear motors.<br>CO2: Develop torque - speed and performance characteristics of above motors. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 403144C | Elective-II Special-Purpose Machines | CO3: Enlist application of above motors.<br>CO4: Demonstrate various control strategies. |
| 403144D | Elective-II HVDC and FACTs | CO1:Choose a proper FACTS controller for the specific application based on system requirements.<br>CO2:Analyze shunt, series, and combined controllers to explore different benefits.<br>CO3:Compare EHVAC and HVDC systems and to describe various types of DC links.<br>CO4:Describe various methods for the control of HVDC systems and to perform power flow analysis in AC/DC systems |
| 403145 | Project Stage I | CO1:Define the project problem statement and identify the scope of the project.<br>CO2:Search the appropriate research papers, standards and e-resources and write a literature survey.<br>CO3:Identify tools, techniques, methods, concepts, measuring devices, and instruments required for the project to define the methodology of the project.<br>CO4:Justify the selection of electrical, electronic and mechanical components for the project prototyping<br>CO5:Simulate or develop a system for software or hardware verification.<br>CO6:Write a project report with proper interpretation of results |
| 403146 | MOOCs | CO1:Enables the students to directly engage and learn from the best faculty in the country in order to strengthen the fundamentals.<br>CO2:Explore new areas of interest in a relevant field.<br>CO3:Enable self learning initiative in learners..<br>CO4:Develop critical thinking to solve complex problems in engineering, science and humanities.<br>CO5:Improve communication skills by interacting with peers and course teachers. |
| 403147A | Audit Course-VII German Language-I | CO1: Will have the ability of basic communication.<br>CO2: Will have the knowledge of German script.<br>CO3: Will get introduced to reading ,writing and listening skills<br>CO4: Will develop interest to pursue profession in Indo-German Industry. |
| 403147B | Audit Course-VII Engineering Economics-I | CO1:Discuss concepts related to business and its impact on enterprise.<br>CO2:Illustrate time value of money in economic analysis |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 403147C | Audit Course-VII Sustainability | CO1: Understand different types of environmental pollution problem.<br>CO2: Suggest solutions for sustainable development.<br>CO3: Develop a broader perspective in thinking for sustainable practices by utilizing engineering principle and knowledge |
| **Final Year (2019 Pattern) : Semester-I** | | |
| 403148 | Switchgear and Protection | CO1:Understand the fundamentals of protective relaying.<br>CO2:Demonstrate the arc interruption and analyze the RRRV in circuit breakers<br>CO3:Demonstrate the construction and working principle of air brake circuit breakers, SF6 circuit breakers, and a vacuum circuit breaker.<br>CO4:Explain the characteristics of static and digital relays and their applications in power systems.<br>CO5:Apply the differential protection scheme to large transformers, alternators, and induction motors.<br>CO6:Apply distance protection, three stepped protection for transmission line |
| 403149 | Advanced Electrical Drives and Control | CO1: Explain motor load dynamics and multi quadrant operation of drives.<br>CO2: Analyze operation of converter fed and chopper fed DC drives.<br>CO3: Apply different braking methods of D.C. and induction motor drive.<br>CO4: Elaborate vector control for induction motor and BLDC drives.<br>CO5: Elaborate synchronous motor, reluctance motor drive.<br>CO6: Differentiate between classes and duty cycles of motors and select suitable drives in various industrial applications. |
| 403150A | Elective-III Digital Control System | CO1: Analyze digital control system and its stability.<br>CO2: Differentiate between various control systems<br>CO3: Present system in state space format.<br>CO4: Design observer for system.<br>CO5: Understand digital controllers<br>CO6: Elaborate applications such as digital temperature control and position control |
| 403150B | Elective-III Restructuring and Deregulation | CO1: Identify the various institutions in the Indian power sector and explain their role in the Indian power sector .<br>CO2: Explain the various fundamentals of power sector economics |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 403150B | Elective-III Restructuring and Deregulation | CO3: Describe the regulatory process in India and list the steps involved in tariff determination and explain the phases of tariff determination<br>CO4: Describe and explain different power sector restructuring models and explain the concept of energy trading<br>CO5: Explain the types of electricity markets and compare the types of electricity markets .<br>CO6: State different transmission pricing methods and describe and compare various congestion management methods. |
| 403150C | Elective-III Smart Grid | CO1: Apply the knowledge to differentiate between Conventional and Smart Grid<br>CO2: Describe importance of Supercapacitors.<br>CO3: Identify the need of Smart metering.<br>CO4: Apply the communication technology in smart grid.<br>CO5: Comprehend the issues of micro grid. |
| 403150D | Elective-III Sensor Technology (Open Elective) | CO1: Understand the characteristics of sensors used for system monitoring and protection.<br>CO2: Interface the various position sensors to microcontrollers.<br>CO3: Demonstrate the characteristics of sensors used for light and image sensing. |
| 403151A | Elective-IV EHV AC Transmission | CO1:Highlight need for EHV ac transmission.<br>CO2:Calculate line and ground parameters.<br>CO3:Enlist problems encountered in EHV transmission.<br>CO4:Describe the effect of electric and magnetic fields on human beings |
| 403151B | Elective-IV Illumination Engineering | CO1: Define and reproduce various terms in illumination.<br>CO2: Identify various parameters for illumination system design.<br>CO3: Design indoor and outdoor lighting systems.<br>CO4: Enlist state of the art illumination systems. |
| 403151C | Elective-IV Electromagnetic Fields | CO1: Describe time varying Maxwell's equations and their applications in electromagnetic problems<br>CO2: Interpret electric and magnetic field with the help of associated laws<br>CO3: Solve simple electrostatic and magnetic boundary conditions<br>CO4: Determine the relationship between time varying electric and magnetic fields and electromotive force<br>CO5: Solve electromagnetic problems with the help of mathematical tools |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 403151D | Elective-IV Artificial Intelligence and Machine Learning | CO1: Evaluate Artificial Intelligence (AI) and Machine Learning(ML) methods and describe their foundations.<br>CO2: Demonstrate knowledge of reasoning and knowledge representation for solving real world problems.<br>CO3: Illustrate the construction of learning and expert system Discuss current scope and limitations of AI and societal implications<br>CO4: Distinguish between different types of learning types.<br>CO5: Apply the different supervised, unsupervised and reinforcement learning methods. |
| 403152 | Project Stage II | CO1: Identify tools, techniques, methods, concepts, measuring devices, and instruments required for the project to define the methodology of the project<br>CO2: Justify the selection of electrical, electronic and mechanical components for the project prototyping<br>CO3: Select the appropriate testing method for system performance evaluation<br>CO4: Interpret results obtained by simulation, and hardware implementation and decide on further action or write a conclusion<br>CO5: Write a project report and research paper on the project work |
| 403153A | Audit Course-VIII German Language-II | CO1: Will have the ability of advanced communication.<br>CO2: Will develop reading, writing and listening skills.<br>CO3: Will understand tenses in German Language.<br>CO4: Will develop interest to pursue a German language course. |
| 403153B | Audit Course-VIII Engineering Economics-I | CO1:Apply various techniques for evaluation of engineering projects.<br>CO2:Assess cash flow under risk with varying parameters. |
| 403153C | Audit Course-VIII GREEN BUILDING | CO1:Design green and sustainable techniques for both commercial and residential buildings.<br>CO2:Design water, lighting, energy efficiency plan using renewable energy sources.<br>CO3:Explain the principles of building planning, its bylaws and provide facilities for rainwater harvesting<br>CO4:Understand the concepts of green buildings |

Shree Mahavir Education Society's

**Sanghavi College of Engineering, Nashik**

# Department of Mechanical Engineering

## Course Outcomes

## Second Year (2019 Pattern) : Semester-I

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 202041 | Solid Mechanics | CO1. DEFINE various types of stresses and strain developed on determinate and indeterminate members.<br>CO2. DRAW Shear force and bending moment diagram for various types of transverse loading and support.<br>CO3. COMPUTE the slope & deflection, bending stresses and shear stresses on a beam.<br>CO4. CALCULATE torsional shear stress in shaft and buckling on the column.<br>CO5. APPLY the concept of principal stresses and theories of failure to determine stresses on a 2-D element.<br>CO6. UTILIZE the concepts of SFD & BMD, torsion and principal stresses to solve combined loading application based problems. |
| 202042 | Solid Modeling and Drafting | CO1. UNDERSTAND basic concepts of CAD system, need and scope in Product Lifecycle Management<br>CO2. UTILIZE knowledge of curves and surfacing features and methods to create complex solid geometry<br>CO3. CONSTRUCT solid models, assemblies using various modeling techniques & PERFORM mass property analysis, including creating and using a coordinate system<br>CO4. APPLY geometric transformations to simple 2D geometries<br>CO5. USE CAD model data for various CAD based engineering applications viz. production drawings, 3D printing, FEA, CFD, MBD, CAE, CAM, etc.<br>CO6. USE PMI & MBD approach for communication |
| 202043 | Engineering Thermodynamics | CO1. DESCRIBE the basics of thermodynamics with heat and work interactions.<br>CO2. APPLY laws of thermodynamics to steady flow and non-flow processes.<br>CO3. APPLY entropy, available and non available energy for an Open and Closed System,<br>CO4. DETERMINE the properties of steam and their effect on performance of vapour power cycle. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 202043 | Engineering Thermodynamics | CO5. ANALYSE the fuel combustion process and products of combustion.<br>CO6. SELECT various instrumentations required for safe and |
| 202044 | Engineering Materials and Metallurgy | CO1. COMPARE crystal structures and ASSESS different lattice parameters.<br>CO2. CORRELATE crystal structures and imperfections in crystals with mechanical behaviour of materials.<br>CO3. DIFFERENTIATE and DETERMINE mechanical properties using destructive and non- destructive testing of materials.<br>CO4. IDENTIFY & ESTIMATE different parameters of the system viz., phases, variables, component, grains, grain boundary, and degree of freedom. etc.<br>CO5. ANALYSE effect of alloying element & heat treatment on properties of ferrous & nonferrous alloy.<br>CO6. SELECT appropriate materials for various applications. |
| 203156 | Electrical and Electronics Engineering | CO1. APPLY programming concepts to UNDERSTAND role of Microprocessor and Microcontroller in embedded systems<br>CO2. DEVELOP interfacing of different types of sensors and other hardware devices with Atmega328 based Arduino Board<br>CO3. UNDERSTAND the operation of DC motor, its speed control methods and braking<br>CO4. DISTINGUISH between types of three phase induction motor and its characteristic features<br>CO5. EXPLAIN about emerging technology of Electric Vehicle (EV) and its modular subsystems<br>CO6. CHOOSE energy storage devices and electrical drives for EVs |
| 202045 | Geometric Dimensioning and Tolerancing Lab | CO1. SELECT appropriate IS and ASME standards for drawing<br>CO2. READ & ANALYSE variety of industrial drawings<br>CO3. APPLY geometric and dimensional tolerance, surface finish symbols in drawing<br>CO4. EVALUATE dimensional tolerance based on type of fit, etc.<br>CO5. SELECT an appropriate manufacturing process using DFM, DFA, etc. |
| **Second Year (2019 Pattern) : Semester-II** | | |
| 207002 | Engineering Mathematics - III | CO1. SOLVE higher order linear differential equations and its applications to model and analyze mass spring systems.<br>CO2. APPLY Integral transform techniques such as Laplace transform and Fourier transform to solve differential equations involved in vibration theory, heat transfer and related mechanical |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 207002 | Engineering Mathematics - III | engineering applications.<br>CO3. APPLY Statistical methods like correlation, regression in analyzing and interpreting experimental data applicable to reliability engineering and probability theory in testing and quality control.<br>CO4. PERFORM Vector differentiation & integration, analyze the vector fields and APPLY to fluid flow problems.<br>CO5. SOLVE Partial differential equations such as wave equation, one and two dimensional heat flow equations. |
| 202047 | Kinematics of Machinery | CO1. APPLY kinematic analysis to simple mechanisms<br>CO2. ANALYZE velocity and acceleration in mechanisms by vector and graphical method<br>CO3. SYNTHESIZE a four bar mechanism with analytical and graphical methods<br>CO4. APPLY fundamentals of gear theory as a prerequisite for gear design<br>CO5. CONSTRUCT cam profile for given follower motion |
| 202048 | Applied Thermodynamics | CO1. DETERMINE COP of refrigeration system and ANALYZE psychrometric processes.<br>CO2. DISCUSS basics of engine terminology,air standard, fuel air and actual cycles.<br>CO3. IDENTIFY factors affecting the combustion performance of SI and CI engines.<br>CO4. DETERMINE performance parameters of IC Engines and emission control.<br>CO5. EXPLAIN working of various IC Engine systems and use of alternative fuels.<br>CO6. CALCULATE performance of single and multi stage reciprocating compressors and DISCUSS rotary positive displacement compressors |
| 202049 | Fluid Mechanics | CO1. DETERMINE various properties of fluid<br>CO2. APPLY the laws of fluid statics and concepts of buoyancy<br>CO3. IDENTIFY types of fluid flow and terms associated in fluid kinematics<br>CO4. APPLY principles of fluid dynamics to laminar flow<br>CO5. ESTIMATE friction and minor losses in internal flows and DETERMINE boundary layer formation over an external surface<br>CO6. CONSTRUCT mathematical correlation considering dimensionless parameters, also ABLE to predict the performance of prototype using model laws |
| 202050 | Manufacturing Processes | CO1. SELECT appropriate moulding, core making and melting practice and estimate pouring time, solidification rate and DESIGN riser size and location for sand casting process |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 202050 | Manufacturing Processes | CO2. UNDERSTAND mechanism of metal forming techniques and CALCULATE load required for flat rolling<br>CO3. DEMONSTRATE press working operations and APPLY the basic principles to DESIGN dies and tools for forming and shearing operations<br>CO4. CLASSIFY and EXPLAIN different welding processes and EVALUATE welding characteristics<br>CO5. DIFFERENTIATE thermoplastics and thermosetting and EXPLAIN polymer processing techniques<br>CO6. UNDERSTAND the principle of manufacturing of fibre-reinforce composites and metal matrix composites |
| 202051 | Machine Shop | CO1. PERFORM welding using TIG/ MIG/ Resistance/Gas welding technique<br>CO2. MAKE Fibre-reinforced Composites by hand lay-up process or spray lay-up techniques<br>CO3. PERFORM cylindrical/surface grinding operation and CALCULATE its machining time<br>CO4. DETERMINE number of indexing movements required and acquire skills to PRODUCE a spur gear on a horizontal milling machine<br>CO5. PREPARE industry visit report<br>CO6. UNDERSTAND procedure of plastic processing |
| 202052 | Project Based Learning - II | CO1. IDENTIFY the real-world problem (possibly of interdisciplinary nature) through a rigorous literature survey and formulate / set relevant aims and objectives.<br>CO2. ANALYZE the results and arrive at valid conclusions.<br>CO3. PROPOSE a suitable solution based on the fundamentals of mechanical engineering by possibly integration of previously acquired knowledge.<br>CO4. CONTRIBUTE to society through proposed solutions by strictly following professional ethics and safety measures.<br>CO5. USE of technology in proposed work and demonstrate learning in oral and written form.<br>CO6. DEVELOP ability to work as an individual and as a team member |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 302041 | Numerical and Statistical Methods | CO1: SOLVE system of equations using direct and iterative numerical methods.<br>CO2: ESTIMATE solutions for differential equations using numerical techniques.<br>CO3: DEVELOP solution for engineering applications with numerical integration.<br>CO4: DESIGN and CREATE a model using a curve fitting and regression analysis.<br>CO5: APPLY statistical Technique for quantitative data analysis.<br>CO6: DEMONSTRATE the data, using the concepts of probability and linear algebra. |
| 302042 | Heat and Mass Transfer | CCO1. ANALYZE & APPLY the modes of heat transfer equations for one dimensional thermal system.<br>CO2. DESIGN a thermal system considering fins, thermal insulation and & Transient heat conduction.<br>CO3. EVALUATE the heat transfer rate in natural and forced convection & validate with experimentation results.<br>CO4. INTERPRET heat transfer by radiation between objects with simple geometries, for black and grey surfaces.<br>CO5. ABILITY to analyze the rate of mass transfer using Fick's Law of Diffusion and understands mass diffusion in different coordinate systems.<br>CO6. DESIGN & ANALYSIS of heat transfer equipments and investigation of its performance. |
| 302043 | Design of Machine Elements | CO1. DESIGN AND ANALYZE the cotter and knuckle Joints, levers and components subjected to eccentric loading.<br>CO2. DESIGN shafts, keys and couplings under static loading conditions.<br>CO3. ANALYZE different stresses in power screws and APPLY those in the procedure to design screw jack.<br>CO4. EVALUATE dimensions of machine components under fluctuating loads.<br>CO5.EVALUATE & INTERPRET the stress developed on the different type of welded and threaded joints.<br>CO6.APPLY the design and development procedure for different types of springs. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 302044 | Mechatronics | CO1. DEFINE key elements of mechatronics, principle of sensor and its characteristics.<br>CO2. UTILIZE concept of signal processing and MAKE use of interfacing systems such as ADC, DAC, Digital I/O.<br>CO3. DETERMINE the transfer function by using block diagram reduction technique.<br>CO4. EVALUATE Poles and Zero, frequency domain parameter for mathematical modeling for mechanical system.<br>CO5. APPLY the concept of different controller modes to an industrial application.<br>CO6. DEVELOP the ladder programming for industrial application. |
| 302045-A | Elective-I Advanced Forming & Joining Processes | CO1. ANALYSE the effect of friction in metal forming deep drawing and IDENTIFICATION of surface defects and their remedies in deep drawing operations<br>CO2. ASSESS the parameters for special forming operation and SELECT appropriate special forming operation for particular applications<br>CO3. ANALYSE the effect of HAZ on microstructure and mechanical properties of materials<br>CO4. CLASSIFY various solid state welding process and SELECT suitable welding processes for particular applications<br>CO5. CLASSIFY various advanced welding process and SELECT suitable welding processes for particular applications.<br>CO6. INTERPRET the principles of sustainable manufacturing and its role in manufacturing industry. |
| 302045-B | Elective-I Machining Science & Technology | CO1. DEFINE metal cutting principles and mechanics of metal cutting and tool life.<br>CO2. DESCRIBE features of gear and thread manufacturing processes.<br>CO3. SELECT appropriate grinding wheel and demonstrate the various surface finishing processes.<br>CO4. SELECT appropriate jigs/fixtures and to draw the process plan for a given component.<br>CO5. SELECT & EVALUATE various parameters of process planning.<br>CO6. GENERATE CNC program for Turning / Milling processes and generate tool path using CAM software |
| 302046 | Digital Manufacturing Laboratory | CO1.DEVELOP a component using conventional machines, CNC machines and Additive Manufacturing Techniques.<br>CO2.ANALYZE cutting tool parameters for machining given job.<br>CO3.DEMONSTRATE simulation of manufacturing process using Digital Manufacturing Tools.<br>CO4.SELECT and DESIGN jigs and Fixtures for a given component. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 302046 | Digital Manufacturing Laboratory | CO5.DEMONESTRATE different parameters for CNC retrofitting and reconditioning |
| 302047 | Skill Development | CO1.APPLY& DEMONSTRATE procedure of assembly & disassembly of various machines.<br>CO2.DESIGN & DEVELOP a working/model of machine parts or any new product.<br>CO3.EVALUATE fault with diagnosis on the machines, machine tools and home appliances.<br>CO4.IDENTIFY & DEMONSTRATE the various activities performed in an industry such as maintenance, design of components, material selection. |
| **Third Year (2019 Pattern) : Semester-II** | | |
| 302049 | Artificial Intelligence &Machine Learning | CO1. DEMONSTRATE fundamentals of artificial intelligence and machine learning.<br>CO2. APPLY feature extraction and selection techniques.<br>CO3. APPLY machine learning algorithms for classification and regression problems.<br>CO4. DEVISE AND DEVELOP a machine learning model using various steps.<br>CO5. EXPLAIN concepts of reinforced and deep learning.<br>CO6. SIMULATE machine learning model in mechanical engineering problems. |
| 302050 | Computer Aided Engineering | CO1: DEFINE the use of CAE tools and DESCRIBE the significance of shape functions in finite element formulations.<br>CO2: APPLY the various meshing techniques for better evaluation of approximate results.<br>CO3: APPLY material properties and boundary condition to SOLVE 1-D and 2-D element stiffness matrices to obtain nodal or elemental solution.<br>CO4: ANALYZE and APPLY various numerical methods for different types of analysis.<br>CO5: EVALUATE and SOLVE non-linear and dynamic analysis problems by analyzing the results obtained from analytical and computational method.<br>CO6: GENERATE the results in the form of contour plot by the USE of CAE tools. |
| 302051 | Design of Transmission Systems | CO1.APPLY the principle of Spur & Helical gear design for industrial application and PREPARE a manufacturing drawing with the concepts of GD&T.<br>CO2.EXPLAIN and DESIGN Bevel & Worm gear considering design parameters as per design standards.<br>CO3.SELECT&DESIGN Rolling and Sliding Contact Bearings from manufacturer's catalogue for a typical application |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 302051 | Design of Transmission Systems | considering suitable design parameters.<br>CO4.DEFINE and DESIGN various types of Clutches, Brakes, used in automobile.<br>CO5.APPLY various concept to DESIGN Machine Tool Gear box, for different applications<br>CO6.ELABORATE various modes of operation, degree of hybridization and allied terms associated with hybrid electric vehicles. |
| 302052-A | Elective II- Composite Materials | CO1. DEFINE & COMPARE composites with traditional materials.<br>CO2. IDENTIFY & ESTIMATE different parameters of the Polymer Matrix Composite<br>CO3. CATEGORISE and APPLY Metal Matrix Process from possessions landscape.<br>CO4. DETERMINE volume/weight fraction and strength of Composites.<br>CO5. SELECT appropriate testing and inspection method for composite materials.<br>CO6. SELECT composites materials for various applications. |
| 302052-B | Elective II-Surface Engineering | CO1. DEFINE the basic's principle & mechanism of surface degradation.<br>CO2. ANALYSE & SELECT correct corrosion prevention techniques for a different service condition.<br>CO3. DEMONSTRATE the role of surface engineering of materials to modify/improve the surface properties.<br>CO4. SELECT the suitable surface heat treatments to improve the surface properties.<br>CO5. APPLY the surface modification technique to modify surface properties.<br>CO6. ANALYSE & EVALUTE various surface coating defects using various testing/characterization method. |
| 302053 | Measurement Laboratory | CO1. EVALUATE causes of errors in Vernier calipers, micrometers by performing experiments in standard metrological conditions, noting deviations at actual and by plotting cause and effect diagram, to reduce uncertainty in measurement.<br>CO2. ANALYZE strain measurement parameters by taking modulus of elasticity in consideration to acknowledge its usage in failure detection and force variations.<br>CO3. EXAMINE surface Textures, surface finish using equipment's like Talysurf and analyze surface finish requirements of metrological equipment's like gauges, jaws of vernier calipers, micrometers, magnifying glasses of height gauge and more, to optimize surface finish accuracy requirements and cost of measurement. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 302053 | Measurement Laboratory | CO4. MEASURE the dimensional accuracy using Comparator and limit gauges and appraise their usage in actual measurement or comparison with standards set to reduce measurement lead time.<br>CO5. PERFORM Testing of Flow rate, speed and temperature measurements and their effect on performance in machines and mechanisms like hydraulic or pneumatic trainers, lathe machine etc. to increase repeatability and reproducibility.<br>CO6. COMPILE the information of opportunities of entrepreneurships/business in various sectors of metrology like calibrations, testing, coordinate and laser metrology etc in an industry visit report. |
| 302054 | Fluid Power &Control Laboratory | CO1.DEFINE working principle of components used in hydraulic and pneumatic systems.<br>CO2.IDENTIFY & EXPLAIN various applications of hydraulic and pneumatic systems.<br>CO3.SELECT an appropriate component required for hydraulic and pneumatic systems using manufactures' catalogues.<br>CO4.SIMULATE & ANALYSE various hydraulic and pneumatic systems for industrial/mobile applications.<br>CO5.DESIGN a hydraulic and pneumatic system for the industrial applications.<br>CO6.DESIGN & DEMONESTRATE various IoT, PLC based controlling system using hydraulics and pneumatics. |
| 302055 | Internship/Mini project * | CO1. DEMONSTRATE professional competence through industry internship.<br>CO2. APPLY knowledge gained through internships to complete academic activities in a professional manner.<br>CO3. CHOOSE appropriate technology and tools to solve given problem.<br>CO4. DEMONSTRATE abilities of a responsible professional and use ethical practices in day to day life.<br>CO5. DEVELOP network and social circle, and DEVELOPING relationships with industry people.<br>CO6. ANALYZE various career opportunities and DECIDE career goals. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 402041 | Heating, Ventilation, Air Conditioning and Refrigeration | CO1.ANALYSE different air-craft refrigeration systems and EXPLAIN the properties, applications and environmental issues of different refrigerants. CO2.ANALYSE multi pressure refrigeration system used for refrigeration applications. CO3.DISCUSS types of compressors, condensers, evaporators and expansion valves along with regulatory and safety controls and DESCRIBE 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. |
| 402042 | Dynamics of Machinery | CO1.APPLY balancing technique for static and dynamic balancing of multi cylinder inline and radial engines. CO2.ANALYZE the gyroscopic couple or effect for stabilization of Ship, Airplane and Four wheeler vehicles. CO3.ESTIMATE natural frequency for single DOF un-damped & damped free vibratory systems. CO4.DETERMINE response to forced vibrations due to harmonic excitation, base excitation and excitation due to unbalance forces. CO5.ESTIMATE natural frequencies, mode shapes for 2 DOF un-damped free longitudinal and torsional vibratory systems. CO6.DESCRIBE noise and vibration measuring instruments for industrial / real life applications along with suitable method for noise and vibration control. |
| 402043 | Turbomachinery | CO1: VALIDATE impulse moment principle using flat, inclined and curved surfaces and INVESTIGATE performance characteristics of hydraulic turbines. CO2: DETERMINE performance parameters of impulse and reaction steam turbine along with discussion of nozzles, governing mechanism & losses. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 402043 | Turbomachinery | CO3: MEASURE performance parameters of single & multistage centrifugal pumps along with discussion of cavitation and selection.<br>CO4: EXPLAIN performance parameters of centrifugal compressor along with discussion of theoretical aspects of axial compressor. |
| 402044A | Elective – III (A):Automobile Design | CO1:COMPREHEND the steps involved in the design process of Principal Engine Components.<br>CO2:GAIN the knowledge and design of Engine Sub-Systems.<br>CO3:COMPUTE the critical dimensions of chassis components involved in the Steering System and Differential and final drive of a vehicle.<br>CO4:SELECT the tyres and wheels required for automobile vehicle and design the various types automotive brakes.<br>CO5:UNDERSTAND the design concepts of Automotive Suspension system<br>CO6:POSSES the knowledge of Vehicle Packaging and System Integration, NVH. |
| 402044B | Elective – III(B):Design of Heat Transfer Equipments | CO1: EXPLAIN the design aspect of heat exchanger considering fouling factor for Heat Transfer Applications<br>CO2: SELECT and DESIGN the double tube heat exchangers for process industry<br>CO3: DESIGN the Shell & Tube Heat Exchangers for specified conditions<br>CO4: DESIGN the condensers and evaporators for refrigeration applications<br>CO5: DESIGN the compact heat exchangers<br>CO6: ANALYSE the performance of counter and cross flow cooling tower. |
| 402044C | Elective – III C :Modern Machining Processes | CO1.UNDERSTAND and ANALYZE the mechanism, process parameters of mechanical assisted modern machining processes.<br>CO2.UNDERSTAND the mechanism, construction and working of laser, plasma and electron beam assisted machining.<br>CO3.CLASSIFY and ANALYZE the mechanism, process parameters of the chemical and electrochemical machining.<br>CO4.RELATE and ANALYZE the mechanism and select process parameters Electrical Discharge Machining for an application.<br>CO5.ILLUSTRATE the application of micromachining processes. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 402044C | Elective – III C :Modern Machining Processes | CO6.SUGGEST appropriate nanomachining process for the specific application. |
| 402044D | Elective – III(D):Industrial Engineering | CO1. EVALUATE the productivity and IMPLEMENT various productivity improvement techniques.<br>CO2. APPLY work study techniques and UNDERSTANDS its importance for better productivity.<br>CO3. DEMONSTRATE the ability to SELECT plant location, appropriate layout and material handling equipment.<br>CO4. USE of Production planning and control tools for effective planning, scheduling and managing the shop floor control.<br>CO5. PLAN inventory requirements and EXERCISE effective control on manufacturing requirements.<br>CO6. APPLY Ergonomics and legislations for human comfort at work place and UNDERSTANDS the role of value engineering in improving productivity. |
| 402044E | Elective – III E:Internet of Things | CO1. EXPLAIN the Applications/Devices, Protocols and Communication Models of IoT<br>CO2. DEMONSTARTE small Mechanical Engineering IoT oriented applications using Sensors, Actuators, Microcontrollers and Cloud<br>CO3. SELECT commonly used IoT Simulation Hardware platforms<br>CO4. APPLICATION of Interfacing and Communication Technologies for IoT<br>CO5. ILLUSTRATE IoT Application Development and Security of IoT Ecosystem<br>CO6. EVALUATE Present and Future Domain specific Applications of IoT Ecosystem |
| 402044F | Elective – III (F):Computational Fluid Dynamics | CO1. DISTINGUISH and ANALYSE the governing equations of fluid mechanics and heat transfer in various formulations<br>CO2. ANALYZE and MODEL the conduction and advection problems<br>CO3. ANALYZE and MODEL the Convection-Diffusion problems<br>CO4. IDENTIFY and EVALUATE the External/Internal flow and its simulation<br>CO5. DISTINGUISH and COMPARE concepts of stability and turbulence.<br>CO6. USE and APPLY a CFD tool for effectively solving practical Fluid-Structure Interaction problems |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 402045A | Elective - IV(A): Product Design and Development | CO1. UNDERSTAND Product design and Product development processes<br>CO2. UNDERSTAND Processes, tools and techniques for Market Survey & Product Specification Finalization<br>CO3. UNDERSTAND Processes, tools and techniques for Concept Inception, Verification and selection<br>CO4. UNDERSTAND Processes, tools and techniques for Concept Exploration & Development<br>CO5. UNDERSTAND Processes, tools and techniques for Design Verification and Validation<br>CO6. UNDERSTAND Processes, tools and techniques for Robust Design and Development |
| 402045B | Elective - IV(B):Experimental Methods in Thermal Engineering | CO1. IDENTIFY the suitable instrument for measuring parameters as per performance characteristics<br>CO2. ANALYZE experimental data by using different statistical techniques and estimate error<br>CO3. DISTINGUISH different methods of temperature measurements and thermal radiation<br>CO4. CLASSIFY various pressure measurement instruments and their comparison<br>CO5. EXPLAIN different flow measurement methods and flow visualization techniques<br>CO6. APPLY knowledge of modern engineering experimentation, including calibration, data acquisition, analysis and interpretation using different AI and ML techniques |
| 402045C | Elective - IV C :Additive Manufacturing | CO1. USE and CLASSIFY the fundamentals of Additive Manufacturing Technologies for engineering applications.<br>CO2. IDENTIFY and CATEGORIZE the methodology to manufacture the products using light-based photo-curing, LASER based technologies and STUDY their applications, benefits.<br>CO3. IDENTIFY and CATEGORIZE the methodology to manufacture the products using extrusion-based deposition, inkjet-based technologies and STUDY their applications, benefits.<br>CO4. SYNTHESIZE, RECOMMEND and DESIGN the suitable material and process for fabrication and build behavior of verities of product.<br>CO5. DESIGN and CONSTRUCT the AM equipment's for appropriate applications and the input CAD model.<br>CO6. DEVELOP the knowledge of additive manufacturing for various real-life applications. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 402045D | Elective - IV(D): Operations Research | CO1. EVALUATE various situations of Games theory and Decision techniques and APPLY them to solve them in real life for decision making.<br>CO2. SELECT appropriate model for queuing situations and sequencing situations and FIND the optimal solutions using models for different situations.<br>CO3. FORMULATE various management problems and SOLVE them using Linear programming using graphical method and simplex method.<br>CO4. FORMULATE variety of problems such as transportation, assignment, travelling salesman and SOLVE these problems using linear programming approach.<br>CO5. PLAN optimum project schedule for network models arising from a wide range of applications and for replacement situations find the optimal solutions using appropriate models for the situation.<br>CO6. APPLY concepts of simulation and Dynamic programming |
| 402045E | Elective - IV E: : Augmented Reality and Virtual Reality | CO1. UNDERSTAND fundamental Computer Vision, Computer Graphics and Human Computer Interaction Techniques related to VR/AR<br>CO2. UNDERSTAND Geometric Modeling Techniques<br>CO3. UNDERSTAND the Virtual Environment<br>CO4. ANALYZE and EVALUATE VR/AR Technologies<br>CO5. APPLY various types of Hardware and Software in Virtual Reality systems<br>CO6. DESIGN and FORMULATE Virtual/Augmented Reality Applications |
| 402046 | Data Analytics Laboratory | CO1:UNDERSTAND the basics of data analytics using concepts of statistics and probability.<br>CO2:APPLY various inferential statistical analysis techniques to describe data sets and withdraw useful conclusions from acquired data set.<br>CO3:EXPLORE the data analytics techniques using various tools<br>CO4:APPLY data science concept and methods to solve problems in real world context<br>CO5:SELECT advanced techniques to conduct thorough and insightful analysis and interpret the results |
| 402047 | Project (Stage I) | CO1. IMPLEMENT systems approach.<br>CO2. CONCEPTUALIZE a novel idea / technique into a product.<br>CO3. THINK in terms of a multi-disciplinary environment.<br>CO4. TAKE ON the challenges of teamwork, and DOCUMENT all aspects of design work. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 402047 | Project (Stage I) | CO5. UNDERSTAND the management techniques of implementing a project.<br>CO6. DEMONSTRATE the final product for Functionality, Designability, and Manufacturability. |
| **Final Year (2019 Pattern) : Semester-II** | | |
| 402048 | Computer Integrated Manufacturing | CO1. EXPLAIN CIM and factory automation.<br>CO2. UNDERSTAND the integration of hardware and software elements for CIM<br>CO3. APPLY CNC program for appropriate manufacturing techniques.<br>CO4. ANALYZE processes planning, quality and MRP integrated with computers.<br>CO5. INTERPRET flexible, cellular manufacturing and group technology.<br>CO6. ANALYZE the effect of IOT, Industry-4.0 and cloud base manufacturing. |
| 402049 | Energy Engineering | CO1:EXPLAIN the power generation scenario, the layout components of thermal power plant and ANALYZE the improved Rankine cycle.<br>CO2:ANALYZE the performance of steam condensers, cooling tower system; RECOGNIZE and environmental impact of energy systems and methods to control the same.<br>CO3:EXPLAIN the layout, component details of diesel engine plant, hydel and nuclear energy systems.<br>CO4:ANALYZE gas and improved power cycles.<br>CO5:EXPLAIN the fundamentals of renewable energy systems.<br>CO6:EXPLAIN basic principles of energy management, storage and economics of power generation. |
| 402050A | Elective-V (A) Quality & Reliability Engineering | CO1. UNDERSTAND basic concepts of quality and RELATE various quality tools<br>CO2. DEVELOP analytical competencies to SOLVE problems on control charts and process capability.<br>CO3. UNDERSTAND fundamental concepts of reliability.<br>CO4. EVALUATE system reliability.<br>CO5.IDENTIFY various failure modes and CREATE fault tree diagram.<br>CO6. UNDERSTAND the concept of reliability centered maintenance and APPLY reliability tests methods |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 402050B | Elective-V(B) Energy Audit and Management | CO1. EXPLAIN the energy need and role of energy management<br>CO2. CARRY OUT an energy audit of the Institute/Industry/Organization<br>CO3. ASSESS the ENCON opportunities using energy economics<br>CO4. ANALYSE the energy conservation performance of Thermal Utilities<br>CO5. ANALYSE the energy conservation performance of Electrical Utilities<br>CO6. EXPLAIN the energy performance improvement by Cogeneration and WHR method |
| 402050C | Elective-V C:Manufacturing System and Simulation | CO1. UNDERSTAND the concepts of manufacturing system, characteristics, type, etc.<br>CO2. UNDERSTAND the concepts of Facilities, manufacturing planning & control and Support System.<br>CO3. UNDERSTAND the concepts of manufacturing towards solving productivity related problems.<br>CO4. DEVELOP a virtual model to solve industrial engineering related issues such as capacity. utilization, line balancing.<br>CO5. BUILDING tools to view and control simulations and their results.<br>CO6. PLAN the data representation & Evaluate the results of the simulation. |
| 402050D | Elective-V (D) Engineering Economics and Financial Management | CO1.UNDERSTAND the business environment, concepts of economics and demand-supply scenario.<br>CO2.APPLY the concepts of costing and pricing to evaluate the pricing of mechanical components.<br>CO3.UNDERSTAND accounting systems and analyze financial statements using ratio analysis<br>CO4.SELECT and PREPARE the appropriate type of budget and understand the controlling aspects of budget.<br>CO5.UNDERSTAND the international business and trade system functioning<br>CO6.DEMONSTRATE understanding of financing decisions of new ventures and performance |
| 402050E | Elective-V (E) Organizational Informatics | CO1. Demonstrate an understanding of the scope, purpose and value of information systems in an organization.<br>CO2. Understand the constituents of the information system.<br>CO3. Demonstrate the Understanding of the management of product data and features of various PLM aspects.<br>CO4. Relate the basic concepts of manufacturing system and the |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 402050E | Elective-V (E) Organizational Informatics | ERP functionalities in context of information usage.<br>CO5. Understand the manufacturing execution system and it's applications in functional areas.<br>CO6. Outline the role of the information system in various types of business and allied emerging technologies. |
| 402050F | Elective-V (F): Computational Multi Body Dynamics | CO1. APPLY the basic terminology and concepts used in Multibody Dynamics to solve varieties of motion related applications<br>CO2. IDENTIFY and EVALUATE the types of joints, its kinematics and relevant transformations<br>CO3. DISTINGUISH and COMPARE the formulation methods<br>CO4. DERIVE equations of motion and EVALUATE the kinematics and dynamics of rigid Planar inter-connected bodies<br>CO5. DERIVE equations of motion and EVALUATE the kinematics of rigid Spatial inter connected bodies<br>CO6. APPLY MBD tool effectively and SIMULATE it to solve and validate practical Multibody Dynamics problems and its solutions |
| 402051A | Elective - VI (A):Process Equipment Design | CO1. INTERPRET the different parameters involved in design of process Equipments.<br>CO2. ANALYZE thin and thick walled cylinder<br>CO3. DESIGN cylindrical vessel, spherical vessel, tall vessels and thick walled high pressure vessels<br>CO4. DESIGN different process Equipments and select pump, compressor etc. and auxiliary services<br>CO5. EVALUATE Process parameters and their correlation<br>CO6. APPLY the concepts of process equipment design for specific applications |
| 402051B | Elective - VI(B): Renewable Energy Technologies | CO1. DESCRIBE fundaments, needs and scopes of renewable energy systems.<br>CO2. EXPLAIN performance aspects of flat and concentric solar collectors along with applications.<br>CO3. DESIGN solar photovoltaic system for residential applications.<br>CO4. DESIGN AND ANALYSIS of wind energy conversion system.<br>CO5. APPLY Installation practices of Wind and Solar Photovoltaic Systems for grid connection.<br>CO6. DETERMINE performance parameters of bio-energy conversion systems. |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 402051C | Elective - VI(C): Automation and Robotics | CO1. UNDERSTAND the basic concepts of Automation<br>CO2. UNDERSTAND the basic concepts of Robotics<br>CO3. IDENTIFY and EVALUATE appropriate Drive for Robotic Applications<br>CO4. COMPARE and SELECT End-effectors and Sensors as per Application<br>CO5. DEVELOPE the Mathematical Modeling Approaches of Robot<br>CO6. EVALUATE the fundamentals of robot programming and CLASSIFY the Applications |
| 402051D | Elective - VI(D) : Industrial Psychology and Organizational Behavior | CO1. DEMONSTRATE fundamental knowledge about need and scope of industrial -organizational psychology and behavior.<br>CO2. ANALYZE the job requirement, have understanding of fatigue, boredom and improve the job satisfaction.<br>CO3. UNDERSTAND the approaches to enhance the performance.<br>CO4. KNOWLEDGE of theories of organizational behavior, learning and social-system.<br>CO5. UNDERSTAND the mechanism of group behavior, various aspects of team, leadership and conflict management.<br>CO6. EVALUATE the organizational culture, manage the change and understands organizational development approaches. |
| 402051E | Elective - VI(E): Electric and Hybrid Vehicle | CO1. UNDERSTAND the basics related to e-vehicle<br>CO2. CLASSIFY the different hybrid vehicles<br>CO3. IDENTIFY and EVALUATE the Prime Movers, Energy Storage and Controllers<br>CO4. DISCOVER and CATAGORIZE the Electric Vehicle Configuration with respect to Propulsion, Power distribution and Drive-Train Topologies<br>CO5. DEVELOP body frame with appropriate suspension system and TESTING of for e Vehicles<br>CO6. CLASSIFY and EVALUATE Battery Charging techniques and management |
| 402052 | Mechanical system analysis Laboratory | CO1. DEVELOP an understanding of the Systems Engineering Process and the range of factors that influence the product need, problem-specific information collection, Problem Definition, Task Specification, Solution Concept inception, Concept Development, System's Mathematical Modelling, Synthesis, Analysis, final solution Selection, Simulation, Detailed Design, Construction, Prototyping, Testing, fault-finding, Diagnosis, Performance Analysis, and Evaluation, Maintenance, Modification, Validation, Planning, Production, Evaluation and use of a system using manual calculation, computational tools to automate product development process, redesign from customer |

| Course code | Course Name | Course Outcomes(Cos) |
|---|---|---|
| 402052 | Mechanical system analysis Laboratory | feedback and control of technological systems.<br>CO2. ILLUSTRATE the concepts and USE the developed skill-set of use of computational tools (FEA, CFD, MBD, FSI, CAE) to automate the complete product development process.<br>CO3. EVALUATE the knowledge of new developments and innovations in technological systems to carry forward to next stage of employment after passing your Undergraduate Degree Examination.<br>CO4. APPRAISE how technologies have transformed people's lives and can be used to SOLVE challenges associated with climate change, efficient energy use, security, health, education and transport, which will be coming your ways in the coming future.<br>CO5. PRIORITIZE the concept of quality and standards, including systems reliability, safety and fitness for the intended purpose.<br>CO6. INVENT yourself to face the challenges of future technologies and their associated Problems. |
| 402053 | Project (Stage II) | CO1. IMPLEMENT systems approach.<br>CO2. CONCEPTUALIZE a novel idea / technique into a product.<br>CO3. THINK in terms of a multi-disciplinary environment.<br>CO4. TAKE ON the challenges of teamwork, and DOCUMENT all aspects of design work.<br>CO5. UNDERSTAND the management techniques of implementing a project.<br>CO6. DEMONSTRATE the final product for Functionality, Designability, and Manufacturability. |