Regulation 2023
Program Structure

2049, 1144 - Diploma in Robotics and Automation, Diploma in Automation and Robotics

Program Outcomes (PO's)

POs are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, analytical ability, attitude, and behavior that students acquire through the program.

The POs essentially indicate what the students can do from subject-wise knowledge acquired by them during the program. As such, POs define the professional profile of an engineering diploma graduate.

NBA has defined the following seven POs for an Engineering diploma graduate:

PO1: Basic and Discipline-specific knowledge: Apply knowledge of basic mathematics, science and engineering fundamentals and an engineering specialization to solve the engineering problems.

PO2: Problem analysis: Identify and analyse well-defined engineering problems using codified standard methods.

PO3: Design/ development of solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

PO4: Engineering Tools, Experimentation, and Testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

PO5: Engineering practices for society, sustainability and environment: Apply appropriate technology in the context of society, sustainability, environment and ethical practices.

PO6: Project Management: Use engineering management principles individually, as a team member or as a leader to manage projects and effectively communicate about well-defined engineering activities.

PO7: Life-long learning: Ability to analyse individual needs and engage in updating in the context of technological changes.

CREDIT DISTRIBUTION

Semester	No of Courses	Periods	Credits
Semester I	8	640	20
Semester II	9	640	20
Semester III	8	640	20
Semester IV	7	640	21
Semester V	8	620	21
Semester VI	3	660	18
		Total	**120**

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF TECHNICAL EDUCATION
DIPLOMA IN ENGINEERING & TECHNOLOGY - REGULATION 2023
2049 DIPLOMA IN ROBOTICS AND AUTOMATION ENGINEERING (FT)

Semester III								
#	**Course Category**	**Course Type**	**Code**	**Course Title**	**L-T-P**	**Period**	**Credit**	**End Exam**
1	Program Core	Practicum	2049233130	Electronic Circuit Applications	2-0-2	60	3	Theory
2	Program Core	Practicum	2049233230	Production Technology	2-0-2	60	3	Theory
3	Engineering Science	Practical/Lab	2049233320	Programming in C	0-0-4	60	2	Practical
4	Program Core	Practicum	2049233440	Elements of Electrical Engineering	1-0-4	75	3	Practical
5	Program Core	Practicum	2049233540	Machine Element Design	1-0-4	75	3	Practical
6	Engineering Science	Practicum	2049233640	Analog and Digital Circuits	1-0-4	75	3	Practical
7	Open Elective	Advanced Skill Certification	2049233760	Advanced Skills Certification - III	1-0-2	60	2	NA
8	Humanities & Social Science	Integrated Learning Experience	2049233880	Growth Lab	-	30	0	-
9	Audit Course	Integrated Learning Experience	2049233881	Induction Program - II	-	16	0	-
10	Audit Course	Integrated Learning Experience	2049233882	I&E/ Club Activity/ Community Initiatives	-	16	0	-
11	Audit Course	Integrated Learning Experience	2049233883	Shop floor Immersion	-	8	0	-
12	Audit Course	Integrated Learning Experience	2049233884	Student-Led Initiative	-	22	0	-
13	Audit Course	Integrated Learning Experience	2049233885	Emerging Technology Seminars	-	8	0	-
14	Audit Course	Integrated Learning Experience	2049233886	Health & Wellness	0-0-2	30	1	-
					Test & Revisions	30		NA
					Library	30		
					Total	**640**	**20**	

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF TECHNICAL EDUCATION
DIPLOMA IN ENGINEERING & TECHNOLOGY - REGULATION 2023
2049 DIPLOMA IN ROBOTICS AND AUTOMATION ENGINEERING (FT)

Semester IV								
#	**Course Category**	**Course Type**	**Code**	**Course Title**	**L-T-P**	**Period**	**Credit**	**End Exam**
1	Program Core	Theory	2049234110	Electronic Measurements and Instrumentation	4-0-0	60	4	Theory
2	Program Core	Practicum	2049234230	Fundamentals of Robotics	2-0-2	60	3	Theory
3	Program Core	Practical/Lab	2049234320	CAD for Robotics and Automation	0-0-4	60	2	Practical
4	Program Core	Practical/Lab	2049234420	Python Programming for Robotics	0-0-4	60	2	Practical
5	Program Core	Practicum	2049234540	Fluid Power Automation	2-0-4	90	4	Practical
6	Engineering Science	Practicum	2049234640	Microcontrollers and Applications	2-0-4	90	4	Practical
7	Open Elective	Advanced Skill Certification	2049234760	Advanced Skills Certification - IV	1-0-2	45	2	NA
8	Audit Course	Integrated Learning Experience	2049234882	I&E/ Club Activity/ Community Initiatives	-	30	0	-
9	Audit Course	Integrated Learning Experience	2049234883	Shop floor Immersion	-	8	0	-
10	Audit Course	Integrated Learning Experience	2049234884	Student-Led Initiative	-	24	0	-
11	Audit Course	Integrated Learning Experience	2049234885	Emerging Technology Seminars	-	8	0	-
12	Audit Course	Integrated Learning Experience	2049234886	Health & Wellness	-	30	0	-
13	Audit Course	Integrated Learning Experience	2049234887	Special Interest Groups (Placement Training)	-	30	0	-
					Test & Revisions	30		
					Library	15		
					Total	**640**	**21**	

GOVERNMENT OF TAMIL NADU
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DIPLOMA IN ENGINEERING & TECHNOLOGY - REGULATION 2023
2049 DIPLOMA IN ROBOTICS AND AUTOMATION ENGINEERING (FT)

Semester V

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	2049235110	Sensors, Actuators and Fabrication of robot components	3-0-0	45	3	Theory
2	Program Core	Theory	2049235210	Industrial Internet of Things	3-0-0	45	3	Theory
3	Program Core	Practicum		Elective – I	1-0-4	75	3	Practical
4	Program Core	Practicum	2049235440	PLC and HMI	1-0-4	75	3	Practical
5	Program Core	Practicum	2049235540	CIM & CNC Programming	1-0-4	75	3	Practical
6	Humanities & Social Science	Practicum	2049235654	Innovation and Start-ups	1-0-2	45	2	Project
7	Project/Internship	Project/Internship	2049235773	Industrial Training* [Summer Vacation - 90 Hours] / Mini Project (SW)	0-0-4	-	2	Project
8	Open Elective	Advanced Skill Certification	2049235860	Advanced Skills Certification - V	1-0-2	60	2	NA
9	Audit Course	Integrated Learning Experience	2049235981	Induction program – III	-	40	0	-
10	Audit Course	Integrated Learning Experience	2049235984	Student-Led Initiative	-	30	0	-
11	Audit Course	Integrated Learning Experience	2049235986	Health & Wellness	-	30	0	-
12	Audit Course	Integrated Learning Experience	2049235987	Special Interest Groups (Placement Training)	-	40	0	-
					Test & Revisions	45		
					Library	15		
					Total	**620**	**21**	

GOVERNMENT OF TAMIL NADU
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DIPLOMA IN ENGINEERING & TECHNOLOGY - REGULATION 2023
2049 DIPLOMA IN ROBOTICS AND AUTOMATION ENGINEERING (FT)

Semester VI

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Open Elective	Theory		Electives - II (Pathway)	3-0-0	45	3	Theory
2	Open Elective	Practicum		Elective - III (Specialization)	1-0-4	75	3	Practical
3	Industrial Training / Project	Project/Internship		In-house Project / Internship / Fellowship ** Industrial Training (SW)	-	540	12	Project
					Total	**660**	**18**	
3	Industrial Training / Project	Project/Internship	2049236351	Internship	-	540	12	Project
3	Industrial Training / Project	Project/Internship	2049236353	Fellowship	-	540	12	Project
3	Industrial Training / Project	Project/Internship	2049236374	In-house Project	-	540	12	Project
3	Industrial Training / Project	Project/Internship	2149234274 2149237274	Industrial Training (SW)	-	540	12	Project

Note: ** Every student should select any one from the In-House Project or Internship or Fellowship. The guidelines given have to be followed.
For the Sandwich programme, Industrial Training in the fourth and seventh semester will be given. The guidelines given have to be followed.

Elective – I

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF TECHNICAL EDUCATION
DIPLOMA IN ENGINEERING & TECHNOLOGY - REGULATION 2023
2049 DIPLOMA IN ROBOTICS AND AUTOMATION ENGINEERING (FT)

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Elective	Practicum	2049235341	Applied Robotics	1-0-4	75	3	Practical
2	Program Elective	Practicum	2049235342	Big Data and Analytics	1-0-4	75	3	Practical
3	Program Elective	Practicum	1020235542	Systems Applications and Product (SAP)$	1-0-4	75	3	Practical

 # Courses from other Programmes with the same credit can be considered after proper approval from the Chairman of Board of Examinations.
$ - Common with Mechanical

Elective – II (Pathway)

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Elective | Higher Education	Theory	6000236111	Advanced Engineering Mathematics	3-0-0	45	3	Theory
2	Elective | Entrepreneurship	Theory	6000236112	Entrepreneurship	3-0-0	45	3	Theory
3	Elective | Technocrats	Theory	6000236113	Project Management	3-0-0	45	3	Theory
4	Elective | Technocrats	Theory	6000236114	Finance Fundamentals	3-0-0	45	3	Theory
5	Elective | Technologists	Theory	2049236111	Industrial Engineering	3-0-0	45	3	Theory
6	Elective | Open elective	Theory		Online Elective Courses *	3-0-0	45	3	Theory

*** Online courses with the same credit available in AICTE, SWAYAM, NPTEL and reputed Institutions with the proper evaluation system and certification can be considered after proper approval from the Chairman Board of Examinations.**

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF TECHNICAL EDUCATION
DIPLOMA IN ENGINEERING & TECHNOLOGY - REGULATION 2023
2049 DIPLOMA IN ROBOTICS AND AUTOMATION ENGINEERING (FT)

Elective - III (Specialization)

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Elective	Practicum	2049236241	Advanced Automation	1-0-4	75	3	Practical
2	Elective	Practicum	2049236242	Automation System Design	1-0-4	75	3	Practical
3	Elective	Practicum	1020236116	Additive Manufacturing**$**	1-0-4	75	3	Practical

$ - Common with Mechanical

Regulation 2023
Program Structure

2149 - Diploma in Robotics and Automation (Sandwich)

Program Outcomes (PO's)

POs are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, analytical ability, attitude, and behavior that students acquire through the program.

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PO4: Engineering Tools, Experimentation, and Testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

PO5: Engineering practices for society, sustainability and environment: Apply appropriate technology in the context of society, sustainability, environment and ethical practices.

PO6: Project Management: Use engineering management principles individually, as a team member or as a leader to manage projects and effectively communicate about well-defined engineering activities.

PO7: Life-long learning: Ability to analyse individual needs and engage in updating in the context of technological changes.

CREDIT DISTRIBUTION

Semester	No of Courses	Periods	Credits
Semester I	8	640	20
Semester II	9	640	20
Semester III	8	640	20
Semester IV	2	600	15
Semester V	8	685	24
Semester VI	7	620	19
Semester VII	2	600	14
		Total	**132**

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF TECHNICAL EDUCATION
DIPLOMA IN ENGINEERING & TECHNOLOGY - REGULATION 2023
2149 - DIPLOMA IN ROBOTICS AND AUTOMATION ENGINEERING (SANDWICH)

Semester III								
#	**Course Category**	**Course Type**	**Code**	**Course Title**	**L-T-P**	**Period**	**Credit**	**End Exam**
1	Program Core	Practicum	2049233130	Electronic Circuit Applications	2-0-2	60	3	Theory
2	Program Core	Practicum	2049233230	Production Technology	2-0-2	60	3	Theory
3	Engineering Science	Practical/Lab	2049233320	Programming in C	0-0-4	60	2	Practical
4	Program Core	Practicum	2049233440	Elements of Electrical Engineering	1-0-4	75	3	Practical
5	Program Core	Practicum	2049233540	Machine Element Design	1-0-4	75	3	Practical
6	Engineering Science	Practicum	2049233640	Analog and Digital Circuits	1-0-4	75	3	Practical
7	Open Elective	Advanced Skill Certification	2049233760	Advanced Skills Certification - III	1-0-2	60	2	NA
8	Humanities & Social Science	Integrated Learning Experience	2049233880	Growth Lab	-	30	0	-
9	Audit Course	Integrated Learning Experience	2049233881	Induction Program - II	-	16	0	-
10	Audit Course	Integrated Learning Experience	2049233882	I&E/ Club Activity/ Community Initiatives	-	16	0	-
11	Audit Course	Integrated Learning Experience	2049233883	Shop floor Immersion	-	8	0	-
12	Audit Course	Integrated Learning Experience	2049233884	Student-Led Initiative	-	22	0	-
13	Audit Course	Integrated Learning Experience	2049233885	Emerging Technology Seminars	-	8	0	-
14	Audit Course	Integrated Learning Experience	2049233886	Health & Wellness	0-0-2	30	1	-
					Test & Revisions	30		NA
					Library	30		
					Total	**640**	**20**	

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF TECHNICAL EDUCATION
DIPLOMA IN ENGINEERING & TECHNOLOGY - REGULATION 2023
2149 - DIPLOMA IN ROBOTICS AND AUTOMATION ENGINEERING (SANDWICH)

Semester IV								
#	**Course Category**	**Course Type**	**Code**	**Course Title**	**L-T-P**	**Period**	**Credit**	**End Exam**
1	Program Core	Practicum	2049234230	Fundamentals of Robotics	2-0-2	60	3	Theory
2	Industrial Training/Project	Project/Internship	2149234274	Industrial Training (SW) – I	-	540	12	Project
					Total	**600**	**15**	

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF TECHNICAL EDUCATION
DIPLOMA IN ENGINEERING & TECHNOLOGY - REGULATION 2023
2149 - DIPLOMA IN ROBOTICS AND AUTOMATION ENGINEERING (SANDWICH)

Semester V

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	2049234110	Electronic Measurements and Instrumentation	4-0-0	60	4	Theory
2	Program Core	Practical/Lab	2049234320	CAD for Robotics and Automation	0-0-4	60	2	Practical
3	Program Core	Practical	2049234420	Python Programming for Robotics	0-0-4	60	2	Practical
4	Program Core	Practicum	2049234540	Fluid Power Automation	2-0-4	90	4	Practical
5	Engineering Science	Practicum	2049234640	Microcontrollers and Applications	2-0-4	90	4	Practical
6	Program Core	Theory	2049235110	Sensors, Actuators and Fabrication of robot components	3-0-0	45	3	Theory
7	Program Core	Practicum		Elective – I	1-0-4	75	3	Practical
8	Open Elective	Advanced Skill Certification	2049234760	Advanced Skills Certification - IV	1-0-2	45	2	NA
9	Audit Course	Integrated Learning Experience	2049234882	I&E/ Club Activity/ Community Initiatives	-	30	0	-
10	Audit Course	Integrated Learning Experience	2049234883	Shop floor Immersion	-	8	0	-
11	Audit Course	Integrated Learning Experience	2049234884	Student-Led Initiative	-	24	0	-
12	Audit Course	Integrated Learning Experience	2049234885	Emerging Technology Seminars	-	8	0	-
13	Audit Course	Integrated Learning Experience	2049234886	Health & Wellness	-	30	0	-
14	Audit Course	Integrated Learning Experience	2049234887	Special Interest Groups (Placement Training)	-	30	0	-
					Test & Revisions	30		
					Total	**685**	**24**	

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF TECHNICAL EDUCATION
DIPLOMA IN ENGINEERING & TECHNOLOGY - REGULATION 2023
2149 - DIPLOMA IN ROBOTICS AND AUTOMATION ENGINEERING (SANDWICH)

Semester VI

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	2049235210	Industrial Internet of Things	3-0-0	45	3	Theory
2	Program Core	Practicum	2049235440	PLC and HMI	1-0-4	75	3	Practical
3	Program Core	Practicum	2049235540	CIM & CNC Programming	1-0-4	75	3	Practical
4	Open Elective	Theory		Electives - II (Pathway)	3-0-0	45	3	Theory
5	Open Elective	Practicum		Elective - III (Specialization)	1-0-4	75	3	Practical
6	Humanities & Social Science	Practicum	2049235654	Innovation and Start-ups	1-0-2	45	2	Project
7	Open Elective	Advanced Skill Certification	2049235860	Advanced Skills Certification - V	1-0-2	60	2	NA
8	Audit Course	Integrated Learning Experience	2049235981	Induction program – III	-	40	0	-
9	Audit Course	Integrated Learning Experience	2049235984	Student-Led Initiative	-	30	0	-
10	Audit Course	Integrated Learning Experience	2049235986	Health & Wellness	-	30	0	-
11	Audit Course	Integrated Learning Experience	2049235987	Special Interest Groups (Placement Training)	-	40	0	-
					Test & Revisions	45		
					Library	15		
					Total	**620**	**19**	

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF TECHNICAL EDUCATION
DIPLOMA IN ENGINEERING & TECHNOLOGY - REGULATION 2023
2149 - DIPLOMA IN ROBOTICS AND AUTOMATION ENGINEERING (SANDWICH)

Semester VII

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Project/Internship	Project/Internship	2049235773	Mini Project (SW)	0-0-4	60	2	Project
2	Industrial Training / Project	Project/Internship	2149237274	Industrial Training (SW) – II	-	540	12	Project
					Total	**600**	**14**	

Note: Mini Project can be done as per the guidelines of in-house project.
For the Sandwich programme, Industrial Training in the fourth and seventh semester will be given. The guidelines given have to be followed.

Elective – I

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Elective	Practicum	2049235341	Applied Robotics	1-0-4	75	3	Practical
2	Program Elective	Practicum	2049235342	Big Data and Analytics	1-0-4	75	3	Practical
3	Program Elective	Practicum	1020235542	Systems Applications and Product (SAP)**$**	1-0-4	75	3	Practical

 # Courses from other Programmes with the same credit can be considered after proper approval from the Chairman of Board of Examinations.
$ - Common with Mechanical

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF TECHNICAL EDUCATION
DIPLOMA IN ENGINEERING & TECHNOLOGY - REGULATION 2023
2149 - DIPLOMA IN ROBOTICS AND AUTOMATION ENGINEERING (SANDWICH)

Elective – II (Pathway)

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Elective | Higher Education	Theory	6000236111	Advanced Engineering Mathematics	3-0-0	45	3	Theory
2	Elective | Entrepreneurship	Theory	6000236112	Entrepreneurship	3-0-0	45	3	Theory
3	Elective | Technocrats	Theory	6000236113	Project Management	3-0-0	45	3	Theory
4	Elective | Technocrats	Theory	6000236114	Finance Fundamentals	3-0-0	45	3	Theory
5	Elective | Technologists	Theory	2049236111	Industrial Engineering	3-0-0	45	3	Theory
6	Elective | Open elective	Theory		Online Elective Courses *	3-0-0	45	3	Theory

*** Online courses with the same credit available in AICTE, SWAYAM, NPTEL and reputed Institutions with the proper evaluation system and certification can be considered after proper approval from the Chairman Board of Examinations.**

GOVERNMENT OF TAMIL NADU
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DIPLOMA IN ENGINEERING & TECHNOLOGY - REGULATION 2023
2149 - DIPLOMA IN ROBOTICS AND AUTOMATION ENGINEERING (SANDWICH)

Elective - III (Specialization)

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Elective	Practicum	2049236241	Advanced Automation	1-0-4	75	3	Practical
2	Elective	Practicum	2049236242	Automation System Design	1-0-4	75	3	Practical
3	Elective	Practicum	1020236116	Additive Manufacturing$	1-0-4	75	3	Practical

$ - Common with Mechanical

Regulation 2023

2049 - Diploma in Robotics and Automation (Full Time – Regular)

2149 – Diploma in Robotics and Automation (Sandwich)

1144 – Diploma in Automation and Robotics (Full Time – Regular)

III SEMESTER SYLLABUS

2049233130	Electronic Circuit Applications (Program Core)	L	T	P	C
Practicum		2	0	2	3

Rationale

This course will give the outline of electronic circuit applications such as Rectifier, optical Regulators, Optical electronic devices, BJT, FET, UJT, SCR, TRIAC, DIAC, Oscillators, Wave shaping circuits and multivibrators. Also, the course instills practical experience and allows students to demonstrate simple experiments using advanced communication systems.

Course Objectives

The objective of this course is to enable the student to

- Understand the principles and applications of rectifiers, filters, and opto-electronic devices in electronic circuits.
- Analyze the construction, working principles, and characteristics of bipolar junction transistors (BJT), field-effect transistors (FET), and unipolar junction transistors (UJT).
- Explore the operation and design of amplifiers, feedback systems, and oscillators using transistor-based circuits.
- Investigate the functionality and applications of special semiconducting devices such as silicon-controlled rectifiers (SCR), DIACs, and TRIACs.
- Examine the construction and operation of wave shaping circuits including clippers, clampers, voltage multipliers, and multivibrators.

Course Outcomes

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

CO1: Apply basic mathematics and science to analyse rectifier circuits and filter designs.

CO2: Identify and analyse engineering problems related to transistor circuits using standardized methods.

CO3: Design transistor amplifiers, feedback circuits, and oscillators to meet specified technical requirements.

CO4: Apply modern engineering tools to conduct tests and measurements on special semiconductor devices.

CO5: Integrate appropriate technology in the design and development of wave shaping circuits.

2049233130	Electronic Circuit Applications (Program Core)	L	T	P	C
Practicum		2	0	2	3

Pre-requisites

- Basics of Electrical and Electronics Engineering

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	3	1	3	1	1
CO2	1	2	1	2	1	1	1
CO3	3	1	3	1	1	1	1
CO4	1	1	1	2	1	1	1
CO5	3	1	3	1	3	1	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- It is advised that teachers take steps to pique pupils' attention and boost their learning confidence.
- To help students learn and appreciate numerous concepts and principles in each area, teachers should provide examples from daily life, realistic situations, and real-world engineering and technological applications.
- The demonstration can make the subject exciting and foster in the students a scientific mindset. Student activities should be planned onall the topics.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome- and employability-based.
- Do not let students work on an activity or an experiment with the expected outcome, rather allow students to be honest about whatever the results of the experiment are. If the results are different from the expectations, students should do an analysis where they could be the source of error, if any.

2049233130	Electronic Circuit Applications (Program Core)	L	T	P	C
Practicum		2	0	2	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test Theory (Any Two Units)	Written Test Theory (Another Two Units)	Practical Test (All Exercises)	Written Test (Complete Theory Portions)	Written Examination (Complete Theory Portions)
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	50	50	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60
Tentative Schedule	6th Week	12th Week	15th Week	16th Week	

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks. The marks scored will be converted to 10 Marks for each test. Best of one will be considered for the internal assessment of 10 Marks.

CA1 and CA2, Assessment written test should be conducted for two units as below.

Answer any Five questions. (5 X 10 Marks = 50 Marks).

Eight questions will be asked; students should write Five questions.

Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA 3: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one experiment by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks

awarded for 100 marks will be converted to 15 Marks for the internal mark.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. Each exercise/experiment should be evaluated for 10 Marks. The total marks awarded should be converted to 30 Marks for the practical test as per the scheme of evaluation as below.

The details of the practical documents to be prepared as per the instruction below.

The observation and calculations should be completed on the day of practice.

The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next exercise.

This documentation can be carried out in a separate notebook / printed manual / file. The reading and calculations and graph should be written by the student manually.

The evaluated practical document should be submitted for the Practical Test (CA3). The mark scored by the students should be converted to 30 marks. The same should be included as per the allocation in the practical test.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION - Practical Test

Part	Description	Marks
A	Circuit Diagram	25
B	Connection and Execution	25
C	Result	10
D	Practical Documents (All Practical's)	30
E	Viva Voce	10
TOTAL MARKS		**100**

2049233130	Electronic Circuit Applications (Program Core)	L	T	P	C
Practicum		2	0	2	3

CA4: Model examination should be conducted for complete theory portions as per the end semester question pattern. The marks awarded should be converted to 15 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.
Four questions will be asked from every unit; students should write any two questions. The question may have two subdivisions only.

2049233130	Electronic Circuit Applications (Program Core)	L	T	P	C
Practicum		2	0	2	3

UNIT 1	Rectifiers, Filters and Opto Electronic Devices	
Rectifier - Definition – Types - half wave, full wave and bridge rectifiers - **Filter** - Definition - Types - Applications Zener diode as a Voltage regulator – Meter protection **Opto-Electronic Devices** -Definition - Types - Symbol, Working, Characteristics and Applications of LED - Photo diode, Phototransistor and Opto- coupler.		6
Ex. No	**Name of the Experiment**	
1	Construct a circuit and test the forward and reverse bias characteristics of a Zener diode. Find the value of its reverse breakdown voltage.	6
2	Construct and plot the VI characteristics of photo diode.	
Unit II	**BJT, FET and UJT**	
Bipolar Junction Transistor BJT– Working principle -Transistor biasing: Need for biasing - Types- Fixed bias, Collector to base bias and Self bias (voltage divider bias)- Transistor as a switch. – RC Coupled Amplifier and Frequency response **Field Effect Transistor (FET)** Construction of FET– Working principle –Classification - Drain Characteristics - Applications–Comparison between FET and BJT- FET amplifier - Working principle of MOSFET **UniJunction Transistors (UJT)** Construction- Equivalent circuit – Operation – Characteristics - UJT as a relaxation oscillator.		9
Ex.No	**Name of the Experiment**	
3	Construct a Common Emitter Transistor circuit and test its input and output characteristic curves.	3
Unit III	**Feedback Circuits and Oscillators**	
3.1 Feedback- Concept –Types - positive feedback and Negative feedback- Types of negative feedback amplifiers- effects of negative feedback. **3.3 Oscillators**-Transistor oscillators–Tank circuit-Conditions for oscillation (Barkhausen criterion)- Classifications – LC oscillators -Hartley Oscillator–Colpitt's Oscillator - RC Phase shift oscillator.		9
Ex.No	**Name of the Experiment**	
4	Construct a Hartley oscillator circuit and test its output characteristic curves.	3
Unit IV	**Thyristor Family**	
4.1: SCR (Silicon Controlled Rectifier)-Symbol – Layered Structure – Transistor analogy – Working Principle–VI characteristics– Applications – Comparison between SCR and Transistor		6

4.2: DIAC (Diode for Alternating Current) -Symbol – Layered structure – Working Principle – VI characteristics- Applications. **(3)** **4.3: TRIAC (Triode for Alternating Current)**-Symbol – Layered structure - Working Principle – VI characteristics- Applications.**(3)**		
Ex.No	**Name of the Experiment**	
6	Construct a circuit and test the characteristics of SCR and mark I_H and I_L	6
7	Construct a circuit illumination control of lamp using TRIAC and DIAC	
Unit V	**Wave Shaping Circuits, Voltage Multipliers and Non Sinusoidal Oscillators**	
Clippers and Clampers Construction and working Principle of Positive, Negative Clippers - Construction and working Principle of Positive and Negative Clamper. **Voltage Multipliers** Construction and working of Voltage Doubler,Tripler. **Multivibrator** Construction - Working Principle of Monostable and bistable Multivibrators using Transistors - Schmitt Trigger		9
8	Test the working of positive and negative clipper circuits.	3
TOTAL HOURS		**60**

Suggested List of Students Activity

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

Text Books

1. David A. Bell, "Electronic Devices and Circuits", Oxford Higher Education press, 5 th Edition, 2010.
2. Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", 11th Edition, Pearson Education / PHI, 2015.
3. Electronics Devices & Circuits by Jacob Millman and Halkias 3rdEdition 2017, Tata McGraw– Hill publication
4. Optical Fiber Communication by GerdKeiser 5th Edition, Tata McGraw– Hill.

Reference Books:

1. Electronics Devices & Circuits by Salivahanan S, N. Suresh Kumar, A.Vallavaraj Tata McGraw Publication 3rd Edition 2016 .
2. "Microelectronic Circuits" by Sedra and Smith.

Web-based/Online Resources

1. https://www.electronics-tutorials.ws/

2049233130	Electronic Circuit Applications (Program Core)	L	T	P	C
Practicum		2	0	2	3

2. https://learn.sparkfun.com/
3. https://www.allaboutcircuits.com/textbook/digital/
4. http://electronicstheory.com/COURSES/ELECTRONICS/e101-1.htm
5. https://www.gadgetronicx.com/electronic-circuits-library/
6. https://www.electronics-lab.com/
7. https://learn.adafruit.com/
8. https://www.electrical4u.com/digital-electronics/
9. https://www.tutorialspoint.com/digital circuits/index.htm

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

List of Equipment required for a batch of 30 students

S. No.	Name of the Equipment	Range	Quantity
1	RPS	(0-30)V	10
2	Function Generator	30MHZ	2
3	CRO	30MHZ	2
4	Orcad Simulation Tool	-	-

2049233230	Production Technology	L	T	P	C
Practicum		2	0	2	3

Introduction:

Production Technology is the major and the most important aspects in manufacturing industries which needs utmost care and attention. Knowledge and skill about the various processes and allied areas will be great use to the personnel involved in production. And by leveraging this technology, the industry could increase efficiency and improve product quality. This will provide the students with an opportunity to skill themselves for the industrial scenario.

Course Objectives:

The student will learn to:

- Study about various conventional machines used for various operations in manufacturing.
- Identify the parts of lathe, milling, drilling and grinding machines.
- Identify the work-holding and tool holding devices used in lathe, drilling, milling and grinding machines.
- Set the tools for various operations lapping, honing, spur and helical gear generation.
- Study about metrology and measuring instruments.
- Obtain accurate linear and angular measurements.
- Machine the component as per the drawings.
- Prepare a record of work for all the exercises.

Course Outcomes:

On successful completion of this course, the student will able to

CO1: Discuss the construction and working principles of lathe machines to produce engineering components.

CO2: Identify the various operations performed on drilling machines.

CO3: Implement the mechanics of milling machines for different machining operations and manufacture gears..

CO4: Select appropriate grinding wheel for different finishing operations.

CO5: Apply basic metrological instruments to measure linear, angular and form features of components

Pre-requisites:

Knowledge of physics, mathematics and engineering drawing.

2049233230	Production Technology	L	T	P	C
Practicum		2	0	2	3

Mapping of COs with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	3	2	2	2
CO2	3	3	3	3	2	2	2
CO3	3	3	2	3	2	2	2
CO4	3	3	3	3	2	2	2
CO5	3	3	3	3	3	2	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Different methods of teaching and demonstration to be used to attain the outcomes.
- Video and power point presentations may be used to teach various topics/ sub topics.
- Incorporating industry examples and field visit to manufacturing facilities fosters experiential learning.
- Assessment methods include practical assessment and written exams.
- Continuous feedback mechanisms ensure the refinement and effectiveness of the instructional approach.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test Theory	Written Test Theory	Practical Test	Written Examination	Written Examination
Portion	(Any Two Units)	(Another Two Units)	All Exercises	(Complete Theory Portions)	(Complete Theory Portions)
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	50	50	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Tentative Schedule	6th Week	12th Week	15th Week	16th Week	

2049233230	Production Technology	L	T	P	C
Practicum		2	0	2	3

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks. The marks scored will be converted to 10 Marks for each test. Best of one will be considered for the internal assessment of 10 Marks.

CA1and CA2: Assessment test should be conducted for two units as below.

Answer any five questions. (5 X 10 Marks = 50 Marks).

Eight questions will be asked; students should write five questions.

Each unit four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one experiment by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded for 100 marks will be converted to 15 Marks for the internal mark.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. Each exercise/experiment should be evaluated for 10 Marks. The total marks awarded should be converted to 15 Marks for the practical test as per the scheme of evaluation.

The details of the documents to be prepared as per the instruction below.

Each experiment should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next exercise.

This documentation can be carried out in a separate notebook or a printed manual or a file with documents. The student should draw the part drawing on the graph, write the procedure and calculations should be prepared manually.

The evaluated practical document should be submitted for the Practical Test (CA3). The mark scored by the students should be converted to 30 marks. The same should be included as per the allocation in the practical test.

2049233230	Production Technology	L	T	P	C
Practicum		2	0	2	3

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION for Practical Test:

Description	Marks
Aim, Tool Required	**10**
Procedure / Observation / Tabular column	**20**
Tabulation / Calculations/ Machining	**20**
Finishing / Result	**10**
Practical Documents (All Practical's)	**30**
Viva voce	**10**
Total Marks	**100**

CA**4:** Model Theory examination should be conducted for complete theory portions as per the end semester question pattern. The marks awarded shall be converted to 15 Marks for the internal assessment.

Question Pattern: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each. Four questions will be asked from every unit; students should write any two questions. The question may have two subdivisions only.

2049233230	Production Technology	L	T	P	C
Practicum		2	0	2	3

Syllabus Contents:

Unit I	LATHE	
THEORY: **Lathe:** Introduction - specifications – simple sketch – principal parts – head stock – back geared type – all gear box. **Lathe tools:** single point cutting tool – grooving tool – parting tool – knurling tool – thread cutting tool. **Lathe operations:** straight turning – step turning - taper turning **(methods:** form tool, tailstock set over method, compound rest method & taper turning attachment) – knurling - thread cutting – facing – boring – chamfering – grooving – parting off – eccentric turning. **Work holding device on lathe:** three jaw chuck – four jaw chuck – centres - faceplate – mandrel – steady rest – follower rest. **PRACTICAL:**		6
Ex. No.	Name of the Experiment	
1	Lathe exercise: Plain Turning, Step Turning and Facing	3
2	Lathe exercise: Taper Turning and Knurling	3
3	Lathe exercise: Grooving and Thread Cutting	3
Unit II	**DRILLING MACHINES**	
THEORY: **Drilling machines:** types of drilling machines – bench type – floor type – radial type – gang drill – multi spindle type – principle of operation in drilling and boring. **Drilling tools:** drills – flat drills – twist drills. **Tool holding device on drilling machine:** drill chucks – sockets and sleeve. **Drilling operations:** drilling - reaming – boring - counter boring - counter sinking – spot facing – tapping – deep hole drilling. **PRACTICAL:**		6
Ex. No.	Name of the Experiment	
4	Drilling exercise: Drilling and Counter Boring using radial drilling machine	3
Unit III	**MILLING MACHINES**	
Milling machines: types – column and knee type – plain – universal milling machine – vertical milling machine – principle of operation **Milling cutters**: cylindrical milling cutter – slitting saw- side milling cutter – angle milling cutter - T slot milling cutter – wood ruff key cutter – fly cutter. **Milling operations:** conventional milling – climb milling – straddle milling – spur		6

and helical milling. **Work and tool holding devices on milling machine:** arbour – stub arbour – spring collets – adapter.	

PRACTICAL:		
Ex. No.	Name of the Experiment	
5	Milling exercise: Plain Milling or Profile Milling	6
6	Milling exercise: Spur Gear Milling	
Unit IV	**SURFACE FINISHING PROCESSES**	
Grinding machines: types and classification-specifications – rough grinding – pedestal grinders- portable grinders – belt grinders - cylindrical grinder – centerless grinders – surface grinder- tool and cutter grinder **Grinding wheel:** grinding wheel abrasives - natural and artificial diamond wheels - mounting of grinding wheel - dressing and truing of wheels - balancing of grinding wheels. **PRACTICAL:**		6
Ex. No	Name of the Experiment	3
7	Grinding exercise: Surface Grinding	3
8	Grinding exercise: Cylindrical grinding of a shaft	3
Unit V	**FUNDAMENTALS OF METROLGY**	
Introduction to metrology: inspection – accuracy – precision – tolerance – surface finish – quality – reliability – inter-changeability **Linear measuring instruments**: Vernier Caliper, Micrometer, Inside Micrometer, Vernier Height gauge, Ring gauges and Slip gauges. **Angular measuring instruments**: Vernier Bevel Protractor - Sine bar **Geometric measurement instruments**: Gear tooth Vernier - Thread Vernier – Thread gauges: measurement of individual elements of a screw thread – measurement of external threads. **PRACTICAL:**		6
Ex. No	Name of the Experiment	
9	Metrology exercise: Measure the angle of a V-block/ Dovetail using universal bevel protractor.	3
10	Metrology exercise: Measure the angle using sine bar and slip gauges.	3
TOTAL HOURS		**60**

2049233230	Production Technology	L	T	P	C
Practicum		2	0	2	3

Text and reference books:

- Elements of workshop Technology Volume I & II – Hajra Chowdry & Bhattacharaya - IIth Edition - Media Promoters & Publishers Pvt. Ltd.,
- Introduction of basic manufacturing processes and workshop technology – Rajendersingh – New age International (P) Ltd. Publishers.
- Mechanical and Industrial Measurements, Jain R K, Khanna Publications.
- Mechanical Measurements and Instrumentation, Rajput R K, S.K.Kataria and Sons.
- Production Technology – HMT - Edn. 18 - published by Tata McGraw Hill
- Production Technology - P. C. SHARMA - Edn. X - S.Chand & Co. Ltd., Ram Nagar, New Delhi 110 055 – 2006.
- Manufacturing process – Begeman – 8 th Edition -McGraw Hill, New Delhi 2017.

List of equipment's required:

No.	Name of the Equipment / Machinery	No. of Quantity
1	Lathe	10
2	Milling Machine	3
3	Cylindrical Grinding Machine	1
4	Surface Grinding Machine	1
5	Radial Drilling Machine	1
6	Vernier Caliper	8
7	Micrometer	2
8	Surface finish comparator	2
9	Slip gauges	2
10	Sine bar	2
11	Surface Plate	2
12	Vernier height gauge	2
13	Screw thread pitch gauge	1

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters:

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

2049233320	Programming in C	L	T	P	C
Practical		0	0	4	2

Introduction

'C' language is the most widely used computer language. 'C' is the general purpose high level language. Due to the flexibility, it is suitable for different development environments.

Course Objectives

The objective of this course is to enable the student to

- Familiarize with the basics of C.
- Write algorithm and flowchart for any problems.
- Know operators used in 'C' and Decision-making statements.
- Define and understand about arrays and functions.
- Understand strings, string handling functions.
- Develop programs using C operators, decision making statements.
- Develop programs using arrays, function and structure.
- Develop programs using strings and string handling functions.

Course Outcomes

On successful completion of this course, the student should

CO1: Formulate the operators used in 'C' and simple algorithms for arithmetic and logical problems

CO2: Implement decision making statements, branching statements and looping statements.

CO3: Use arrays, pointers and structures to formulate algorithms and programs.

CO4: Write and Execute 'C' program using strings, string handling functions.

CO5: Apply programming to solve matrix addition and multiplication problems

Pre-requisites

Knowledge of programming skill.

2049233320	Programming in C	L	T	P	C
Practical		0	0	4	2

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	1	1	1	-	-
CO2	3	3	2	1	1	-	-
CO3	3	3	2	1	1	-	-
CO4	3	3	2	1	1	-	-
CO5	3	3	2	1	1	-	-

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

2049233320	Programming in C	L	T	P	C
Practical		0	0	4	2

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Practical Document	Practical Test	Practical Examination
Portion	First Cycle	Second Cycle	All Exercises	All Exercises	All Exercises
Duration	2 Periods	2 Periods	Regularly	3 Hours	3 Hours
Exam Marks	50	50		100	100
Converted to	10	10	10	20	60
Marks	10		10	20	60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

CA1 and CA2: All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the evaluation scheme as below. The marks awarded will be converted to 10 Marks for each assessment test. The best of one will be considered for the internal assessment of 10 Marks.

Cycle I: 1 to 6.

Cycle II: 7 to 12.

SCHEME OF EVALUATION

Part	Description	Marks
A	Program Writing	20
B	Execution / Procedure	20
C	Result / Output	10
TOTAL MARKS		50

2049233320	Programming in C	L	T	P	C
Practical		0	0	4	2

CA 3: Practical document should be maintained for every exercise immediately after completion of the practice. The same should be evaluated for 10 Marks. The total marks awarded should be converted to 10 Marks for the internal assessment. The practical document should be submitted for the Practical Test and End Semester Examination with a bonafide certificate

The details of the documents to be prepared as per the instruction below.

Each exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next exercise.

This documentation can be carried out in a separate notebook or printed manual or in a file with the documents. The procedure and sketch should be written by the student manually.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The logbook and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

CA 4: All the exercises should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test (CA4) should be conducted as per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment.

SCHEME OF EVALUATION

Part	Description	Marks
A	Program Writing	40
B	Execution / Procedure	35
C	Result / Output	15
D	Vive – Voce	10
TOTAL MARKS		100

2049233320	Programming in C	L	T	P	C
Practical		0	0	4	2

Ex.No	Name of the Exercise	Hours
1	Write a program for AND, OR and NOT logical functions.	4
2	Write a program for calculate the equivalent resistance of resistors connected in series and parallel.	4
3	Write program to implement Kirchhoff's current law.	4
4	Write program to find sum of series using "while" loop and execute it.	4
5	Write a program to find whether the given number is positive or negative or zero.	4
6	Write a program for Fibonacci series.	4
7	Write a program for converting Decimal number into Binary number.	4
8	Write a program to print the given matrix element using 2D array.	4
9	Write a program for String Palindrome.	4
10	Write a program for addition of two matrixes.	4
11	Write a program for automatic door OPEN and CLOSE system using if - else condition.	4
12	Write a program for forward and reverse operation of motor control.	4
	Revision	**12**
	Total Hours	**60**

Suggested Activity

Apart from classroom and laboratory learning, Teachers should use the following strategies to achieve the various outcomes of the course.

- Different methods of teaching and media to be used to attain classroom attention.
- Massive open online courses (MOOCs) may be used to teach various topics/sub-topics.
- Micro-projects may be given to a group of students for hands-on experiences.

2049233320	C Programming	L	T	P	C
Practical		0	0	4	2

TEXTBOOK:

1. "Prof. E. BALAGURUSAMY" "Programming in ANSI C", TATA Mc Grawhill publications.

REFERNCE BOOKS:

2. "Yashavant Kanetkar" " Let us C", BPB Publications - 2018.
3. "Venkatesh Ramasamy ""ANSI C Programming Guide

END SEMESTER EXAMINATION – PRACTICAL EXAM.

BOARD EXAMINATIONS

Note:

- All the exercises have to be completed, any one exercise will be given for examination.
- All the exercises should be given in the question paper. The student is allowed to select by lot or question papers issued by the DOTE Exam section shall be used.
- Practical documents along with the activity report should be submitted for the End Semester Examinations.

Allocation of Marks for End Semester Practical and Model Practical Examination

Part	Description	Marks
A	Program Writing	40
B	Execution / Procedure	35
C	Result / Output	15
D	Vive – Voce	10
TOTAL MARKS		100

LIST OF EQUIPMENT:

Hardware Requirement:

1. Desktop / Laptop Computers - 15 Nos

2. Laser printer – 1No

Software requirement:

3. C-compiler and editor.

2049233440	ELEMENTS OF ELECTRICAL ENGINEERING	L	T	P	C
Practicum		1	0	4	3

Rationale

This course will outline Elements of Electrical Engineering that are relevant to polytechnic Diploma in Robotics and Automation branch.

Course Objectives

On successful completion of the course, the students must be able to

- Understand the DC circuit and network theorems.
- Get knowledge of AC fundamentals.
- Understand about resonance in series and parallel circuits.
- Know the operation of the Transformer.
- Get the knowledge of AC and DC motor
- Get the knowledge of Special motor
- Know the operation of the control components of the motor.

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Reduce the complex circuits using reduction techniques, theorems

CO2: Define terms used for AC and solve AC series and parallel resonance circuits using various circuit elements.

CO3: Know the working operation of transformer, AC and DC motors.

CO4: Explain the working principle and applications special motors.

CO5: Understand the working of protecting devices and control components.

Pre-requisites

Knowledge about of basic electrical parameters and Laws

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	3	-	-	3
CO2	3	2	3	3	-	-	3
CO3	3	2	3	3	-	-	3
CO4	3	2	3	3	-	-	3
CO5	3	2	3	3	-	-	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

2049233440	ELEMENTS OF ELECTRICAL ENGINEERING	L	T	P	C
Practicum		1	0	4	3

Instructional Strategy

- It is advised that teachers take steps to pique pupils' attention and boost their learning confidence.
- To help students learn and appreciate numerous concepts and principles in each area, teachers should provide examples from daily life, realistic situations, and real-world engineering and technological applications.
- The demonstration can make the subject exciting and foster in the students a scientific mindset. Student activities should be planned on all the topics.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome- and employability-based.
- Do not let students work on an activity or an experiment with the expected outcome, rather allow students to be honest about whatever the results of the experiment. If the results are different from the expectations, students should do an analysis where they could be the source of error, if any.

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Experiments/ 50% Experiments	Cycle II Experiments/ Another 50% Experiments	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

2049233440	ELEMENTS OF ELECTRICAL ENGINEERING	L	T	P	C
Practicum		1	0	4	3

Note:

CA1 and CA2: All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The experiment should be completed on the day of practice.

The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook / printed manual / file. The Circuit Diagram, Readings, Calculations and Graph/Result should be written by the student manually.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

Scheme of Evaluation

S. No	Name of the Activity/Description	Mark Allocation
1.	Circuit Diagram	20
2.	Connection & Execution	20
4.	Result	10
5.	Practical Documents	10
Total		**60**

2049233440	ELEMENTS OF ELECTRICAL ENGINEERING	L	T	P	C
Practicum		1	0	4	3

CA 3: A written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

CA 4: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

S. No	Name of the Activity	Mark Allocation
1.	Circuit Diagram	20
2.	Connection & Procedure	20
3.	Reading, Calculation & Graphs	20
4.	Result	10
5.	Written Test	30
6.	Viva Voce	10
Total		**100**

Note: For the written test 30 MCQ shall be asked from the theory portions.

2049233440	ELEMENTS OF ELECTRICAL ENGINEERING	L	T	P	C
Practicum		1	0	4	3

Unit I	DC FUNDAMENTALS	
Basic parameters of DC circuits, Series and parallel connections of resistors- Mesh analysis for DC circuits. Thevenin's theorem –Superposition theorem – Maximum power transfer theorem (Statement, Explanation)		3
Ex.No	Name of the Experiment	
1	Construct a circuit to verify Kirchoff's voltage and current law.	12
2	Construct a circuit to verify the Superposition theorem.	
3	Construct a circuit to verify the Maximum power transfer theorem.	
UNIT II	**AC CIRCUITS AND POLYPHASE CIRCUITS**	
Definition for impedance, reactance, admittance, and Power factor – Average and RMS value - RLC series circuits(no problems) – RLC parallel circuits (no problems) - Definition for resonance - Series resonance – Parallel resonance – frequency response, Resonant frequency. Three phase over single phase, phase sequence, balanced and unbalanced load, Phase and line current, phase and line voltage (Star-connected system and Delta-connected system) Current, Power, and power factor in a 3-phase balanced system. (No Problems)		3
Ex.No	Name of the Experiment	
4	Construct and test the performance of series and parallel resonant circuits and obtain the resonance frequency	4
UNIT III	**TRANSFORMER, AC, AND DC MOTORS**	
DC Motors – Types, Construction, and working principle, Definition and working principle of transformer, OC and SC test on transformer, Load test on single phase transformer, Types of Single Phase Motors – Construction, Working Principle, Principle of Operation of Three Phase Induction Motors –Comparison between Cage and Slip Ring Induction Motors, Starters of Induction Motors – Direct online.		3
Ex.No	Name of the Experiment	
5	Load test on DC shunt motor	16
6	Load test on Single phase induction motor	
7	Load test on Single phase Transformer	
Unit IV	**SPECIAL MOTOR**	
Permanent Magnet DC Motors – construction – principle of operation, Brushless DC motor - construction - principle of operation - applications. Permanent Magnet Synchronous Motors-construction - principle of operation, Stepper motors - Basic		3

principle - different types - principle of operation – open loop and closed loop control of Stepper Motor-applications, Synchronous Reluctance Motor - Construction, principle of operation Switched reluctance motors - principle of operation – applications, DC Servo motors – DC servo motors – construction– principle of operation - applications. AC Servo motors -Construction – the principle of operation- applications.		
Ex.No	Name of the Experiment	
8	Testing of Stepper motor drive	8
9	Testing of Servo motor drive	
Unit V	**PROTECTIVE DEVICES AND CONTROL COMPONENTS**	
Fuse: Operation and Types, Difference between switch fuse unit and fuse switch unit. Circuit Breaker: Types of circuit breakers — MCBs, MCCBs, and ELCBs Control Circuit Components: Switches – Push button, selector, drum, limit, pressure, temperature (Thermostat), float switch. Relays – Voltage relay, DC series current relay, and phase failure relay (single phasing preventer). Over-current relay – Bimetallic thermal overload relay. Timer – Electronic timer. Solenoid Valve, Solid state relay, Simple ON-OFF motor control circuit.		3
Ex.No	Name of the Experiment	
10	Testing control components and constructing of DOL starter.	8

Text and Reference Books:

- Robert.L. Boylestead, "Introductory Circuit Analysis", Pearson Education India, 13th Edition, 2015. B.L.Theraja, A.K.Theraja, —A Textbook of Electrical Technology‖,S. Chand & co-publisher, New Delhi 2015.
- Charles.K.Alexander, Mathew N.O.Sadiku," Fundamentals of Electric Circuits", McGraw Hill, 5th Edition, 2012.
- Dr.M.Arumugam, N.Premkumaran, —Electric Circuit Theory‖, Khanna Publishers, New Delhi 5th edition.

Suggested List of Student Activity:

- Presentation/Seminars by students on any recent technological developments based on the course Periodic class quizzes conducted on a weekly/fortnightly based on the course

Web-based/Online Resources:

- https://onlinecourses.nptel.ac.in/noc23_ee81/preview
- https://onlinecourses.nptel.ac.in/noc24_ee103/preview

2049233440	ELEMENTS OF ELECTRICAL ENGINEERING	L	T	P	C
Practicum		1	0	4	3

Equipment / Facilities required to conduct the Practical Course.

Sl. No	Name of the Equipment	Range / Specification	Required Quantity
1.	Dual power supply	0-30 V	5 No's
2.	Single phase Transformer	1 KVA, 250V	2 No's
3.	DC Shunt Motor with Loading arrangement	3/5 KW, 220 V DC	1 No
4.	Three Phase Squirrel Cage Induction Motor with loading arrangement	1/3/5 Hp	1 No
5.	Stepper motor Control Kit	-	1 No
6.	DC motor Speed control Kit	-	1 No
7.	AC Motor Speed control Kit	-	1 No
8.	DOL Starter	5Hp, 415 V	1 No
9.	Star Delta Starter	20A,600V	1 No
10.	Variac (Autotransformer)	0 – 250 V	1 No
11.	Three point Starter	20 A, 220 V	1 No
12.	Four Point Starter	20 A, 220 V	1 No
13.	MCB – Single & Three Pole	20 A	Each 1 No
14.	ELCB	2 Pole, 20 A	1 No
15.	DC Ammeter	Different ranges	10 No's
16.	DC Voltmeter	Different ranges	10 No's
17.	AC Ammeter	Different ranges	10 No's
18.	Tachometer & Resistive Load Bank	0-1000rpm, 1 KW	Each 1 No

Note:

- Sufficient number of Worktables to be provided in the laboratory to conduct experiments for students.
- Ensure Permanent wiring connections with suitable circuit breakers / Protective mechanism in the Worktables with proper safety measures.
- In addition to the above list sufficient quantities of consumable, Tools and Testing Instruments to be maintained.

- Charts on Electrical Safety and Procedure of First Aid to be displayed in the Laboratory.
- Necessary proper electrical safety arrangements should be done in the laboratory.
- Awareness about the First Aid for Electrical accidents should be given.

END SEMESTER EXAMINATIONS – PRACTICAL EXAM

Note:

All the exercises should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises / experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by the DOTE Exam section shall be used. The record of work done by the student should be submitted with a Bonafide Certificate.

SCHEME OF EVALUATION

S. No	Name of the Activity	Mark Allocation
1.	Circuit Diagram	20
2.	Connection & Procedure	20
3.	Reading, Calculation & Graphs	20
4.	Result	10
5.	Written Test	30
6.	Viva Voce	10
Total		**100**

Note: For the written test 30 MCQ shall be asked from the theory portions.

2049233540	Machine Elements Design	L	T	P	C
Practicum		1	0	4	3

RATIONALE

Day by day, engineering and technology experience tremendous growth. Design plays an important role in developing engineering and technology. Mechanical engineering is the backbone for robotics and automation. The fundamentals of mechanical engineering deal generally with the material properties, behavior of materials when they are subjected to the action of forces. Evaluations derived from these basic fields provide tools for investigation of mechanical structure.

COURSE OBJECTIVES

The student will learn to

1	Define various mechanical properties of engineering materials.
2	Calculate the deformation of materials, which are subjected to axial load and shear.
3	Acquire skills on different types of testing methods of metals.
4	Calculate the power transmission through belt drives and gear drives.
5	Obtain accurate geometric measurements.
6	Conduct material testing on elasticity, hardness, shear strength.
7	Study the various types of bearings and their applications.
8	Calculate the power transmission through solid and hollow shafts.
9	Determine modulus of rigidity of open coil spring and closed coil springs.

COURSE OUTCOMES

On successful completion of this course, the student will able to

CO1	Identify the various mechanical properties of engineering materials.
CO2	Analyze the effect of load on the behavior of materials.
CO3	Discuss the various types of bearings and the forces acting on them.
CO4	Select the suitable belt drives and gear drives for power transmission.
CO5	Design shaft and helical springs using the principles of pure torsion.

PRE-REQUISITES

Knowledge of engineering drawing, physics and mathematics.

2049233540	Machine Elements Design	L	T	P	C
Practicum		1	0	4	3

MAPPING OF COs WITH POs

	Basic and Discipline Specific Knowledge	Problem Analysis	Design / Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering practices for society, sustainability and Environment	Project Management	Life Long Learning
CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	3	3	2	2
CO2	3	3	3	3	3	2	2
CO3	3	2	2	2	2	2	2
CO4	3	3	2	2	3	2	2
CO5	3	3	3	3	2	2	2

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

INSTRUCTIONAL STRATEGY

i. Practice approach may be followed throughout the course so that students are able to understand and grasp the concepts.

ii. Teacher Directed Lecture, Demonstration and Group Discussion class room process could be used for theory.

2049233540	Machine Elements Design	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Experiments/ 50% Experiments	Cycle II Experiments/ Another 50% Experiments	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.
  Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each

exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

Each experiment should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook or a printed manual or a file with documents. The Circuit Diagram, Readings, Calculations and Graph / Result should be written by the student manually.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Procedure	20
B	Tabulation / Calculations	20
C	Result	10
TOTAL		50
D	Practical Documents (As per the portions)	10
Total Marks		60

- **CA 3:** A written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical

test should be conducted as per the scheme of evaluation below. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

S. No	Description	Marks
A	Procedure / Observation	20
B	Tabulation / Calculations	30
C	Result / Graph	10
D	Written Test (Theory Portions)	30
E	Viva voce	10
F	Total Marks	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

2049233540	Machine Elements Design	L	T	P	C
Practicum		1	0	4	3

Unit I	PROPERTIES OF MATERIALS	
THEORY: **Mechanical properties of materials (Types and Definitions)**: Engineering materials – Ferrous and non-ferrous materials - Definition of mechanical properties: Elasticity, Plasticity, Hardness, Toughness, Ductility, Malleability, Brittleness, fatigue, fatigue strength, creep -temperature creep – cyclic loading and repeated loading – endurance limit. PRACTICAL:		3
Ex. No.	Name of the Experiment	
1	**Hardness test on ferrous material:** Determination of Rockwell's/ Brinell Hardness Number for various ferrous materials like mild steel/ high carbon steel.	10
2	**Hardness test on non-ferrous material:** Determination of Rockwell's/ Brinell Hardness Number for various nonferrous materials like brass, copper and aluminum.	
Unit II	STRESS AND STRAIN	

<table>
<tr><td colspan="2">THEORY:
Simple stresses and strains (Definitions and formulas only): Load, stress and strain – Classification of force systems – tensile, compressive and shear force systems – Behaviour of mild steel in tension up to rupture – Stress –Strain diagram – limit of proportionality – elastic limit – yield stress –breaking stress – Ultimate stress – percentage of elongation and percentage reduction in area – Hooke's law. Young's modulus - working stress, factor of safety, load factor, shear stress and shear strain - modulus of rigidity. Linear strain – Deformation due to tension and compressive force. Lateral strain – Poisson's ratio – volumetric strain – bulk modulus – volumetric strain of rectangular and circular bars.

PRACTICAL:</td><td>3</td></tr>
<tr><td>Ex. No.</td><td>Name of the Experiment</td><td></td></tr>
<tr><td>3</td><td>**Tensile test on mild steel:** Finding modulus of elasticity, yield points, percentage elongation and percentage reduction in area.</td><td rowspan="2">10</td></tr>
<tr><td>4</td><td>**Tensile test on brass:** Finding modulus of elasticity, yield points, percentage elongation and percentage reduction in area.</td></tr>
<tr><td>**Unit III**</td><td>**BELT DRIVES AND GEAR DRIVES**</td><td></td></tr>
<tr><td colspan="2">THEORY:
Gear Drives (Concepts and Types): Classification of gears – Nomenclature of a gear – Application of spur, Helical and Bevel Gears, Worm and worm wheel, rack and pinion – Velocity of a gear drive – merits and demerits of gear drive

Belt drives (Concepts and Types): Types of Belt drives –Open Belt drive – Cross belt drive – Flat belt drive – V belt drives
PRACTICAL:</td><td>3</td></tr>
<tr><td>Ex. No.</td><td>Name of the Experiment</td><td></td></tr>
<tr><td>5</td><td>**Spur Gear test:** Measure the geometrical dimensions of spur gear using gear tooth vernier caliper or profile projector.</td><td>5</td></tr>
<tr><td>**Unit IV**</td><td>**FRICTION AND BEARINGS**</td><td></td></tr>
<tr><td colspan="2">THEORY:
Friction (Definitions and laws): Definition: Force of friction - Limiting friction - Static friction - Dynamic friction - Angle of friction - co-efficient of friction. Laws: Laws of static and dynamic friction.

Bearings: Types of bearings: Ball bearing - angular contact, axial, deep groove. Roller bearing-cylindrical, spherical, tapered, needle. Applications of bearings - Loads acting on bearing -Selection of bearings - Lubrication of bearings.

PRACTICAL:</td><td>3</td></tr>
</table>

Ex. No.	Name of the Experiment	
6	**Impact test (Charpy):** Finding the resistance of materials to impact loads by Charpy test.	15
7	**Impact test (Izod):** Finding the resistance of materials to impact loads by Izod test.	
8	**Shear test:** Single or double shear test on M.S. bar to finding the resistance of material to shear load	
Unit V	**TORSION AND SPRINGS**	
THEORY: **Theory of torsion (Basic concepts and formulas):** Assumptions – torsion equation –strength of solid and hollow shafts – power transmitted – Definition –Polar modulus – Torsional rigidity – strength and stiffness of shafts. **Springs (Basic concepts and formulas):** Types of springs – Laminated and coiled springs and applications – Types of coiled springs – Difference between open and closely coiled helical springs – closely coiled helical spring subjected to an axial load. **PRACTICAL:**		3
Ex. No	Name of the Experiment	
9	**Torsion test:** Torsion test on mild steel – relation between torque and angle of twist determination of shear modulus and shear stress.	10
10	**Tests on springs of circular section:** Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open coil spring/ Closed coil spring)	
	Students Activity and report preparation	10
TOTAL HOURS		**75**

SUGGESTED LIST OF STUDENTS ACTIVITY:

Other than the classroom learning, the following are the suggested student related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes. In this course.

1. Conduct survey, specific to properties of various types of materials used in mechanical engineering and prepare a report.
2. Compare the strength of solid shaft with that of hollow shaft for same power transmission for an automobile and make report.
3. Students can be given practices in the Virtual Labs | Mechanical and Civil Engineering (vlab.co.in).

This can be given for a team of students and make them to prepare a report.

Sample Experiments: Four bar mechanism, Slider crank mechanism, Elliptical Trammel, Cam Mechanism, Linkage Model, Crank and Slotted Mechanism, Whitworth Mechanism, Straight Line Mechanism, Universal Joint etc…

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T	Strength of Materials, S. Ramamrutham, 18th Edn 2017, Dhanpat Rai Pub. Co.
	Strength of Materials, R. S. Khurmi, S.Chand & Co., Ram Nagar, New Delhi.
	Rattan.S.S, -Theory of Machines‖, Tata McGraw -Hill Publishers, New Delhi 2018.
R	Engineering mechanics, R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, 5th Edition, 2017.
	Thomas Bevan, —Theory of Machines‖, CBS Publishers and Distributors, 6th Edition, 2017.
	Strength of materials, S.S.Rattan, Tata McGraw hill, New Delhi,2018.

Web-based / Online Resources:

- Virtual Labs - A MHRD Govt of india Initiative (vlabs.ac.in)
  https://sm-nitk.vlabs.ac.in/List%20of%20experiments.html
- Strength of Materials - YouTube
  https://www.youtube.com/playlist?app=desktop&list=PL1b9Ht9ISqIFInLTS7xxQ6dRdIp4Jc8Vh
- Structural Analysis: Statically Determinate Beams - YouTube
  https://www.youtube.com/watch?app=desktop&v=aNi_Zn_gQrA

LIST OF EQUIPMENT:

No.	Name of the Equipment / Machinery	No. of Quantity
1	Universal Testing Machine (UTM)	1
2	Rockwell's Hardness Testing Machine	1
3	Brinell Hardness Testing Machine*	1
4	Torsion testing machine	1
5	Impact testing machine	1
6	Spring testing machine	1
7	Shear testing machine	1
8	Digital Vernier Caliper	4
9	Gear Tooth Vernier	2

*Optional

2049233540	Machine Elements Design	L	T	P	C
Practicum		1	0	4	3

END SEMESTER EXAMINATIONS – PRACTICAL EXAM

Note:

All the exercises should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises / experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by the DOTE Exam section shall be used. The practical document prepared by the student should be submitted with a Bonafide Certificate.

SCHEME OF EVALUATION

S. No	Description	Marks
A	Procedure / Observation	20
B	Tabulation / Calculations	30
C	Result / Graph	10
D	Written Test (Theory Portions)	30
E	Viva voce	10
F	Total Marks	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

2049233640	Analog and Digital Circuits	L	T	P	C
Practicum		1	0	4	3

Introduction

Analog and Digital Circuits Practicum is supportive for the students to obtain the basic knowledge of both analog and digital logic levels and its application to construct both circuits. This course will guide the students to perform the analysis and design of various analog and digital circuits. This will improve the practical knowledge of the students to handle real time applications and working in an efficient manner.

Course Objectives

The objective of this course is to enable the student to

- Know the basics of analog electronics, Opamp-based applications and IC-based voltage regulators
- Learn the basics of digital electronics, and Boolean algebra, and be able to design simple logic circuits and test/verify the functionality of the logic circuits
- Understand the working principle of various arithmetic and combinational logic circuits
- Analyse and design different sequential logic circuits in this lab.

Course Outcomes

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

CO1: Basic knowledge of analog application circuits and get familiar with IC.

CO2: Create digital functions using Boolean Algebra and verify experimentally.

CO3: Understanding different combinational circuits and design circuits.

CO4: Able to solve problems using sequential circuit and logic design.

CO5: Understand the function of simple digital circuits under real and simulated environment.

Pre-requisites

Basics of LCM, Division, and True or False Statement

2049233640	Analog and Digital Circuits	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	1	1	1	-	-
CO2	3	3	2	1	1	-	-
CO3	3	3	2	1	1	-	-
CO4	3	3	2	1	1	-	-
CO5	3	3	2	1	1	-	-

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

2049233640	Analog and Digital Circuits	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Experiments/ 50% Experiments	Cycle II Experiments/ Another 50% Experiments	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

  Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

2049233640	Analog and Digital Circuits	L	T	P	C
Practicum		1	0	4	3

The details of the documents to be prepared as per the instruction below.

Each experiment should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook or a printed manual or a file with documents. The Circuit Diagram, Readings, Calculations and Graph / Result should be written by the student manually.

The detailed dates of the practices and their evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim	5
B	Circuit Diagram	20
C	Connections	15
D	Output	10
E	Practical Documents (As per Portions)	10
TOTAL MARKS		**60**

- **CA 3:** A written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

2049233640	Analog and Digital Circuits	L	T	P	C
Practicum		1	0	4	3

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim	5
B	Circuit Diagram	20
C	Connection/Execution	25
D	Output	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
TOTAL MARKS		**100**

Note: For the written test 30 MCQ shall be asked from the theory portions.

2049233640	Analog and Digital Circuits	L	T	P	C
Practical		1	0	4	3

Unit I	Analog Circuits and Its Application	
Introduction Analog Circuits: Classification of IC- Operational amplifier IC 741- Schematic symbol for opamp - pin diagram of IC 741-Block diagram of an opamp - Characteristics of an ideal opamp – CMRR -Slew Rate. **Applications:** Inverting Amplifier, Non Inverting Amplifier Summing amplifier - Voltage follower – Comparator - Integrator – Differentiator Waveform generators-Square wave,triangularwave,sinewave,saw tooth wave generators. **Waveform generators**: Square wave, triangular wave, sinewave, saw tooth wave generators.		3
Exp.No	**Name of the Experiments**	**Hrs**
1	Test the performance of Inverting and Non Inverting Amplifier with waveforms forinput and output signals	4
2	Test the performance of Integrator & Differentiator trace the waveforms forinput and output signals	4
Unit II	**A/D and D/A Converters**	
A/D Converters Analog to digital converter-Basics of A/D conversion-Types of A/D converter - Block diagram of Flash type ADC, Successive approximationADC. **D/A Converters** Digital to analog converter-Basics of D/A conversion-weighted Resistor D/A Converter – R-2R Ladder D/A **IC voltage regulators** Linear fixed voltage regulator-Positive voltage regulator using IC 78XX,negative voltage regulator using IC 79XX- LDOregulators.		3
Exp.No	**Name of the Experiments**	**Hrs**
3	Design and implement the Binary weighted resistor DAC by using IC741	4

4	Test the line regulation for positive voltage regulator using 78xx and negative voltage regulator using 79xx	4
Unit III	**A/D and D/A Converters**	
Introduction to number system: Decimal, Binary, Octal and Hexa Decimal – conversion between the above number systems–1's and 2's Complement representation – Binary addition and Binary Subtraction– BCD, Gray code to Binary, Binary to Gray code conversion, ASCII **Introduction to Boolean Algebra:** Basic Boolean laws– Demorgan's Theorems – Simplification of Boolean equations using Boolean laws – SOP and POS definition **Introduction to Logic Gates:** AND, OR, NOT, NAND, NOR, XOR and XNOR gates – Realization of logic gates using universal gates –Tristate Buffer and Bi-directional Buffer **Karnaugh Map:** Simplification of Boolean equations using K-Map – Simple problems using 4 variables		3
Exp.No	**Name of the Experiments**	**Hrs**
5	Realization of logic gates using NAND & NOR gates.	4
6	Verification of Demorgan's theorems.	4
7	Convert and verify with truth table of Gray code to Binary, Binary to Gray code methods	4
Unit IV	**Logic Gates, Arithmetic Circuits & Combinational Circuits**	
Arithmetic Circuits: Half Adder, Full Adder, Half Subtractor, Full Subtractor - Digital Comparator. **Multiplexor:** 4 to 1 MUX. **Demultiplexor:** 1 to 4DEMUX. **Encoder & Decoder:** Encoder - 2 to 4 Decoder and BCD to Seven Segment Decoder **Parity Generator & Checker:** Parity bit: Types of Parity - Basic Concepts of Parity Generator and Checker.		3
8	Construct and verify the Half Subtractor and Full Adder Circuit	4
9	Construct and verify the Multiplexer and Demultiplexer Circuit	4

10	Construct and verify the Parity Generator and Checker Circuit	4
Unit V	**Sequential Circuits & Storage Devices**	
Introduction to Sequential logic circuits: Truth table and Operation of SR, JK, D, T, JKMS Flip-flop **Counters:** Operation of 4 - bit Asynchronous counter - 4-bit Synchronous counter - up-down counter and decade counter. **Shift Registers:** Operation of Serial in Serial out, Parallel in Serial out, Serial in Parallel out and Parallel in Parallel out shift registers. **Introduction to memory**: ROM – Organization of ROM and types of ROM (PROM, EPROM, UVEPROM - RAM Organization - types of RAM		3
11	Construct and verify of truth table for JK, D and T flip-flops.	4
Introduction, Preparation and Revision		**16**
Total Hours		**75**

Suggested List of Students Activity

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.

Reference

1. D.RoyChoudhry, ShailBala Jain, "Linear Integrated Circuits", New Age International Pvt.Ltd., 1st Edition, 2021,.
2. Sergio Franco, " Design with Operational Amplifiers and Analog Integrated Circuits", 4th Edition, Tata Mc Graw-Hill,2016
3. Albert Paul Malvino and Donold P. Leach – Digital Principles and applications. Thomas L. Floyd, Digital Fundamentals, Pearson Education, Inc, New Delhi.

Text Book

1. Digital Electronics principles and integrated circuits. AnilK. Maini, Wiley publications, First edition. Digital Principles and Modern Digital Electronics,R.P.Jain – TMH.
2. William H.Goth Mann – Digital Electronics: An introduction to theory and practice

Web-based/Online Resources

1. https://www.electronics-tutorials.ws/

2. https://learn.sparkfun.com/
3. https://www.allaboutcircuits.com/textbook/digital/
4. http://electronicstheory.com/COURSES/ELECTRONICS/e101-1.htm
5. https://www.gadgetronicx.com/electronic-circuits-library/
6. https://www.electronics-lab.com/
7. https://learn.adafruit.com/
8. https://www.instructables.com/circuits/

List of Equipment required for a batch of 30 students

S. No	Items	Quantity Required
1.	Digital Trainers	20
2.	Digital ICs	--

Note:

- Sufficient number of Worktables to be provided in the laboratory to conduct experiments for students.
- Ensure Permanent wiring connections with suitable circuit breakers / Protective mechanism in the Worktables with proper safety measures.
- In addition to the above list sufficient quantities of consumable, Tools and Testing Instruments to be maintained.
- Charts on Electrical Safety and Procedure of First Aid to be displayed in the Laboratory.
- Necessary proper electrical safety arrangements should be done in the laboratory.
- Awareness about the First Aid for Electrical accidents should be given.

END SEMESTER EXAMINATIONS – PRACTICAL EXAM

Note:

All the exercises should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises/experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by the DOTE Exam section shall be used. The practical document prepared by the student should be submitted with a Bonafide Certificate.

2049233640	Analog and Digital Circuits	L	T	P	C
Practicum		1	0	4	3

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim	5
B	Circuit Diagram	20
C	Connection/Execution	25
D	Output	10
E	Written Test (Theory Portions)	30
F	Viva voce	10
TOTAL MARKS		100

Note: For the written test 30 MCQ shall be asked from the theory portions.

2049 - Diploma in Robotics and Automation (Full Time – Regular)

2149 – Diploma in Robotics and Automation (Sandwich)

1144 – Diploma in Automation and Robotics (Full Time – Regular)

2049234110	ELECTRONIC MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
Theory		4	0	0	4

Rationale

Sound knowledge about various measurement techniques used in industries is essential for the student of automation engineering. This subject provides the knowledge of measurement of strain, displacement, force, temperature using various types of transducers/transmitters and related circuits.
Sensors and transducers are used in automation in construction, domestic appliances industries, transport, space exploration, defence equipment, health services and other applications. Transducers have achieved substantial accuracy and control in Industrial automation; Transducers lie at the heart of instrumentation. Hence it becomes imperative to study about the principles and applications of various types of transducers in a single volume in Diploma level.

Course Objectives

- To learn about the fundamentals of measurement systems.
- To acquire adequate knowledge about electrical measurements.
- To understand the necessity and advantages of the transducer.
- To learn about different types of transducers.
- To learn the operation and applications of capacitive and inductive transducers.
- To learn about various active transducers and their applications.
- To understand the concept of a Data acquisition system.
- To know the concept of signal conditioning.

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Interpret the characteristics of electrical measuring instruments.

CO2: Illustrate the working functionality of transducers used for strain, force, and displacement measurement.

CO3: Illustrate the working functionality of transducers used for strain, force, and displacement measurement.

CO4: Extend the concept of signal conditioning circuits to produce signal as per the control system requirements.

CO5: Describe the working of instrumentation transmitters and data acquisition system.

Pre-requisites

- Basic understanding of electrical circuits.
- Awareness of physical quantities in industries.

2049234110	ELECTRONIC MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
Theory		4	0	0	4

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	1	2	2	1	1	2
CO2	3	2	3	2	1	1	2
CO3	3	2	3	2	1	1	3
CO4	2	2	3	2	1	1	3
CO5	2	2	3	2	1	1	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Massive open online courses (MOOCs) may be used to teach various topics.
- The topics that are relatively simpler or descriptive are to be given to the students for **self-directed learning** and assess the outcomes through classroom seminars or group discussions.
- Teachers must ensure to create opportunities for co-curricular activities.
- Videos and simulations may be used to teach various topics.
- Encourage students to refer to different textbooks and case studies to have a deeper understanding of the subject.
- Demonstrate the working of instruments and transducers.
- Encourage students to refer to different OEM websites to have a deeper understanding of measuring instruments and transducers.

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Two units)	Written test (Another Two units)	Activity Report	Model Examination	Written Examination
Duration	2 Periods	2 Periods	-	3 Hours	3 Hours
Exam Marks	50	50	40	100	100
Converted to	15	15	10	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

2049234110	ELECTRONIC MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
Theory		4	0	0	4

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. The best of one will be considered for the internal assessment of 15 Marks.

CA1 and CA2, Assessment tests should be conducted for two units as below.

Answer five questions (5 X 10 Marks = 50 Marks).

Eight questions will be asked; students should write Five questions. In each unit, Four questions can be asked. Each question may have subdivisions. A maximum of two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end-semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

2049234110	ELECTRONIC MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
Theory		4	0	0	4

Unit I	INTRODUCTION TO MEASUREMENT SYSTEM, ELECTRICAL MEASUREMENTS	
Functional elements of an instrument - Static characteristics - accuracy, precision, sensitivity, linearity, Reproducibility, Repeatability - Dynamic characteristics – Dynamic error, speed of response, measurement lag, settling time Electrical Measurements: Analog vs Digital Instruments – Operating Forces – Deflecting force, controlling force, damping force – PMMC and Moving iron instrument – Dynamometer – Digital voltmeter (Only Successive Approximation Type) – Digital Multimeter		12

UNIT II	TRANSDUCERS	
Instrumentation system: Block diagram and function of each block. Sensors and Transducers: Definition and Difference, Classification of transducers (Only list and basic definition). Strain: Types of strain gauges – Theory of operation of resistive strain gauge – Thin film strain gauges – Application of strain gauges. Force: Types of load cells – Hydraulic load cell - Pneumatic load cell – Piezoelectric load cell – Strain gauge load cell Displacement: LVDT - Capacitive transducer – Inductive transducer		12
UNIT III	**PRESSURE FLOW AND TEMPERATURE MEASUREMENT**	
Pressure: Units and scale of pressure – Bourdon tube – Bellows gauge – Diaphragm type - Electrical methods: LVDT for pressure measurement. **Flow**: Differential pressure meter: Orifice plate - Venturi tube – Turbine flow meter – Electromagnetic flow meter – Ultrasonic flow meter. **Temperature**: Bimetallic thermometers – Thermocouple – Principle of operation, Operation of Thermistor, Operation of RTD - High temperature measurement: Total radiation pyrometer, Optical pyrometer.		12
Unit IV	**LEVEL MEASUREMENT AND SIGNAL CONDITIONING CIRCUIT**	
Level: Types of level measurement – Float gauges – Electrical methods: Capacitive type, Ultrasonic type, and Radiation method. Signal Conditioning Circuit: Need for signal conditioning circuit – Types – Block diagram of AC and DC signal conditioning circuit. Bridge circuits: Wheatstone bridge, Kelvin bridge, Schering bridge Construction and working of instrumentation amplifier.		12
Unit V	**TRANSMITTERS AND DATA ACQUISITION SYSTEM**	
Operation of Pneumatic transmitter – Operation of Electronic transmitter –2 wire and 4 wire transmitter – Smart transmitters – Application: Operation of Pressure transmitter, Temperature transmitter. Data acquisition system(DAS): Types, Block diagram of analog data acquisition system – Block diagram of digital data acquisition system. Signal Converter: I to P Converter, P to I converter		12

Text Book:

S. No	Title	Author	Publishers
1.	Transducers and Instrumentation	DVS Murty	PHI 2012

2049234110	ELECTRONIC MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
Theory		4	0	0	4

Reference Books:

S. No	Title	Author	Publishers
1.	Sensor and Transducers	D. Patranabis	PHI 2017
2.	A Course in Electrical and Electronics Measurements and Instrumentation.	1.A.K. Sawhney 2.Puneet Sawhney	DhanpatRai& Co (P) Ltd., New Delhi 2021
3.	Measurement and Instrumentation	Arun. K	PHI 2012
4.	Op. amp & Linear Integrated Circuits	Ramakant. A. Gayakwad	PHI 2012

Suggested Student Activity:

In addition to classroom and laboratory learning, **student-centric co-curricular activities** can be undertaken to accelerate the attainment of various outcomes of the course.

- Students should conduct the following activities in groups, prepare a report of about 5 – 10 pages, and collect the physical evidence for the internal assessment.
- Conduct an internet survey and make a list of leading manufacturers of sensors and transducers.
- Give seminars on any measuring instrument used in the industry.
- Prepare a PPT to demonstrate the operation of transducers.
- Prepare a presentation or report on troubleshooting techniques.
- Survey different measuring devices used in the industry and list the specifications.

END SEMESTER QUESTION PATTERN – THEORY EXAM

Duration: 3 Hours. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

2049234230	FUNDAMENTALS OF ROBOTICS	L	T	P	C
Practicum		2	0	2	3

Rationale

Robotics is an interdisciplinary field that integrates knowledge from computer science, mechanical engineering, electrical engineering, and mathematics. A fundamentals course provides students with a broad foundation across these disciplines, preparing them for advanced studies and careers in robotics. With the increasing automation of various industries, there is a growing demand for professionals skilled in robotics. A fundamentals course equips students with the basic knowledge and skills needed to enter the workforce and contribute to the design, development, and implementation of robotic systems

Course Objectives

On successful completion of the course, the students must be able to

- Explain different components of the robot
- Compare various types of Robot
- Study the working of various robot controllers.
- Differentiate various robot controllers.
- Explain the kinematics of a robot.
- Appreciate the application of robots in various industries.

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Describe the basic setup and operations of an industrial robot.
CO2: Interpret the transformations used in robot kinematics.
CO3: Evaluate the selection factors and design considerations of various types of robot grippers.
CO4: Comprehend the working of different robot drives and various control schemes available.
CO5: Use the codes to program the robot for given applications.

Pre-requisites

- Knowledge about the mechanisms, sensors and actuators.

2049234230	FUNDAMENTALS OF ROBOTICS	L	T	P	C
Practicum		2	0	2	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	2	2	3	1	2
CO2	3	2	3	3	3	1	2
CO3	3	2	3	3	3	1	3
CO4	3	2	3	3	3	1	3
CO5	3	2	3	3	3	1	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Massive open online courses (MOOCs) may be used to teach various topics.
- The topics that are relatively simpler or descriptive are to be given to the students for **self-directed learning** and assess the outcomes through classroom seminars or group discussions.
- Teachers must ensure to create opportunities for co-curricular activities.
- Videos and simulations may be used to teach various topics.
- Encourage students to refer to different textbooks and case studies to have a deeper understanding of the subject.
- Observe and continuously monitor the performance of the student in the laboratory.
- Foster collaborative learning exercises within the classroom to encourage group participation and engagement.
- Pose a minimum of three higher-order thinking (HOT) questions during class discussions to stimulate critical thinking among students.
- Implement Problem-Based Learning (PBL) as an approach that enhances students' analytical skills and nurtures their ability to design, evaluate, generalize, and analyze information, rather than solely relying on rote memorization.

2049234230	FUNDAMENTALS OF ROBOTICS	L	T	P	C
Practicum		2	0	2	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test Theory	Written Test Theory	Practical Test	Written Examination	Written Examination
Portion	(Any Two Units)	(Another Two Units)	All Exercises	(Complete Theory Portions)	(Complete Theory Portions)
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	50	50	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Tentative Schedule	6th Week	12th Week	15th Week	16th Week	

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks. The marks scored will be converted to 10 Marks for each test. Best of one will be considered for the internal assessment of 10 Marks.

CA1and CA2: Assessment test should be conducted for two units as below.

Answer any five questions. (5 X 10 Marks = 50 Marks).

Eight questions will be asked; students should write five questions.

Each unit four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one experiment by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded for 100 marks will be converted to 15 Marks for the internal mark.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical

test. Each exercise/experiment should be evaluated for 10 Marks. The total marks awarded should be converted to 15 Marks for the practical test as per the scheme of evaluation.

The details of the documents to be prepared as per the instruction below.

Each experiment should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next exercise.

This documentation can be carried out in a separate notebook or a printed manual or a file with documents. The student should draw the part drawing on the graph, write the procedure and calculations should be prepared manually.

The evaluated practical document should be submitted for the Practical Test (CA3). The mark scored by the students should be converted to 30 marks. The same should be included as per the allocation in the practical test.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

Program	: 20 Marks
Simulation / Execution	: 30 Marks
Result	: 10 Marks
Viva Voce	: 10 Marks
Practical Documents	: 30 Marks
Total	**: 100 Marks**

CA4: Model Theory examination should be conducted for complete theory portions as per the end semester question pattern. The marks awarded shall be converted to 15 Marks for the internal assessment.

Question Pattern: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each. Four questions will be asked from every unit; students should write any two questions. The question may have two subdivisions only.

2049234230	FUNDAMENTALS OF ROBOTICS	L	T	P	C
Practicum		2	0	2	3

Unit I	FUNDAMENTAL OF ROBOTIC SYSTEMS	
	Introduction – Definition – History - Law of robotics – Robot Anatomy (Basic components of a robot) – Robot links (Definition and function) – Types of joints - Joint Configuration of robots – Joint notation scheme – Wrist Configuration: Pitch, Yaw, and Roll - Specifications of Robot – Robot Classifications (Based on different factors) **Practical:** 1. Identify and operate the different joints in a robot using simulation software. 2. Use simulation software to study different types of robots based on configuration and application. (Open Source – Robo Analyzer, Coppelia Sim)	6 6
UNIT II	**ROBOT KINEMATICS**	
	Robot Coordination Frames (Types and its details) – Position and orientation of robots (Brief Explanation with examples) – DH parameters Introduction to forward kinematics and inverse kinematics – Differentiate forward and inverse kinematics – Forward kinematics and Reverse kinematics of manipulators with Two degrees of freedom – Robot dynamics (Introduction and purpose only). **Practical:** 3. Use software to visualize DH parameters. (Robo Analyzer) 4. Use software to visualize forward kinematics. (Robo Analyzer) 5. Use software to visualize inverse kinematics. (Robo Analyzer)	6 6
UNIT III	**END EFFECTORS**	
Mechanical grippers – Types of gripper mechanisms: Slider crank mechanism, Screw type, Rotary actuators, cam type - Magnetic grippers - Vacuum grippers – Pneumatic grippers - Gripper force analysis - Gripper design - Selection and design considerations.		6
Ex.No	Name of the Experiment	
6	Move a 6-axis robot by manipulating its joints and coordinates and record its position. (Simulation Software or Teach Pendant)	4
Unit IV	**DRIVES AND CONTROL SYSTEM FOR ROBOTICS**	
Objectives, open loop control, closed-loop control with velocity and position feedback - Robot path control types: limited sequence control, point to point – continuous path control, and intelligent control Drives system: Functions of Drive system, Hydraulic drives, Pneumatic drives, Electrical drives, Servo drive.		6

Ex.No	Name of the Experiment	
7	Develop a program using teach pendant/simulation software to teach the robot to draw a circle (or arc) using the CIRCULAR motion command.	8
8	Develop a program using teach pendant/simulation software to trace a hexagon,	
Unit V	**ROBOT PROGRAMMING**	
Robot programming: Types - On-Line & Off-Line programming - Teach Pendant Programming - Lead through programming Robot programming languages: Generations of robot programming languages –- robot language structure – Introduction to various robot programming Languages (VAL, RAIL, AML, Python, ROS) – VAL Language: Motion Commands, Sensor Commands, End effecter commands, and Simple programs-(Robot pick and place application using VAL Language.		6
Ex.No	Name of the Experiment	
9	Develop a program using teach pendant/simulation software to teach the robot to write an alphabet using JOINT interpolation and LINEAR interpolation motion commands.	6
10	Develop a program using teach pendant/simulation software to pick and place the objects and execute it	

TEXT BOOKS

1. Mikell P Groover& Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, "Industrial Robotics Technology Programming and Applications", McGraw Hill, 2017.
2. R.K. Mittal, I.J.Nagrath, Robotics and Controls, Tata Mcgraw Hill Education Pvt.

REFERENCES

3. Deb. S.R, "Robotics Technology and flexible automation", Tata McGraw-Hill Education, 2017.
4. Carl D. Crane and Joseph Duffy, "Kinematic Analysis of Robot manipulators", Cambridge University Press, 2009.
5. Fu. K. S., Gonzalez. R. C. & Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill Book co, 2013.
6. Ray Asfahl. C., "Robots and Manufacturing Automation", John Wiley & Sons.

Suggested Student Activity: In addition to classroom and laboratory learning, **student-centric co-curricular activities** can be undertaken to accelerate the attainment of various outcomes of the course.

- Students should conduct the following activities in groups, prepare a report of about 5 – 10 pages, and collect the physical evidence for the internal assessment.
- Prepare a chart displaying the various types of robots.
- Prepare a chart displaying the various types of grippers.

- Prepare a chart displaying the various types of actuators.
- Prepare a presentation or report on robotic systems used in industries.
- Survey of programming languages used in robotic industries.

Equipment / Facilities required for conducting the Practical Course

1. Computer with Accessories: 30 Nos.
2. Compatible Software: Sufficient quantity
3. Hardware: 6 Axis Robot / Separate devices for the individual task.
4. Teach Pendant control or PC based control through Software.

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters:

Four questions will be asked from every unit; students should write any two questions for 10 marks. The question may have two subdivisions only.

2049234320	CAD for Robotics and Automation	L	T	P	C
Practicum		0	0	4	2

RATIONALE

This course enables students to become familiar with the usage of CAD software and can meet the needs of companies by leveraging skills and knowledge across CAD design in mechanical and electrical engineering. Students practice creating blocks of mechanical, electrical, or electronic components and dynamically inserting them in different layers of assembly/circuit layouts. Exercise also included to enhance design, innovate, open source the existing components from the design centre library, and deliver the design innovation at speed.

COURSE OBJECTIVES

The student will learn to

1	understand the various CAD tools modules and workspace.
2	practice to use CAD tools in mechanical and electrical engineering design.
3	draw the various joints, links, couplings and electrical components.
4	understand the GD&T and finishing symbols used in engineering drawings.
5	procedure to about the blocks and layers.
6	find and apply engineering drafting standards.
7	obtain the required components from the design centre library.
8	edit and customize the imported components as per the design requirements.
9	set print layouts and converting CAD files into required file format for exporting.

COURSE OUTCOMES

On successful completion of this course, the student will able to

CO1	Customize the CAD workspace and tools to improve the productivity in design.
CO2	Draw the mechanical components using CAD commands and modules.
CO3	Apply the block and layers in electrical symbols, layouts and electronic circuits.
CO4	Select the appropriate components available in the design center library
CO5	Convert the CAD file to various file format to export and print out.

2049234320	CAD for Robotics and Automation	L	T	P	C
Practicum		0	0	4	2

PRE-REQUISITES

Knowledge of engineering drawing and mathematics.

MAPPING OF COs WITH POs

	Basic and Discipline Specific knowledge	Problem Analysis	Design / Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering practices for society, sustainability and Environment	Project Management	Life Long Learning
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	3	2	2	3	3	2	2
CO2	3	3	3	3	3	2	3
CO3	3	3	2	3	3	3	2
CO4	3	3	3	3	3	3	3
CO5	3	2	3	3	3	2	2

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

INSTRUCTIONAL STRATEGY

Apart from laboratory skill practices, Teachers should use the following strategies to achieve the various outcomes of the course.

- Different methods of teaching and demonstration to be used to attain the outcomes.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
-

2049234320	CAD for Robotics and Automation	L	T	P	C
Practicum		0	0	4	2

- Micro-projects/ additional exercises may be given to individual/ group of students to encourage self-learning, creativity and innovation.
- Incorporating industry examples and field visit to manufacturing facilities fosters experiential learning.
- Assessment methods include practical assessment exams.

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	5 Exercises-First Cycle (Practical)	5 Exercises-Second Cycle (Practical)	10 Exercises-Record of Work Done (Practical)	Model Examination (Practical)	Practical Examination
Duration	2 hours	2 hours	Regularly	3 hours	3 hours
Exam Marks	60	60	Each Practical 10 Marks	100	100
Converted to	10	10	10	20	60
Marks	10		10	20	60
Internal Marks	40				60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	-

Note:

- CA1 and CA2: All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as given. The marks awarded will be converted to 10 marks for each assessment test. The best one will be considered for the Internal Assessment of 10 marks.

2049234320	CAD for Robotics and Automation	L	T	P	C
Practicum		0	0	4	2

SCHEME OF EVALUATION

Description	Marks
Drawing Component / Assembly / Layout / Circuit	**20**
Blocks, Layers, Annotations/ Symbols	**20**
Print out	**05**
Viva voce	**05**
Total Marks	**50**

- CA3 Record (practical document) of work done should be maintained and the same have to be evaluated after completion of each practical exercise for 10 marks. The total marks awarded should be converted to 10 marks for the internal assessment. The practical document should be submitted for the practical test.

- CA4: After completion of all the exercises, Model examination should be conducted as per end semester exam question pattern. The students shall be permitted to select any one by lot for the test. The model practical examination should be conducted as per the scheme of evaluation as given. The marks awarded should be converted to 20 marks for the internal assessment.

ALLOCATION OF MARKS FOR PRACTICAL EXAMINATION:

Description	Marks
Drawing Component / Assembly / Layout / Circuit	**55**
Blocks, Layers, Annotations/ Symbols	**25**
Print out	**10**
Viva voce	**10**
Total Marks	**100**

2049234320	CAD for Robotics and Automation	L	T	P	C
Practicum		0	0	4	2

SYLLABUS		
Study of AutoCAD: Name of the Topics: Introduction Sectional views, Limits, Fits, Tolerance, GD&T Surface Finish - Draw commands, Dimstyle, Osnap options, Drafting setting and Function keys - Edit and Modify commands, Pedit, Text edit - View groups, Inquiry, Block commands – Hatching – Layer: color and line, properties – Matchprop - File commands, model, layout setting, Plotting, External reference. Introduction to Indian Electricity Rules, List of electrical symbols. **PRACTICAL,**		
Ex. No.	Name of the Experiment	
1	Draw the orthographic top view any two robotic/ mechanical links.	
2	Draw the orthographic top view of any two robotic/ mechanical joints.	
3	Draw the orthographic top view of any two robotic/ mechanical gripper.	60
4	Draw the orthographic view of any two threaded fasteners.	
5	Draw the 2D model of a mechanism for automation (cam and follower).	
6	Draw the assembly of induction motor end elevation top half in section	
7	Create the single line diagram of electrical symbols (switch, wire, contactor, motor, transformer) using layers and block.	
8	Create a single-line diagram of an electrical circuit using the available components in the library or outsourcing on the web.	
9	Prepare the layout/ plan of a robotic work cell using a block diagram.	
10	Prepare a single line diagram of PLC panel wiring consists of the main breaker switch, bus bar, circuit breakers, relays, contactors, PLC, fuses, SMPS, terminal boards, utility sockets, and earthing points.	
TOTAL HOURS		60

TEXT/REFERENCE BOOKS:

BOOK TITLE/AUTHORS/PUBLICATION
Autodesk AutoCAD 2023 and AutoCAD LT 2023, Jaiprakash Pandey Yasser Shoukry
AutoCAD 2023: A Power Guide for Beginners and Intermediate Users, Sandeep Dogra
AutoCAD Electrical 2024 Black Book, Gaurav Verma, Matt Weber
Engineering Drawing, D.N. Ghose, Dhanpat Rai & Sons, Delhi
Machine Drawing, P.S. Gill, Katsan Publishing House, Ludiana
AutoCAD Electrical 2023 for Engineers & Designers By Sham Tickoo

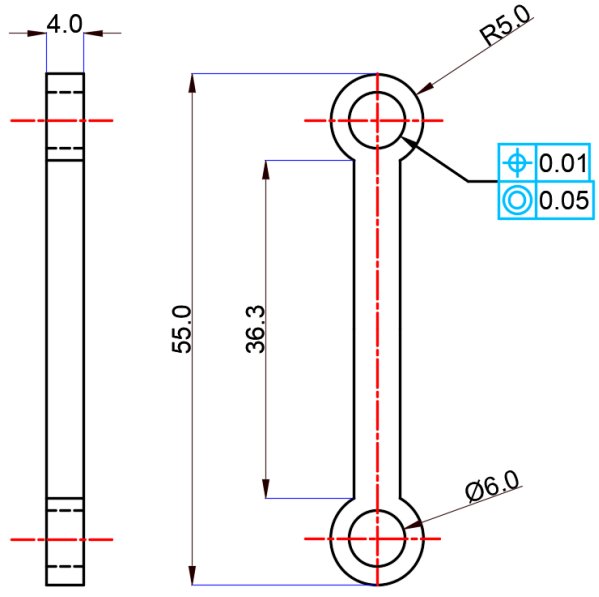
WEB-BASED/ONLINE RESOURCES:

https://www.autodesk.in/campaigns/autocad-tytorials
https://www.mycadsite.com/tutorials.html
https://www.youtube.com/watch?app=desktop&v=Rib-_ZK8KfE
https://www.youtube.com/watch?v=asPzWqRAgRg
https://www.youtube.com/watch?v=xoWmECynYA0
https://www.youtube.com/watch?v=cmR9cfWJRUU
https://www.youtube.com/watch?v=jzLQDEUwiG0 (3 phase induction motor)

LIST OF EQUIPMENTS:

No.	Name of the Equipment	No. of Quantity
1	Personal computer	30
2	Printer	1
3	Required Software: CAD Package AutoCAD (Mechanical and Electrical)	Sufficient to the strength
4	Internet	Sufficient to the strength

Exercise: 1. Orthographic top view of the robotic/ mechanical links.
Links: Links is used in a manufacturing automation cell to perform task of lifting and inserting palettes in a CNC machine (especially in a manufacturing process). Geometric tolerances, dimensioning, and GD&T are included in the 2D engineering drawings.



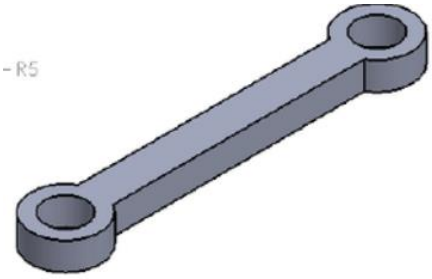
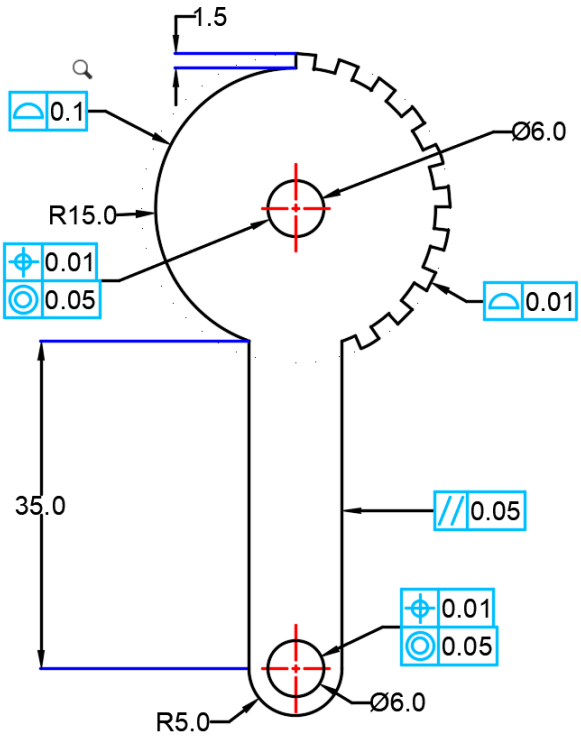
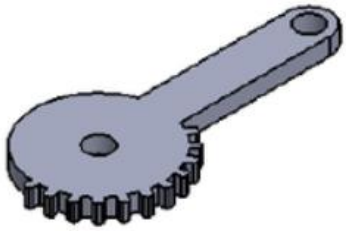


Fig.1 Connecting Rod





ALL DIMESNIONS IN MM

Fig.2 Geared Link

Exercise: 2. Orthographic top view of the robotic/ mechanical joints.

Joints: It connects two shafts/links and also provides support to hold the drive mechanism and actuator.

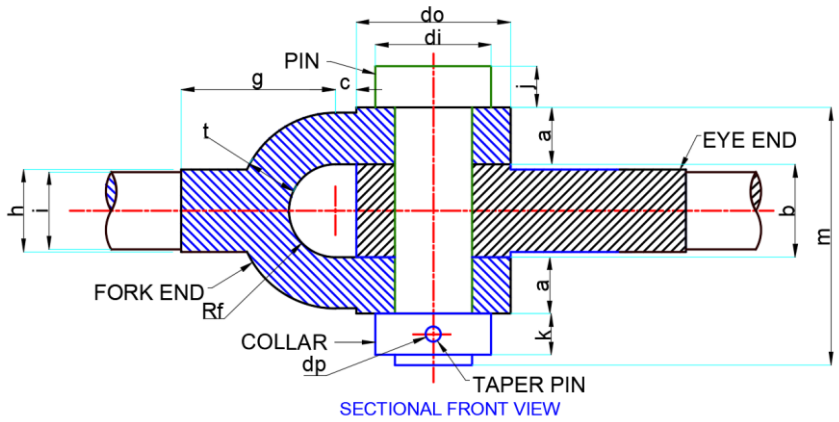


Fig.3 Knuckle joint

Dimension Variable	Value (mm)
a	22
do	60
b	36
c	8
Rf	R18
t	20
di	45
g	60
h	32
i	30
J, k	16
dp	Φ6
m	100

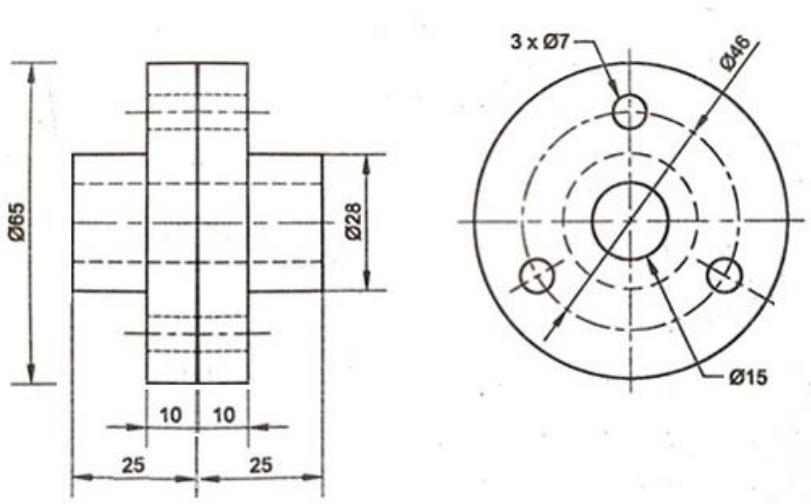


Fig.4 Flange (flange coupling main part)

ALL DIMESNIONS IN MM

Exercise: 3. Orthographic top view of the robotic/ mechanical gripper.

Gripper (End effector): Grippers are mainly used to hold and move objects from one place to another. The two finger gripper is that it is simple and multidisciplinary in its tasks.

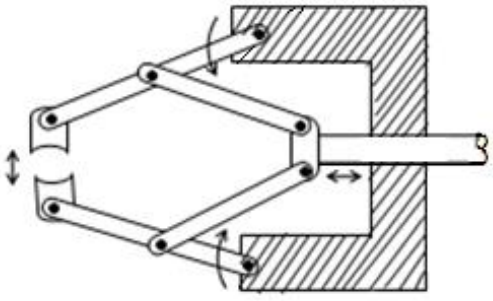
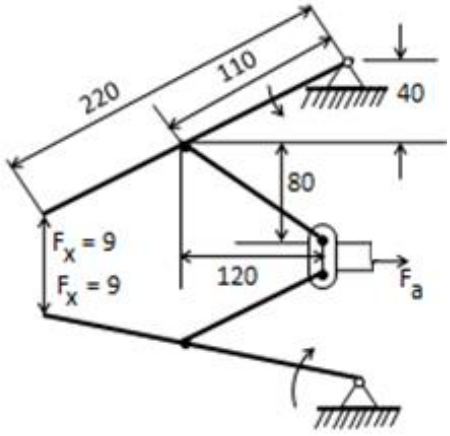


Fig.5. (i) Two finger rotary motion gripper



(ii) Free body diagram for dimension reference only.

Take links width as 12 mm.

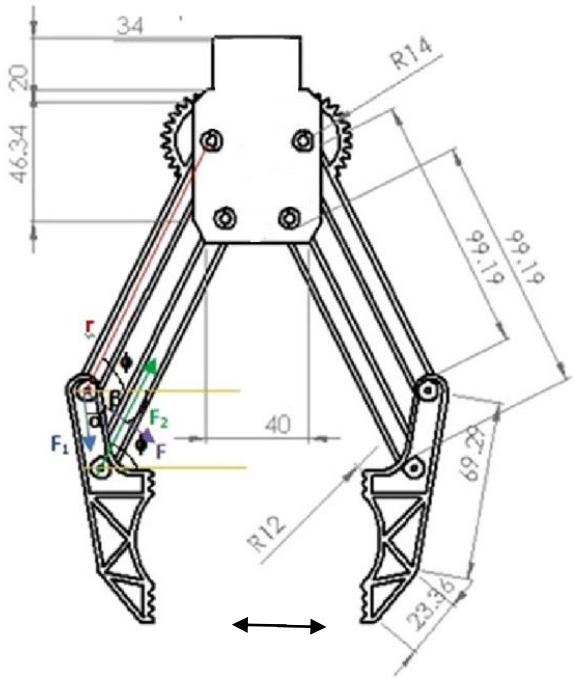


Fig.6. Two finger linear motion gripper

Exercise: 4. Orthographic view of any two threaded fasteners.

Threaded Fastener: *Screwed or threaded fasteners* such as machine screws, bolts and nuts are used to join *machine* parts. They allow for both permanent and removable connections.

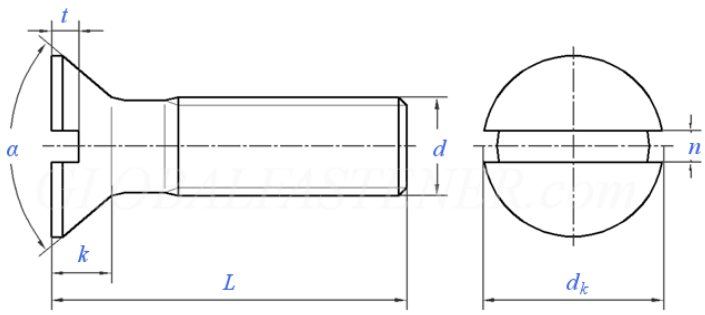
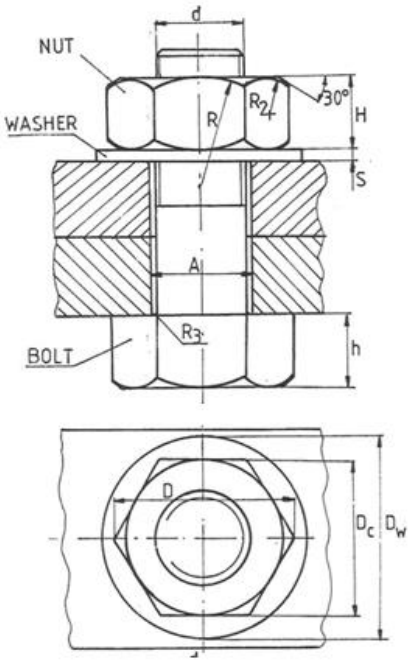


Fig.7. Slotted Flat Countersunk Head Machine Screw

Dimension	Description	mm
d	Nominal Thread Size	6.0
L	max	25.0
d_k	max	12.9
	min	11.5
k	max	2.7
	min	2.4
n	max	1.9
	min	1.6
t	max	1.2
	min	0.8
α	max	82°
	min	80°

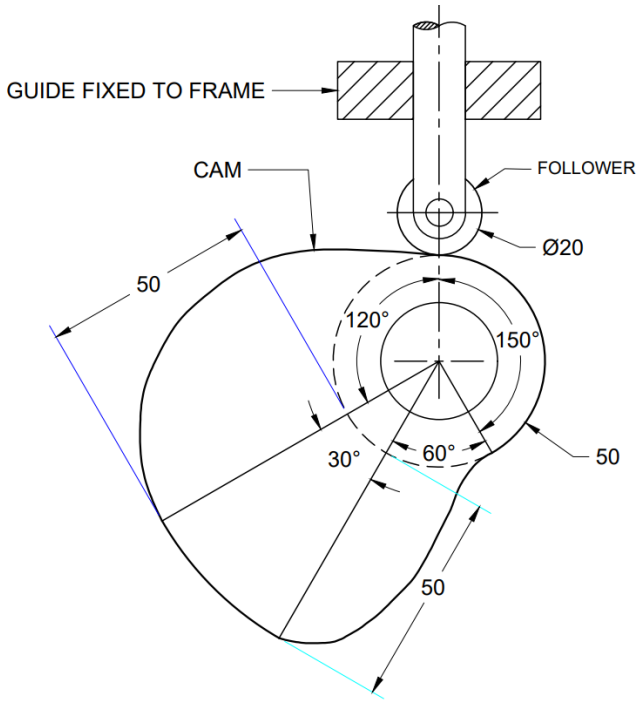


d – nominal diameter
D – 1,7d
Dc–1,5d
H=0,6d
h=0,7d
A=d + 1 mm
R=1,5d
R_1=d
R_2=0,4 d
R_3=0,1d
S = 0,15d
D_w=2d
r =1,25d

Fig.8. Hexagonal Bolt and Nut

Exercise: 5. 2D modeling of the cam and follower mechanism.

Cam and follower: A cam mechanism generally comprises three elements, a cam, a follower and a fixed frame. A cam is a component that gives a specific motion, by its rotation, to the follower. A follower is a component which is in reciprocating or swinging motion.



CAM
Minimum Radius= 25mm
CAM Shaft Diameter= 25mm
Rotation= 100 RPM Clockwise

Roller Follower- Inline with CAM Axis
Roller Diameter= 20mm
Stroke length= 50mm,
Motion During Raise & Lowering: SHM (Simple Harmonic Motion) 1. **Raise** 50mm during 120° Rotation of CAM 2. **Dwell** next 30° 3. **Lower** 50mm during next 60° 4. **Dwell** next 150°

Fig.9 CAM and Follower

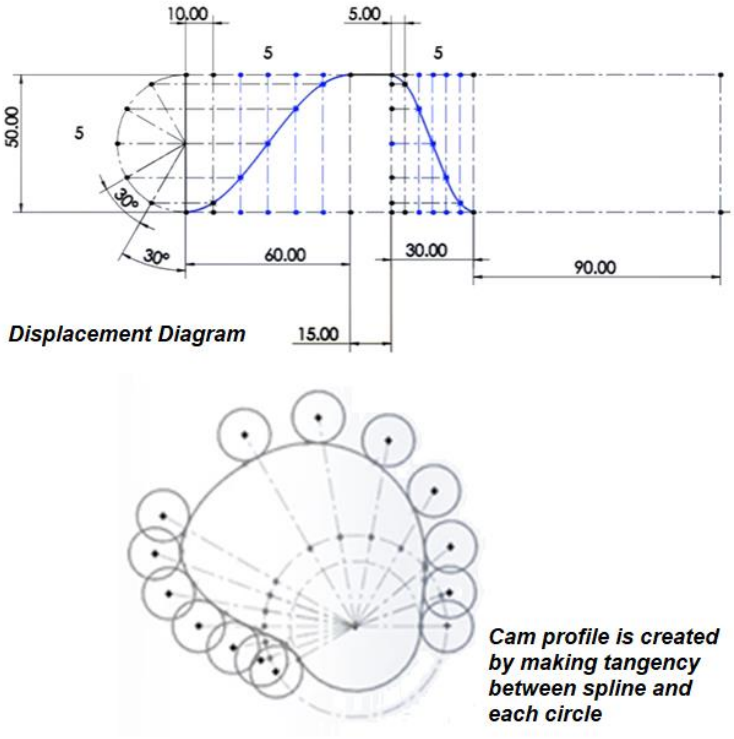


Fig.10 Steps involved in creating CAM

Exercise: 6 Draw the assembly of an induction motor end elevation top half in section.

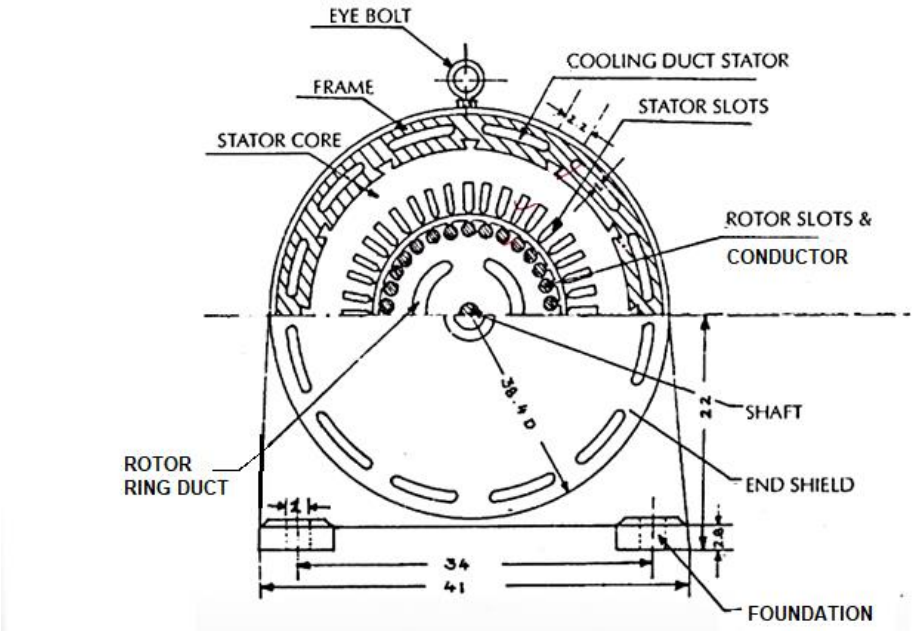


Fig.11 Half sectional side view of an induction motor

Exercise: 7 Create the single line diagram of electrical symbols (switch, wire, contactor, motor, transformer) using layers and block.

Single-Line Diagram: A diagram which shows, by means of single lines and electrical symbols, electric circuit or system of circuits and the component devices.

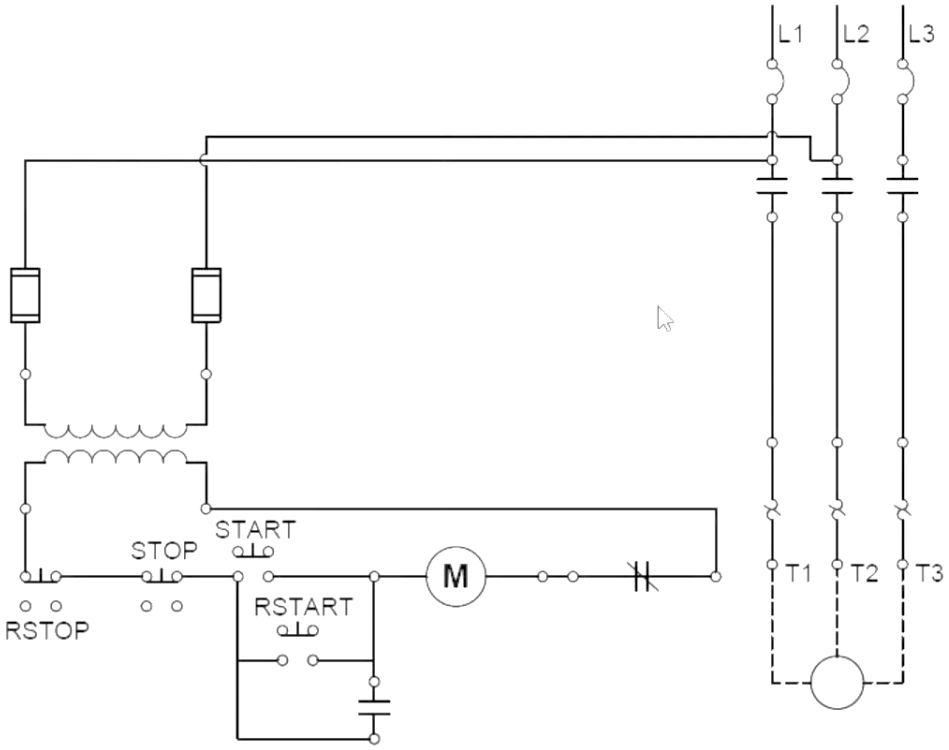


Fig.12 Electrical symbols in a circuit

Exercise: 8 Create a single-line diagram of an electrical circuit using the available components in the library or outsourcing on the web.

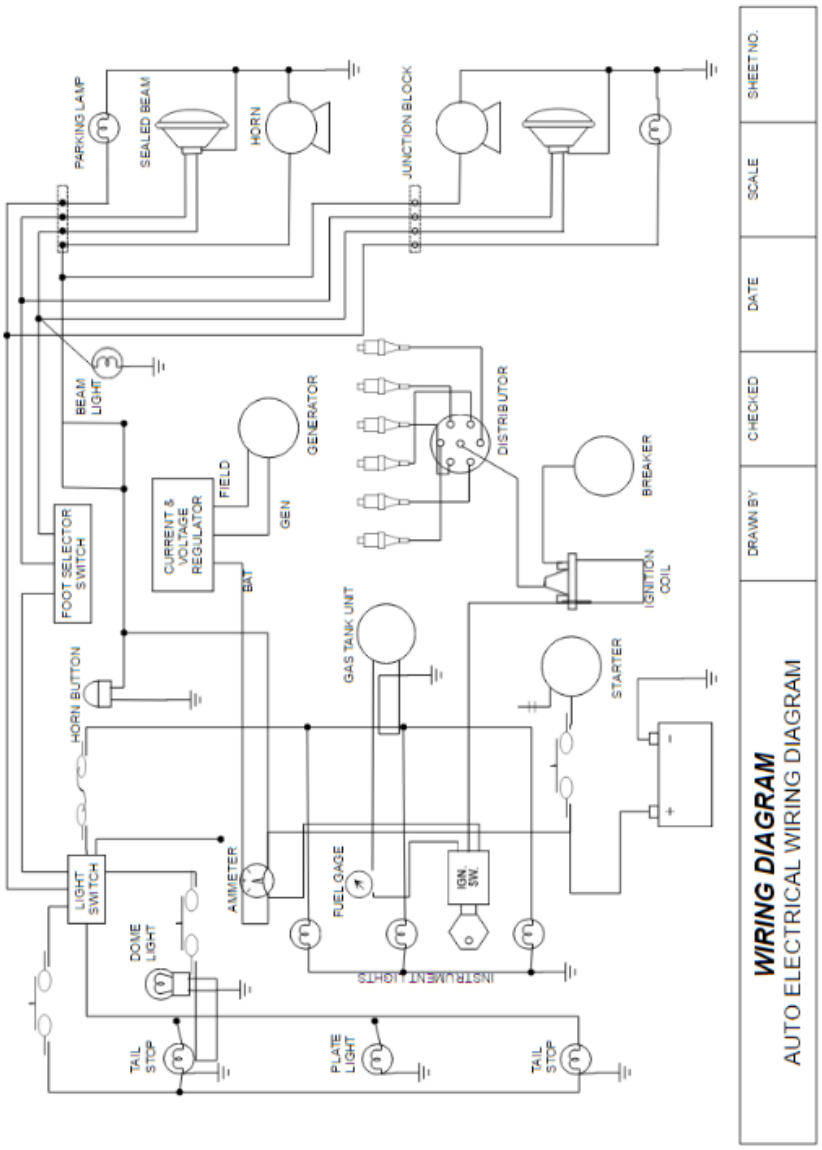
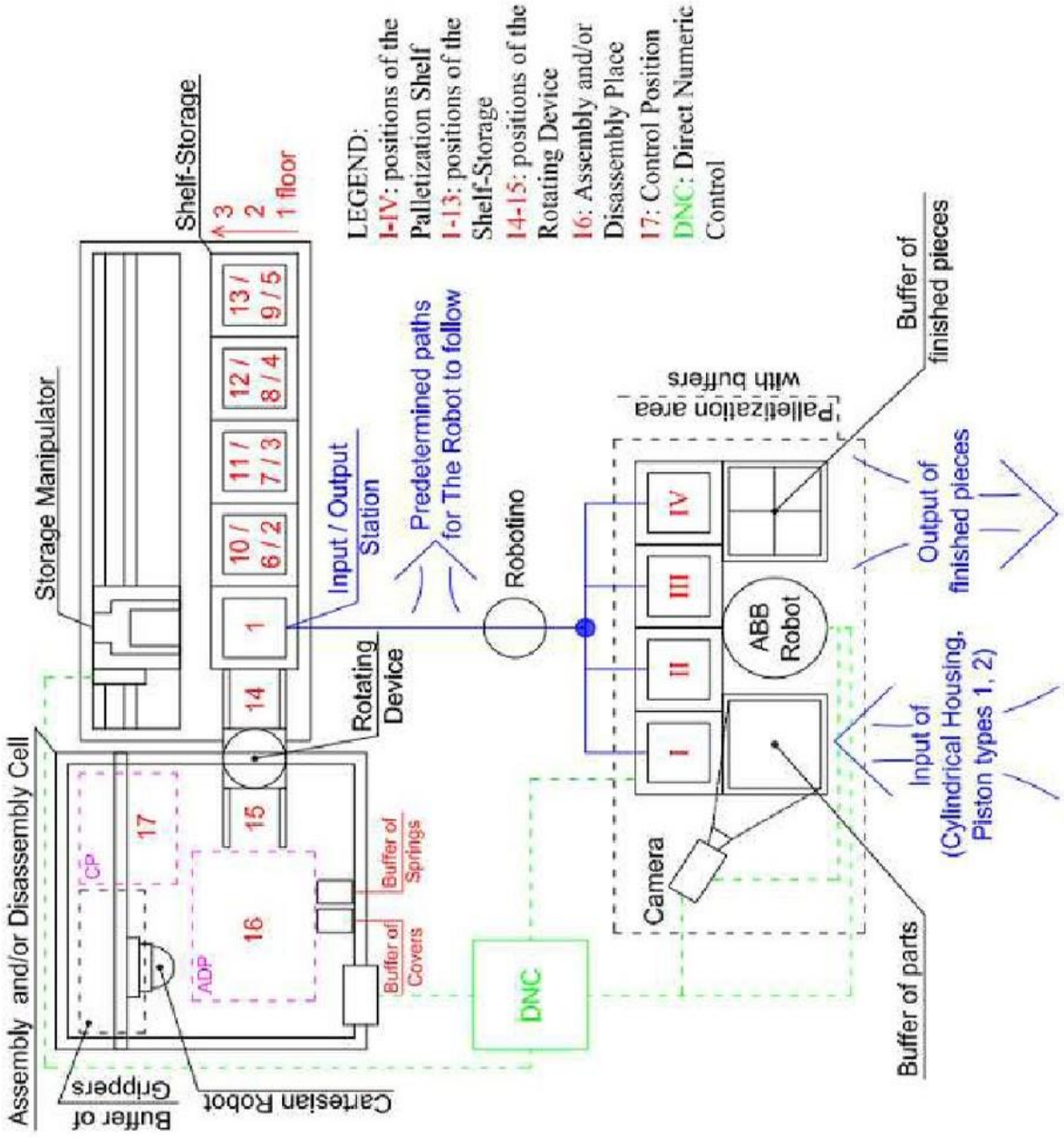


Fig.13 Auto electrical wiring diagram

Exercise: 9. Robotic work cell Layout/Plan using a block diagram

Robotic work cell: It is a complete system that includes the robot, controller, and other peripherals such as a part positioner (palletizer), storage manipulator (ASRS), CNC/DNC and safety environment.



Courtesy: Radovan Holubek, Slovak University of Technology

Fig.14 Detailed Robot work cell layout intended for the Intelligent manufacturing cell

Exercise: 10

Prepare a single line diagram of PLC panel wiring consists of the main breaker switch, bus bar, circuit breakers, relays, contactors, PLC, fuses, SMPS, terminal boards, utility sockets, and earthing points.

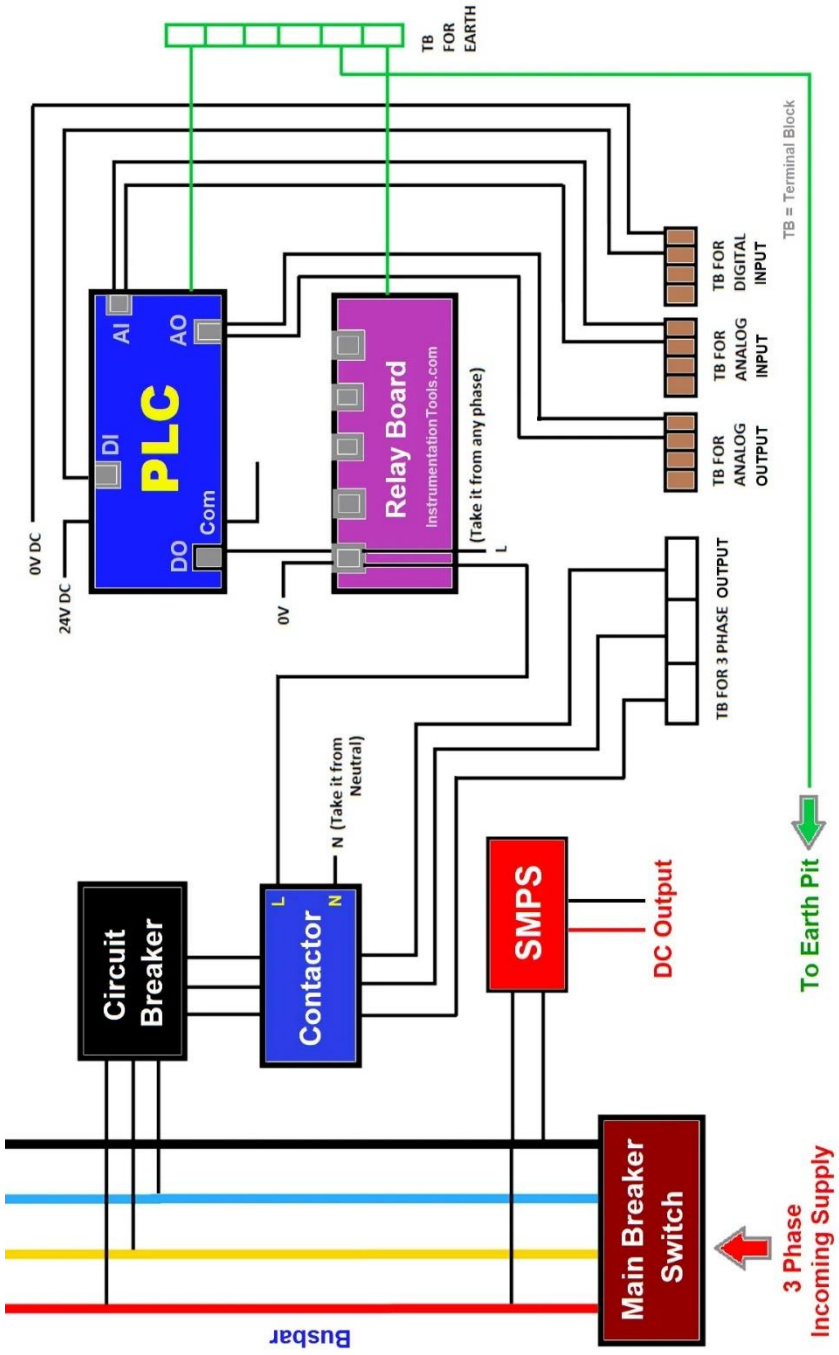


Fig.15 Wiring in PLC Panel

2049234320	CAD for Robotics and Automation	L	T	P	C
Practicum		0	0	4	2

END SEMESTER EXAMINATION – PRACTICAL EXAM

Duration: 3 Hours. **Max. Marks: 100**

Note:

- All the exercises have to be completed, any one exercise will be given for examination.
- All the exercises should be given in the question paper. The student is allowed to select by lot or question papers issued by the DOTE Exam section shall be used.
- Practical documents along with the activity report should be submitted for the End Semester Examinations.

DETAILED ALLOCATION OF MARKS

Description	Marks
Drawing Component / Assembly / Layout / Circuit	**20**
Blocks, Layers, Annotations/ Symbols	**20**
Print out	**05**
Viva voce	**05**
Total Marks	**50**

2049234420	PYTHON PROGRAMMING FOR ROBOTICS	L	T	P	C
Practicum		0	0	4	2

Rationale

Python is a powerful programming language. Python has become one of the most popular programming languages worldwide due to its simplicity, readability, and versatility. A Python programming course provides students with a valuable skillset that is in high demand across various industries, including software development, data science, machine learning, web development, scientific computing, and automation.

Course Objectives

- Familiarize students with the Python programming language, its syntax, basic data types, and control structures.
- Teach fundamental programming concepts such as variables, data types, operators, conditional statements, loops, functions, and error handling using Python
- Explore built-in data structures in Python such as lists, tuples, dictionaries, and sets, and teach students how to manipulate and iterate over these data structures efficiently
- Teach students how to read from and write to files, manipulate file objects, and work with file paths using Python's file-handling capabilities
- Create Functions that can be called from other parts of the code

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Explain fundamental programming concepts such as variables, data types, operators, conditional statements, loops, functions, and error handling using Python.

CO2: Develop a Python program to demonstrate the use of operators.

CO3: Perform operations on data structures in Python.

CO4: Develop functions for the given problem.

CO5: Implement and analyze existing learning algorithms, including well-studied methods for classification and regression.

Pre-requisites

1. Basic understanding of computer science concepts.
2. Familiarity with programming fundamentals, such as variables, loops, and conditionals.
3. Knowledge of basic mathematics and logic.

2049234420	PYTHON PROGRAMMING FOR ROBOTICS	L	T	P	C
Practicum		0	0	4	2

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	2	2	1	1	2
CO2	3	1	3	3	1	1	2
CO3	3	1	3	3	1	1	3
CO4	3	2	3	3	1	1	3
CO5	3	2	3	3	1	1	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Massive open online courses (MOOCs) may be used to teach various topics.
- The topics that are relatively simpler or descriptive are to be given to the students for **self-directed learning** and assess the outcomes through classroom seminars or group discussions.
- Teachers must ensure to create opportunities for co-curricular activities.
- Videos and simulations may be used to teach various topics.
- Encourage students to refer to different case studies to have deeper understanding of the subject.
- Observe and continuously monitor the performance of the student in the laboratory.

2049234420	PYTHON PROGRAMMING FOR ROBOTICS	L	T	P	C
Practicum		0	0	4	2

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Practical Document	Practical Test	Practical Examination
Portion	First Cycle	Second Cycle	All Exercises	All Exercises	All Exercises
Duration	2 Periods	2 Periods	Regularly	3 Hours	3 Hours
Exam Marks	50	50		100	100
Converted to	10	10	10	20	60
Marks	10		10	20	60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

CA1 and CA2: All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the evaluation scheme as below. The marks awarded will be converted to 10 Marks for each assessment test. The best of one will be considered for the internal assessment of 10 Marks.
Cycle I: 1 to 6.
Cycle II: 7 to 12.

SCHEME OF EVALUATION

Aim & Algorithm	: 05 Marks
Program	: 20 Marks
Execution	: 20 Marks
Result	: 05 Marks
Total	**: 50 Marks**

CA 3: Practical document should be maintained for every exercise immediately after completion of the practice. The same should be evaluated for 10 Marks. The total marks awarded should be converted to 10 Marks for the internal assessment. The practical document should be submitted for the Practical Test and End Semester Examination with a bonafide certificate

2049234420	PYTHON PROGRAMMING FOR ROBOTICS	L	T	P	C
Practicum		0	0	4	2

The details of the documents to be prepared as per the instruction below.

Each exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or the next day of practice before the commencement of the next exercise.

This documentation can be carried out in a separate notebook or printed manual or a file with the documents. The procedure and sketch should be written by the student manually.

The detailed dates of the practices and their evaluations should be maintained in the course logbook. The logbook and the practical documents should be submitted for verification by the Flying Squad and DOTE Official.

CA 4: All the exercises should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test (CA4) should be conducted as per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment.

SCHEME OF EVALUATION

Aim & Algorithm	: 10 Marks
Program	: 30 Marks
Execution	: 30 Marks
Result	: 20 Marks
Viva Voce	: 10 Marks
Total	**: 100 Marks**

2049234420	PYTHON PROGRAMMING	L	T	P	C
Practicum		0	0	4	2

INTRODUCTION AND SYNTAX OF PYTHON	
The Python Programming Language, History, features (interactive, object-oriented, interpreted, platform independent). Python building blocks: Identifiers, Keywords, Indention, Variables, Comments. Python environment setup – Installation and working of IDE Running simple python script to display message. Python data types: Numbers, Strings, Tuples, Lists, Dictionary. Declaration and Types Basic operators: Arithmetic, Comparison, Assignment, Logical, Bitwise, Membership, Identity operators. Control Flow: Conditional Statements: if, if-else, nested if –else Looping: for, while, nested loops	8

	Loop manipulation using continuous, pass, break, etc. Lists, tuples, and their operations in Python - String manipulation and dictionary data structure in Python - Functions, function definition, parameters, and return statement. File handling in Python (open, read, write, close) - Exception handling in Python (try, except, finally) - Python modules and packages, importing modules.	
1	Install Python and write a simple program to display message on the screen.	52
2	Write a program to perform different Arithmetic Operations on numbers in Python.	
3	Implement a program to find the largest of three numbers using if-elif-else.	
4	Write a program to create, append, and remove lists in python.	
5	Write a program to find maximum of two numbers in python list.	
6	Write a program to create, concatenate and print a string	
7	Write a program for row wise element addition in tuple matrix.	
8	Write a program to demonstrate working with dictionaries in python.	
9	Write a program to read a file and count the number of words in it.	
10	Write a python program to define a module and import a specific function in that module to another program	
11	Implement a python program for simple class and create objects.	
12	Develop a program to create a simple GUI application.	

Text and Reference Books:

7. "Python Crash Course" by Eric Matthes, No Starch Press, 2nd Edition, 2019.
8. "Python Programming: An Introduction to Computer Science" by John Zelle, Franklin, Beedle & Associates Inc., 3rd Edition, 2016.
9. "Learning Python" by Mark Lutz, O'Reilly Media, 5th Edition, 2013.
10. "Python Cookbook" by David Beazley and Brian K. Jones, O'Reilly Media, 3rd Edition, 2013.

Web-based/Online Resources:

11. https://www.python.org/ - Official Python website with documentation and tutorials.
12. https://www.codecademy.com - Offers Interactive Python programming courses.
13. https://www.geeksforgeeks.com/ - Provides Python programming tutorials and practice questions.

2049234420	PYTHON PROGRAMMING FOR ROBOTICS	L	T	P	C
Practicum		0	0	4	2

Suggested Student Activity: In addition to classroom and laboratory learning, **student-centric co-curricular activities** can be undertaken to accelerate the attainment of various outcomes of the course.

1. Write a program to calculate the factorial of a number.
2. Create a simple calculator program using Python functions.
3. Develop a program to manage a student database using dictionaries.
4. Implement a basic text-based game using Python classes.
5. Write a program to simulate a bank account management system.
6. Create a program to analyze and visualize data using matplotlib.
7. Develop a web scraper to extract information from a website.
8. Write a program to automate file handling tasks, such as renaming files in a directory.
10. Create a program to generate and analyze statistical data sets using numpy and pandas.

Equipment / Facilities required for conducting the Practical Course

HARDWARE
1. Desktop Computers – 30 Nos
2. Printer – 1 Nos

SOFTWARE
1. Python 3.x

END SEMESTER EXAMINATION – PRACTICAL EXAM

Duration: 3 Hours. **Max. Marks: 100**

Note:

- All the exercises have to be completed, any one exercise will be given for examination.
- All the exercises should be given in the question paper. The student is allowed to select by lot or question papers issued by the DOTE Exam section shall be used.
- Practical documents along with the activity report should be submitted for the End Semester Examinations.

DETAILED ALLOCATION OF MARKS

Aim & Algorithm	: 10 Marks
Program	: 30 Marks
Execution	: 30 Marks
Result	: 20 Marks
Viva Voce	: 10 Marks
Total	**: 100 Marks**

2049234540	FLUID POWER AUTOMATION	L	T	P	C
Practicum		2	0	4	4

Rationale

Fluid power automation, encompassing hydraulic and pneumatic systems, is widely adopted in various industries due to its numerous advantages.
Hydraulic systems can generate a significant amount of power relative to their size and weight. This makes them suitable for applications requiring high force and torque in compact spaces, such as heavy machinery and construction equipment.
Pneumatic and hydraulic systems offer precise control over force, speed, and movement. This precision is essential in applications like robotics, material handling, and manufacturing, where accuracy is crucial for performance and safety.
These benefits make fluid power systems an essential component in modern automation across various industries.

Course Objectives

On successful completion of the course, the students must be able to

- Understand the basic concepts and principles of industrial automation.
- Explain the role of automation in modern manufacturing and production processes.
- Understand the basic principles of fluid power.
- Understand the need for a Hydraulics and Pneumatics system in industries.
- Explain the working principles of Pneumatic components and their selection.
- Explain the working principles of Hydraulic components and their selection.
- Develop a Hydraulic and Pneumatic control circuit for various industrial applications.
- Develop practical skills through hands-on lab exercises, including assembling, testing, and troubleshooting hydraulic and pneumatic circuits.

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Explain the role of automation in modern manufacturing and production processes.
CO2: Demonstrate a thorough understanding of the fundamental principles of hydraulics and pneumatics.
CO3: Design basic to complex hydraulic and pneumatic circuits, demonstrating an understanding of system requirements and constraints.
CO4: Analyze and interpret fluid power schematics and diagrams to troubleshoot and optimize system performance.
CO5: Implement various control methods for fluid power systems, including manual, electrical, and electronic controls.

Pre-requisites

Knowledge about the behavior of fluids.

2049234540	FLUID POWER AUTOMATION	L	T	P	C
Practicum		2	0	4	4

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	2	2	3	1	2
CO2	3	2	3	3	3	1	2
CO3	3	2	3	3	3	1	3
CO4	3	2	3	3	3	1	3
CO5	3	2	3	3	3	1	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Massive open online courses (MOOCs) may be used to teach various topics.
- The topics that are relatively simpler or descriptive are to be given to the students for **self-directed learning** and assess the outcomes through classroom seminars or group discussions.
- Teachers must ensure to create opportunities for co-curricular activities.
- Videos and simulations may be used to teach various topics.
- Encourage students to refer to different textbooks and case studies to have deeper understanding of the subject.
- Observe and continuously monitor the performance of the student in the laboratory.
- Instruct students about safety concerns of fluid power systems and avoid any damage to the components.

2049234540	FLUID POWER AUTOMATION	L	T	P	C
Practicum		2	0	4	4

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Experiments/ 50% Experiments	Cycle II Experiments/ Another 50% Experiments	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

CA1 and CA2: All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The experiment should be completed on the day of practice.

The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook / printed manual / file. The Circuit Diagram, Readings, Calculations and Graph/Result should be written by the student manually.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

Scheme of Evaluation

Circuit Diagram	: 20 Marks
Connection and Execution	: 20 Marks
Result	: 05 Marks
Viva Voce	: 05 Marks
Practical Document	: 10 Marks
Total	**: 60 Marks**

CA 3: A written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

CA 4: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

2049234540	FLUID POWER AUTOMATION	L	T	P	C
Practicum		2	0	4	4

SCHEME OF EVALUATION

A. Circuit Diagram	: 25 Marks
B. Connection and Execution	: 25 Marks
C. Result	: 10 Marks
D. Written Test	: 30 Marks
E. Viva Voce	: 10 Marks
F. Total	**: 100 Marks**

Note: For the written test 30 MCQ shall be asked from the theory portions.

2049234540	FLUID POWER AUTOMATION	L	T	P	C
Practicum		2	0	4	4

Unit I	Introduction to Fluid Power Automation	
	Introduction to Automation – Definition - Need for Automation - Elements of an Automated System - Benefits and Impact of Automation in Manufacturing and Process Industries - Types of Automation (Fixed/Hard Automation, Programmable Automation, Flexible/Soft Automation) - Industrial Control Systems (Continuous, Discrete, Sequential logic, Supervisory) – Hierarchy of industrial automation systems (Five Layer Pyramid) - Low-cost automation (Brief introduction, features and benefits only) Fluid Power System: Definition, Types, Application and Advantages of Fluid Power – Illustration of Pascal's Law - Comparison of Hydraulics and Pneumatics – Fluid Properties (Density, Specific Gravity, Specific Weight, Viscosity, Kinematic Viscosity, Bulk Modulus, Pour Point, Oxidation Resistance)	6
UNIT II	**HYDRAULIC PUMPS AND ACTUATORS**	
	Hydraulic Pumps and Actuators: Pumps: Classification of pumps – Principle of Positive displacement pumps – Construction and Working of External Gear pumps, Balanced Vane pumps and Inline Axial Piston pump – Pump Performance Characteristics – Pump selection factors – Accumulator and Types – Gas loaded accumulator – Pressure intensifier Actuators: Classification of actuators – Linear actuator: Definition and Types – Single acting cylinder – Telescopic cylinder – Tandem cylinder. Rotary actuators: Definition and Types – Gear motor – Two vane semi rotary actuator – Rack and Pinion semi rotary actuator. ISO symbols of hydraulic pumps and actuators.	8

UNIT III	HYDRAULIC CONTROL COMPONENTS AND HYDRAULIC CIRCUIT DESIGN	
	Control Valves: Classification of valves – Comparison of Poppet Valve, Sliding Spool and Rotary Spool Valves DCV: Two-way valve – Three-way valve – Four-way valve – Check valve – Valve actuation types. FCV: Needle valve PCV: Pilot operated Pressure relief valve – Pressure sequence valve Hydraulic Circuit Design: Control of single acting cylinder – Control of double acting cylinder – Counterbalance circuit – Pressure sequence circuit – Hydraulic regenerative circuit – Pressure intensification circuit.	7
Unit IV	**PNEUMATIC SYSTEM**	
	Pneumatic system: Basic principle and its structure - Compressor Types – Two stage piston Compressor – Air treatment – FRL unit – 5/2 DCV – Double pilot dcv - Quick exhaust valve – Shuttle valve – One way FCV - Pneumatic double acting cylinder.	5
Unit V	**ELECTRO-PNEUMATICS**	
	Control Circuit Components: Switches – Push button, selector, proximity switch, Reed switch. Electromagnetic Relays – Electronic Timer. Double Solenoid Pneumatic Valve, Electrohydraulic Servo and proportional valves.	4
S. No	**Name of the Experiment**	
	Hydraulic Exercises	
1	Control of single acting cylinder and double acting cylinder.	60
2	Speed control of double acting cylinder using meter–in and meter–out circuit	
3	Sequence operation of two double acting cylinders using a pressure sequence valve.	
	Pneumatic Exercises	
4	Direct actuation of cylinders (Single Acting and Double Acting).	
5	Operation of double acting cylinder using shuttle valve and dual pressure valve.	
6	Operation of the double acting cylinder using a quick exhaust valve.	
7	Automatic operation of double acting cylinder – single cycle using limit switch and pilot valve.	

2049234540	FLUID POWER AUTOMATION	L	T	P	C
Practicum		2	0	4	4

Electro-hydraulic and Electro-pneumatic Exercises	
8	Operation of the hydraulic motor using a solenoid valve.
9	Indirect actuation of a pneumatic cylinder using a relay.
10	Logic control circuit for pneumatic actuator (AND Logic and OR Logic)

Text Book:

1. Industrial Hydraulics –Third Edition John J. Pippenger Tyler, G.Hicks. McGraw -Hill Book Company.
2. Introduction to Fluid Power--James L. Johnson. -Delmar Thomson Learning Inc.
3. Control of Electrical Machines. S.K. Bhattacharya New Age International Publishers, New Delhi

Reference Books:

14. Hydraulics and Pneumatics - (HB) Adrewparr –Jaico Publishing House.
15. Pneumatic and Hydraulic Systems - Bolton W. Butterworth-Heinemann-1987
16. Industrial motor control. Stephen Herman 6th Edition, Cengage Learning.

Web-based/Online Resources:

- https://nptel.ac.in/courses/105103096
- https://archive.nptel.ac.in/courses/112/106/112106300/
- https://www.youtube.com/watch?v=YDZJCSKFvns&list=PLB96E97514E04836E
- https://www.youtube.com/watch?v=Isc08DU6WTE&list=PLPV5qNu37aSHjqAOMFgH8p7iZ2XzCfBwK

Suggested Student Activity: In addition to classroom and laboratory learning, **student-centric co-curricular activities** can be undertaken to accelerate the attainment of various course outcomes.

- Students should conduct the following activities in groups, prepare a report of about 5 – 10 pages, and collect the physical evidence for the internal assessment.
- Conduct an internet survey and make a list of leading manufacturers of fluid power components and other automation tools.
- Identify the industrial standards followed in fluid power automation.
- Read the safety precautions to be followed for the installation of fluid power automation.
- Prepare a presentation or report on troubleshooting techniques.
- Observe the working of a Hydraulic Jack at any garage and relate it with Pascal's
- law.

2049234540	FLUID POWER AUTOMATION	L	T	P	C
Practicum		2	0	4	4

Equipment / Facilities required for conducting the Practical Course

Sl. No	Name of Equipment's	Quantity Required
Pneumatics Lab		
1.	Basic Trainer Kit	2 No's
2.	Electro Pneumatic Trainer Kit	2 No's
Hydraulic Lab		
3	Basic Trainer Kit	2 No's
4.	Electro Hydraulic Trainer Kit	1 No
Control Circuit Component		
5.	Sensors 1) Proximity Sensors 2) Limit Switches 3) Reed switch	 4 No's 8 No's 4 No's
6.	Push button (NO & NC Contact)	Each 10 No's

END SEMESTER EXAMINATION – PRACTICAL EXAM
BOARD EXAMINATION

Duration: 3 Hours. **Max. Marks: 100**

Note:

All the exercises should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises / experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by the DOTE Exam section shall be used. The record of work done by the student should be submitted with a Bonafide Certificate.

DETAILED ALLOCATION OF MARKS

A. Circuit Diagram	: 25 Marks
B. Connection and Execution	: 25 Marks
C. Result	: 10 Marks
D. Written Test	: 30 Marks
E. Viva Voce	: 10 Marks
F. Total	**: 100 Marks**

Note: For the written test 30 MCQ shall be asked from the theory portions.

2049234640	Microcontroller and Applications	L	T	P	C
Practicum		2	0	4	4

Introduction:

Introducing this subject will enable the students to learn about microcontroller 8051 architecture, Instruction sets, Programming and interfacing. This subject enables the students to do the project effectively. It also helps the students to choose their field of interest. This subject is the foundation if the student is aiming for higher studies.

Course Objectives:

- Know the difference between microprocessor and microcontroller, architecture of 8051.
- Learn the Instruction set and write programs using 8051 ALP.
- Understand the programming of I/O ports, Timer, Interrupt and Serial Programming.
- Learn the interfacing techniques
- Learn PIC Microcontroller

Course Outcomes:

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

CO1: Discuss the fundamentals of the 8051 microcontroller.

CO2: Create and develop programs using 8051.

CO3: Create and develop applications for 8051 peripherals.

CO4: Understanding the interfacing techniques for 8051.

CO5: Explain the features of the PIC Microcontroller.

Pre-requisites

Knowledge of basic science and simple programming.

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	1	1	1	-	1
CO2	3	3	2	1	1	-	1
CO3	3	3	2	1	1	-	1
CO4	3	3	2	1	1	-	1
CO5	3	3	2	1	1	-	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

2049234640	Microcontroller and Applications	L	T	P	C
Practicum		2	0	4	4

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Experiments/ 50% Experiments	Cycle II Experiments/ Another 50% Experiments	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

2049234640	Microcontroller and Applications	L	T	P	C
Practicum		2	0	4	4

Note:

CA1 and CA2: All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents are to be prepared as per the instructions below.

The experiment should be completed on the day of practice.

The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook / printed manual / file. The Circuit Diagram, Readings, Calculations and Graph/Result should be written by the student manually.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

Scheme of Evaluation

Part	Description	Marks
A	Aim & Procedure	05
B	Program	20
C	Connections/Execution	20
D	Output	05
E	Practical Documents	10
TOTAL MARKS		**60**

CA 3: A written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

2049234640	Microcontroller and Applications	L	T	P	C
Practicum		2	0	4	4

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

CA 4: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim & Procedure	10
B	Program	20
C	Connection & Execution	20
D	Output	10
E	Written Test (Theory Portions)	30
E	Viva voce	10
TOTAL MARKS		**100**

Note: For the written test 30 MCQ shall be asked from the theory portions.

2049234640	Microcontroller and Applications	L	T	P	C
Practicum		2	0	4	4

Unit I	Architecture of 8051	
Block diagram of Microcontroller — Comparison with Microprocessor and Microcontroller – Pin details of 8051 – ALU – Special function registers — ROM — RAM — RAM Memory Map (including registers and register banks) – Program Counter – PSW register –Stack - I/O Ports — Timer — Interrupt — Serial Port — External memory – Clock – Reset – Clock Cycle – Machine Cycle – Instruction cycle – Instruction fetching and execution – Overview of 8051 family		5
Unit II	**Instruction Set and Programming**	
Assembling and running an 8051 program – Instruction set of 8051 – Data transfer instructions – Different addressing modes – Arithmetic Instructions – Signed number concepts and arithmetic operations – Logic and Compare instructions — Rotate instruction and data serialization — BCD, ASCII — Loop and jump instructions — Call instructions – Time delay routines – Program control – Assembler directives – Sample programs.		5
Exp. No	**Name of the Experiments**	**Hrs.**
1	Write a program for Addition, Subtraction, Multiplication, and Division of two numbers and execute the same in the 8051 trainer kit.	12
2	Write a program to convert BCD number into a hexadecimal number.	
3	Write a program for Parity Bit.	
Unit III	**I/O, Timer, Interrupt and Serial Programming**	
Bit addresses for I/O and RAM — I/O programming — I/O bit manipulation programming – Programming 8051 Timers – Counter programming – Basics of Serial programming – 8051 connection to RS 232 — 8051 Serial Port Programming — 8051 interrupt — Programming Timer Interrupt — Programming external hardware interrupts – Programming the serial communication interrupt –Interrupt priority in 8051		5
Exp. No	**Name of the Experiments**	**Hrs.**
4	Write a program to generate square wave signal of 10 kHz using Timer 0.	12
5	Write a program to interface a switch or proximity sensor, LED and relay with 8051 and test it.	
6	Write a Program for moving a data to port.	

Unit IV	**Interfacing External Device with 8051** 8051 interfacing to external memory – 8051 interfacing with the 8255 – (Programs are to be written in Assembly for the following interfacing applications) Relays and Opto isolators — Sensors interfacing and signal conditioning – Parallel ADC and Serial ADC interfacing – DAC interfacing - Keyboard interfacing – Seven segments and LCD display interfacing – Stepper Motor interfacing – DC motor interfacing and PWM - RTC Interfacing-Interfacing with I2C Bus and SPI Bus	5
Exp. No	**Name of the Experiments**	**Hrs.**
7	Write a Program for interfacing seven segments of LED displays and test it	12
8	Write a Program for interfacing STEPPER MOTOR and test it.	
9	Write a program to display the string to 16 x 2 LCD to 8051	
Unit V	**PIC**	
Overview of PIC 18 family-PIC 18 Features-PIC Architecture -WREG Register in the PIC-PIC File Register-File register and access bank in PIC 18- PIC Status Register- Program counter in the PIC-ROM memory map in the PIC18-Where the PIC wakes up when it is powered up-Placing code in Program ROM-Executing a program byte by byte-ROM Width in the PIC18-Harvard architecture in the PIC-RISC architecture in the PIC-Features of RISC, PIC Instructions- MOVWF instructions-COMF instruction-DECF instruction –MOVF instruction-ADDLW instruction and Status Register		5
Exp. No	**Name of the Experiments**	**Hrs.**
10	Write a program to Generate square wave P16f877A	12
11	Write a program to interface a relay with PIC16F877A	
12	Write a Program for interfacing DC motor and PIC16F877A.	
Total Hours		**60**

Suggested List of Students Activity

- Presentation/Seminars by students on any recent technological developments based on the course
- Periodic class quizzes conducted on a weekly/fortnightly based on thecourse
- Micro project that shall be an extension of any practical lab exercise to real-world application.

Reference

1. “Microcontrollers : Principles And Applications”, Pal Ajit EEE, PHI ,New Delhi
2. “The 8051 Microcontrollers: Architecture, Programming and Applications”, RaoDr. KUma Pearson Education India, New Delhi

3. "The 8051 microcontroller and embedded systems", Mazidi Ali, MuhammadMazidi, Gillispie Janice PHI, New Delhi
4. "The 8051 Microcontroller", Mackenzie Pearson Education India, New Delhi
5. "Microprocessor and Microcontroller", R. Theagarajan, Sci Tech Publication,Chennai.

Text Books

1. "Design with PIC Microcontrollers", by John B. Peatman
2. "Beginning Arduino", by Michael McRoberts
3. "Getting Started with Raspberry Pi", by Matt Richardson
4. "Internet of Things 2nd Edition", by Samuel Greengard
5. "Internet of Things, 2ed", by Shriram K Vasudevan

Web-based/Online Resources

1. https://www.electronics-tutorials.ws/
2. https://learn.sparkfun.com/
3. https://www.allaboutcircuits.com/textbook/digital/
4. http://electronicstheory.com/COURSES/ELECTRONICS/e101-1.htm
5. https://www.gadgetronicx.com/electronic-circuits-library/
6. https://www.electronics-lab.com/
7. https://learn.adafruit.com/
8. https://www.instructables.com/circuits/
9. https://www.electrical4u.com/digital-electronics/

List of Equipment required for a batch of 30 students

S. No	Name of the Equipment	Quantity required
1.	AT89C51/52 Evaluation Board or Trainer kit with ISP	15 No's
2.	PIC 16F877A Evaluation board or Trainer kit	6 No's
3.	Digital I/O Boards	2 No's
4.	Seven segment LED display interface board	2 No's
5.	8 Bit ADC Interface Board	2 No's
6.	DC Motor control Interface board	2 No's

7.	Temperature Sensors LM 35	5 No's
8.	Proximity Sensors	5 No's
9.	Desktop Computer	15 No's
10.	8051 simulation software – (μVision Keil software)	Any one free software
11.	PIC Simulation software - (MPLab, ..)	Any one free software

2049234640	Microcontroller and Applications	L	T	P	C
Practicum		2	0	4	4

END SEMESTER EXAMINATION – PRACTICAL EXAM
BOARD EXAMINATION

Duration: 3 Hours. **Max. Marks: 100**

Note:

All the exercises should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises/experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by the DOTE Exam section shall be used. The record of work done by the student should be submitted with a Bonafide Certificate.

Allocation of Marks for End Semester Board Practical Examination

Part	Description	Marks
A	Aim & Procedure	10
B	Program	20
C	Connection & Execution	20
D	Output	10
E	Written Test (Theory Portions)	30
E	Viva voce	10
TOTAL MARKS		**100**

Note: For the written test 30 MCQ shall be asked from the theory portions.

Regulation 2023

2049 - Diploma in Robotics and Automation (Full Time – Regular)

2149 – Diploma in Robotics and Automation (Sandwich)

1144 – Diploma in Automation and Robotics (Full Time – Regular)

V SEMESTER SYLLABUS

2049235110	SENSORS, ACTUATORS AND FABRICATION OF	L	T	P	C
Theory	ROBOTS	3	0	0	3

Rationale

Robotics is an interdisciplinary field that integrates knowledge from computer science, mechanical engineering, electrical engineering, and mathematics. A fundamentals course provides students with a broad foundation across these disciplines, preparing them for advanced studies and careers in robotics. With the increasing automation of various industries, there is a growing demand for professionals skilled in robotics. A fundamentals course equips students with the basic knowledge and skills needed to enter the workforce and contribute to the design, development, and implementation of robotic systems

Course Objectives

On successful completion of the course, the students must be able to

- Understand the concepts of measurement technology.
- Learn the various sensors used to measure various physical parameters.
- Introduce students the criteria for selecting a sensor for a particular measurement.
- Elucidate students the types of actuators: electrical, pneumatic, and hydraulic and enlighten their operation.
- Introduce students to different methods of fabrication used in the manufacturing of robotic components.

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Analyze the characteristics and performance measures of sensors and select suitable sensor for the given applications.

CO2: Choose proper sensor by comparing different standards and guidelines to make sensitive measurements of physical parameters.

CO3: Elucidate the construction and working of various actuators used in robots.

CO4: Comprehend the working of different pneumatic and hydraulic robot drives and various control schemes available.

CO5: Understand various fabrication methods, material used and their applications in the robotics field.

Pre-requisites

- Knowledge about the mechanisms, sensors and actuators.

2049235110	SENSORS, ACTUATORS AND FABRICATION OF	L	T	P	C
Theory	ROBOTS	3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	2	2	2	1	2
CO2	3	2	3	2	2	1	2
CO3	3	1	2	2	2	1	1
CO4	3	1	2	2	2	1	2
CO5	3	2	3	2	2	1	2

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Massive open online courses (MOOCs) may be used to teach various topics.
- The topics that are relatively simpler or descriptive are to be given to the students for **self-directed learning** and assess the outcomes through classroom seminars or group discussions.
- Teachers must ensure to create opportunities for co-curricular activities.
- Videos and simulations may be used to teach various topics.
- Encourage students to refer to different textbooks and case studies to have a deeper understanding of the subject.
- Observe and continuously monitor the performance of the student in the laboratory.
- Foster collaborative learning exercises within the classroom to encourage group participation and engagement.
- Pose a minimum of three higher-order thinking (HOT) questions during class discussions to stimulate critical thinking among students.
- Implement Problem-Based Learning (PBL) as an approach that enhances students' analytical skills and nurtures their ability to design, evaluate, generalize, and analyze information, rather than solely relying on rote memorization.

2049235110	SENSORS, ACTUATORS AND FABRICATION OF ROBOTS	L	T	P	C
Theory	ROBOTS	3	0	0	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Two units)	Written test (Another Two units)	Activity Report	Model Examination	Written Examination
Duration	2 Periods	2 Periods	-	3 Hours	3 Hours
Exam Marks	50	50	40	100	100
Converted to	15	15	10	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. The best of one will be considered for the internal assessment of 15 Marks.

CA1 and CA2, Assessment tests should be conducted for two units as below.

Answer five questions (5 X 10 Marks = 50 Marks).

Eight questions will be asked; students should write Five questions. In each unit, four questions can be asked. Each question may have subdivisions. A maximum of two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end-semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Theory		3	0	0	3

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit; students should write any two questions. The question may have two subdivisions only.

2049235110	SENSORS, ACTUATORS AND FABRICATION OF ROBOTS	L	T	P	C
Theory		3	0	0	3

Unit I	INTRODUCTION AND MOTION, POSITION SENSORS	
	Introduction to sensors and transducers, Difference between transducer and sensor, Types of sensors used in robots (Only List), Requirements of a sensor, Sensor output and signal types (Analog and Digital output). Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive Tactile sensor – Introduction, working and applications Proximity sensor – Inductive, Capacitive, Photoelectric	9

UNIT II	RANGE, FORCE, MAGNETIC SENSOR AND HEADING SENSOR	
	Accelerometer – Types (MEMS, Piezoelectric), Range Sensors – Ultrasonic Ranging, Laser Range Sensor (LIDAR). Range sensors (Triangulation Principle, Structured lighting approach) Strain Gauge, Load Cell, Magnetic Sensors –types, principle, requirements and advantages Magneto resistive – Hall Effect – Heading Sensors – Compass, Gyroscope, Inclinometers	9

UNIT III	MECHANICAL AND ELECTRICAL ACTUATION SYSTEMS	
	Mechanical actuation systems: Mechanical systems, types of motions, cams, gear trains, ratchet & pawl mechanism, belt and chain drives, mechanical aspect of motor selection. Electrical actuation system: Electrical systems, Mechanical switches, solenoids, EM Relay, SSR, DC/AC motors (Introduction and Types only), Stepper motors & Servo Motors (Introduction, working and applications).	9

Unit IV	PNEUMATIC AND HYDRAULIC ACTUATION SYSTEM	
	Pneumatic and Hydraulic actuation system: Comparison of Pneumatic and Hydraulic actuation system, classification of valves, function of pressure	9

	relief valves, function of pressure regulating valves, cylinders and rotary actuators – double acting cylinder, air motor. DCV & FCV: Principle & construction details, Types(Only List)	
Unit V	ROBOT PROGRAMMING	
	Methods of Fabrication: Introduction to Fabrication Methods, Definition of fabrication methods, Importance of fabrication in robotics and automation, **Overview of different fabrication techniques**. Welding and Joining Techniques, Types of welding processes (arc welding, spot welding) Principles and applications of welding in robotic component fabrication, Joint design considerations, Machining Processes (turning, milling, drilling, etc.) (Only brief discussion) **Materials for Robotic Components:** Material Selection for Robotic Components, Introduction to materials used in robotics (metals, polymers and composites), Material properties and their significance in robotic component design, Factors influencing material selection for specific applications. Properties and advantages of composite materials, Application areas and considerations for using composites in robotic components.	9

TEXT BOOKS

17. Ernest O Doebelin, ―Measurement Systems – Applications and Design‖, Tata McGraw-Hill, 2017
18. Sawney A K and Puneet Sawney, ―A Course in Mechanical Measurements and Instrumentation and Control‖, 12th edition, Dhanpat Rai & Co, New Delhi, 2013.

REFERENCES

19. C. Sujatha ... Dyer, S.A., Survey of Instrumentation and Measurement, John Wiley & Sons, Canada, 2010
20. Hans Kurt Tönshoff (Editor), Ichiro, ―Sensors in Manufacturing‖ Volume 1, Wiley-VCH April 2001.
21. John Turner and Martyn Hill, ―Instrumentation for Engineers and Scientists‖, Oxford Science Publications.

Suggested Student Activity: In addition to classroom and laboratory learning, **student-centric co-curricular activities** can be undertaken to accelerate the attainment of various outcomes of the course.

- Students should conduct the following activities in groups, prepare a report of about 5 – 10 pages, and collect the physical evidence for the internal assessment.
- Prepare a chart displaying the various types of sensors.
- Prepare a chart displaying the various types of robot measurement system.
- Prepare a chart displaying the various types of actuators.
- Prepare a presentation or report on robotic systems used in industries.
- Survey of materials used in robotic industries.

2049235110	SENSORS, ACTUATORS AND FABRICATION OF ROBOTS	L	T	P	C
Theory		3	0	0	3

END SEMESTER QUESTION PATTERN – THEORY EXAM

Duration: 3 Hours. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

2049235210	INDUSTRIAL INTERNET OF THINGS	L	T	P	C
Theory		3	0	0	3

Introduction

Industrial Internet of Things or IIoT refers to interconnected instruments, sensors and other devices which can be networked together in an industrial setting. This connectivity enables remote access, efficient monitoring, data acquisition and collection, analysis and exchange of different data sources and a lot more. IIoT solutions have enormous potential for increasing productivity, and are also known for their low cost and quick implementation.

Course Objectives

The objective of this course is to prepare the student to

- Understand the basics of Technology of Industry 4.0 and IoT
- Study of Building blocks of IIoT and its various components
- Understand the Augmented & Virtual Reality and its applications
- Learn the evolution of IoT, Sensors, and Actuators
- Study of protocols in IIoT and analyse the security issues in IIoT
- Select proper IIoT technology for application.

Course Outcomes

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

CO1: Describe the Industry 4.0 technology and Industrial Internet of Things

CO2: Explain the elements used for IIoT implementation.

CO3: Discuss the connectivity networking technologies used in IIoT

CO4: Demonstrate the cloud data management for IIoT

CO5: Explain the applications of IIoT and emerging technologies

Pre-requisites

Basic Knowledge of Industry 4.0 and its Applications

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	1	1	1
CO2	3	2	2	1	1	2	1
CO3	3	2	1	1	1	2	1
CO4	3	2	1	1	1	2	1
CO5	3	2	2	1	1	2	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

2049235210	INDUSTRIAL INTERNET OF THINGS	L	T	P	C
Theory		3	0	0	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.
CA1and CA2, Assessment test should be conducted for two units as below.
Answer five questions (5 X 10 Marks = 50 Marks).
Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.
CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.
CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:
Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.
Four questions will be asked from every unit; students should write any two questions. The question may have two subdivisions only.

Theory		3	0	0	3

Syllabus Contents

Unit I:	Introduction to IIoT and Connected Factories	
Evolution of IoT/IIoT - Definition & Characteristics of IoT - Applications of IoT - IIoT Vs IoT - IT and OT in IIoT: Big Data, AI, Cloud Manufacturing, Additive Manufacturing, Industrial Analytics, AR/VR - Challenges of Implementing IIoT: Robust Connectivity, Standardization, Interoperability, Privacy and Security, Domain Knowledge Building blocks of Industry 4.0: Industrial success skills, Industrial equipment and technology, Smart sensors and devices, Control systems, Connectivity and networking, Inform - Actionable data. Smart Factory: Introduction, basic structure (block diagram), key characteristics.		9
Unit II:	**IIoT Components**	
Smart Devices Smart Sensors: Introduction, components (use block diagram), working, list of sensors, applications. Smart Actuators: Introduction, components (use block diagram), working, list of actuators, applications. Cyber-physical System: Definition, CPS in Manufacturing (Any two applications with explanation) Generic block diagram of an IoT Device – IIoT layered architecture (Block Diagram and Explanation) – IIoT Protocols – Hardware in IIoT		9
Unit III:	**Connectivity and Networking**	
Network: Definition, Role of networks - OSI model – IP Addressing Networking Hardware: Hub/Repeater, Bridge, Switch, Router, VLAN Topology: Star, Mesh, Bus, Peer to Peer RFID: Definition, Types, Block Diagram, Working of RFID system IEEE 802.15.4 Protocols – Protocols based on IEEE 802.15.4: 6LoWPAN, ZIGBEE, ISA 100.11A, Wireless HART – LoRaWAN		9
Unit IV:	**M2M and Data Management in IIoT**	
M2M: Introduction of M2M, Working of M2M, Difference between M2M and IoT. Cloud Computing: Definition, Types, Benefits of cloud, Essential characteristics (on-demand self-service, Broad network access, Location independent resource pooling, Rapid elasticity, measured service) – Cloud deployment model: Public		9

cloud, Private cloud, Hybrid cloud, Community cloud Software as a Service (SaaS) – Platform as a Service (PaaS) – Infrastructure as a Service (IaaS) *(Introduction, Service Providers, Any two examples, Benefits)* Security Challenges in IIoT.		
Unit V:	**IIoT Applications and Emerging Technologies**	
IIoT Applications: Healthcare, Inventory Management & Quality Control, Oil Industry, Pharmaceutical Industry, Manufacturing Industry. AR: Definition - Tools for Augmented Reality – Hololens - Advantages and Challenges of AR - Applications of AR in Industries. Virtual Reality: Definition – Types of Head Mounted Displays – Tools for Virtual Reality – Applications of VR in Industries - Difference between VR and AR. Digital Twin: Introduction, Application, Benefits.		9
	Total	45

Textbook:

1. Internet of Things: A Hands-On Approach by Arshdeep Bahga, Vijay Madisetti, University Press Publication, 2015.
2. Sudip Misra, Chandana roy, and Anandarup Mukherjee, Introduction to Industrial Internet of Things and Industry 4.0, Taylor & Francis India, 2021.
3. Dr Anand Kumar Singh and Dr. Manish Gangil, INDUSTRY 4.0, Shashwat Publication, 2022.
4. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, 1st Edition, Apress, 2017.
5. Dr Kamlesh Lakhwani, Dr Hemant Kumar Gianey, Joseph Kofi Wireko, and Kamal Kant Hiran, Internet of Things (IoT), First Edition, BPB Publications, 2020.

Reference Books:

1. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, 1/e by David Hanes , cisco press
2. Internet of Things: Architecture and Design Principles Rajkamal. 1st Edition, Mc Graw Hill

Website links for reference:

- https://www.youtube.com/playlist?list=PLbRMhDVUMngdcLdH4-YF1uJI4IuhcDZPR

2049235210	INDUSTRIAL INTERNET OF THINGS	L	T	P	C
Theory		3	0	0	3

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit; students should write any two questions for 10 marks. The question may have two subdivisions only.

2049235440	PLC AND HMI	L	T	P	C
Practicum		1	0	4	3

Rationale

Various control operations are to be performed automatically and sequentially on the electrical machines to suit the industrial requirements. Programmable controllers are mainly employed to control the process in industries. In order to impart knowledge on programmable Logic Controller this theory subject is introduced.

Course Objectives

On successful completion of the course, the students must be able to

- Explain the meaning of automation and List the types of automation
- Define PLC and Explain why their use is valuable
- Explain what PLC can do
- Compare fixed and modular PLC
- Explain the advantages of PLC
- Explain the functions of various elements of power supply unit
- Know the difference between digital and analog input and output signals.
- Observe how digital field device information gets into a PLC
- Observe how analog field device information gets into a PLC
- Understand I/O addresses and how they are used in a PLC
- Describe PLC timer instruction and differentiate between a non-retentive and retentive timer
- Program the control of outputs using the timer instruction
- List and describe the functions of PLC counter instructions
- Create PLC programs involving program control instructions, math instructions

Course Outcomes

After successful completion of this course, the students should be able to
CO1: Explain the role of PLC in modern manufacturing and its architecture.
CO2: Demonstrate PLC programming using Bit instructions for various circuits.
CO3: Design basic to complex plc programs for industrial application.
CO4: Develop plc programs for analog signal processes.
CO5: Discuss the role of HMI in industrial automation systems.

Pre-requisites

Knowledge about the digital electronics and electrical control circuits.

Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	2	2	1	1	2
CO2	3	2	2	3	1	2	2
CO3	3	2	2	3	1	2	3
CO4	3	2	2	3	1	2	3
CO5	3	2	2	2	1	2	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Massive open online courses (MOOCs) may be used to teach various topics.
- The topics that are relatively simpler or descriptive are to be given to the students for **self-directed learning** and assess the outcomes through classroom seminars or group discussions.
- Teachers must ensure to create opportunities for co-curricular activities.
- Videos and simulations may be used to teach various topics.
- Encourage students to refer to different textbooks and case studies to have deeper understanding of the subject.
- Observe and continuously monitor the performance of the student in the laboratory.
- Instruct students about safety concerns of automatic systems and avoid any damage to the control components.

2049235440	PLC AND HMI	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Experiments/ 50% Experiments	Cycle II Experiments/ Another 50% Experiments	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

CA1 and CA2: All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The experiment should be completed on the day of practice.

The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook / printed manual / file. The Circuit Diagram, Readings, Calculations and Graph/Result should be written by the student manually.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification

Sl. No	NAME OF ACTIVITY	MARK ALLOCATION
1.	Drawing Connection/Ladder Diagram and Writing Details of the Components	20
2.	I/O connections	10
3.	Conducting the Experiment - Following the correct procedure - Verifying the operation / appropriate readings - Following the appropriate safety procedure	10
4.	Interpretation of Results	10
5.	Practical Documents	10
Total Marks		**60**

by the Flying Squad and DOTE Official.

Scheme of Evaluation

CA 3: A written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

2049235440	PLC AND HMI	L	T	P	C
Practicum		1	0	4	3

CA 4: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be

conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern

Sl. No	NAME OF ACTIVITY	MARK ALLOCATION
1.	Drawing Connection/Ladder Diagram and Writing Details of the Components	20
2.	I/O Connections	20
3.	Conducting the Experiment - Following the correct procedure - Verifying the operation / appropriate readings - Following the appropriate safety procedure	15
4.	Interpretation of Results	05
5.	Written Test	30
5.	Viva-voce	10

scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Total Marks	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

2049235440	PLC AND HMI	L	T	P	C
Practicum		1	0	4	3

Unit I	BASICS OF PLC	
Definition - Overview of PLC system - Architecture of a PLC: Function of each blocks -Types of PLC - PLC modules: Discrete and Analog I/O modules - PLC advantage & disadvantage - PLC versus Computers - PLC Applications - Scan cycle - Selection criteria for PLC – PLC Communication with PC and software- PLC Wiring- Installation of PLC and its Modules		3
Ex.No	**Name of the Experiment (Develop ladder or SFC, interface and test)**	
1	Start/Stop operation (Latching & Unlatching) of a motor using two push button	12
2	Delayed operation of a lamp using push button (On-delay & Off-delay)	
3	Blinking lamp using On-delay or Off-delay timer	
UNIT II	**PLC PROGRAMMING**	
Fundamentals of logic – General PLC programming procedure - PLC programming methodologies: Ladder Diagram, Functional block diagram, Sequential function chart, Structured text, Instruction list – Bit Instructions – Instruction Addressing – PLC basic functions: Logical functions - Timers and counters.		3
Ex.No	**Name of the Experiment (Develop ladder or SFC, interface and test)**	

4	Event count operation using UP counter & DOWN counter	12
5	Star Delta control with interlocking	
6	Conveyor control using PLC	
UNIT III	**ADVANCED INSTRUCTIONS**	
Arithmetic functions (ADD, SUB, MUL, DIV, NEGATE)– Comparison functions (Equal, Not equal, Less Than, Greater than, Limit test) – Data transfer instructions (8-bit data, 16-bit word, Array) – Program control functions (Jump to label, Jump to subroutine, Return, Return from subroutine and Master control functions) – PID function - PTO / PWM generation.		3
Ex.No	**Name of the Experiment (Develop ladder or SFC, interface and test)**	
7	Tank level control.	8
8	Automatic operation two pneumatic cylinders in a sequence.	
Unit IV	**ANALOG PROGRAMMING**	
Types of analog modules – Configure analog signals in PLC – Analog Inputs: Voltage inputs, Current inputs, Analog input scaling – Analog outputs: Voltage outputs, Current outputs, Analog output scaling/unscaling - Servo drive control – Stepper Motor Control – Design of interlocks and alarms -		6
Ex.No	**Name of the Experiment (Develop ladder or SFC, interface and test)**	
9	Illumination control using analog I/O.	8
10	Heater control with PID function of the PLC	
Unit V	**HMI SYSTEMS**	
Need for HMI in Industrial Automation - Types of HMI – Configuration of HMI – Procedure for project development - Configuration of HMI elements / objects(Defining Tags, planning graphic design, Navigation, Linking objects with tags, Tag logging) – Push buttons, Text boxes, Bar graphs, Graphics & other features – Alarm generation, Data logging, Trends generation- Interfacing with PLC		3
Ex.No	Name of the Experiment	
11	Fire alarm and display the status in HMI A. Multiple alarms B. Sound alarm C. If not acknowledged, Sound alarms 1 and 2	8
12	Develop Ladder logic for Servo motor control (PLC and HMI)	
	Revision	12

2049235440	PLC AND HMI	L	T	P	C
Practicum		1	0	4	3

TEXT BOOKS:

1. W. Bolton ―Programmable logic controllers‖, Elsevier Ltd, 2015.
2. Frank D Petruzella, ―Programmable logic controllers‖, McGraw-Hill, 2011.

REFERENCES:

3. John R Hackworth and Fredrick D Hackworth Jr., ―Programmable Logic Controllers: Programming Methods and Applications‖, Pearson Education, 2006.
4. SIMATIC Programming with STEP 7, SIEMENS Manual, 2014.

Suggested Student Activity: In addition to classroom and laboratory learning, **student-centric co-curricular activities** can be undertaken to accelerate the attainment of various outcomes of the course.

- Students should conduct the following activities in groups, prepare a report of about 5 – 10 pages, and collect the physical evidence for the internal assessment.
- Conduct an internet survey and make a list of leading manufacturers of control components and other automation tools.
- Identify the industrial standards followed in PLC.
- Read the safety precautions to be followed for the installation of plc panel.

Equipment / Facilities required for conducting the Practical Course

S No	Name of the Equipment	No of Quantity
1	PLC Simulation Panel any brand with software	5
2	2 Channel Analog Input and Output Module	2
3	HMI Simulation Panel any brand	5
4	Limit switch	5
5	Reed switch	5
6	Inductive proximity sensor	5
7	Capacitive proximity sensor	5
8	Solenoid valve	2
9	Double acting Cylinder	2
10	Heater Control Trainer kit	1
11	Liquid Level Control Kit	1
12	Fire alarm Control Kit	1
15	PC or Laptop	10

END SEMESTER EXAMINATION – PRACTICAL EXAM

2049235440	PLC AND HMI	L	T	P	C
Practicum		1	0	4	3

BOARD EXAMINATION

Duration: 3 Hours. **Max. Marks: 100**

Sl. No	NAME OF ACTIVITY	MARK ALLOCATION
1.	Drawing Connection/Ladder Diagram and Writing Details of the Components	20
2.	I/O Connections	20
3.	Conducting the Experiment - Following the correct procedure - Verifying the operation / appropriate readings	15

Note:

All the exercises should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises / experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by the DOTE Exam section shall be used. The record of work done by the student should be submitted with a Bonafide Certificate.

DETAILED ALLOCATION OF MARKS

	- Following the appropriate safety procedure	
4.	Interpretation of Results	05
5.	Written Test	30
5.	Viva-voce	10
Total Marks		**100**

Note: For the written test 30 MCQ shall be asked from the theory portions.

2049235540	CIM and CNC PROGRAMMING	L	T	P	C
Practicum		1	0	4	3

Introduction:

As per the latest requirements in industries, this course enables the use of computers in the fields of design and manufacturing. It's able to learn the latest manufacturing concepts for shop floors and manufacturing methods like additive manufacturing. They are able to operate CNC machines and write CNC part programs. Enables to understand the advanced concepts adopted in automated industries and CNC machine maintenance.

Course Objective:

The student will learn

- The concept and requirements of the integration of design, manufacturing, and business activities.
- The concept and requirements of the integration of design, manufacturing, and business activities.
- The concepts of manufacturing with computer assistance in process planning, production planning, and production control.
- The principles, components, and workings of the various CNC machines.
- The principles of the latest manufacturing and metrology machines like additive manufacturing, EDM, and CMM.
- The method of CNC programming with standard G codes and M codes.
- To understand the advanced material handling and manufacturing systems like AGV, ASRS and FMS.
- To schedule maintenance on CNC machines.

Course outcomes:

On successful completion of this course, the student will able to

CO1	Demonstrate the CAD modeling and activities in product design.
CO2	Apply computer-aided techniques to replace conventional manufacturing planning and control functions.
CO3	Create a CNC part program to produce components on a CNC machine.
CO4	Illustrate the effective usage of CNC in advanced machines.
CO4	Describe the integrated manufacturing system and scheduled maintenance to optimize the performance.

Pre-requisites:

Knowledge of engineering drawing, production technology, computer applications, machine element design, and electrical devices and controls.

2049235540	CIM and CNC PROGRAMMING	L	T	P	C
Practicum		1	0	4	3

Mapping of COs with POs:

	Basic and Discipline Specific knowledge	Problem Analysis	Design / Development of Solutions	Engineering Tools, Experimentation and Testing	Engineering practices for society, sustainability and Environment	Project Management	Life Long Learning
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	3	3	3	3	3	3	2
CO2	3	2	2	2	2	2	1
CO3	3	3	3	3	2	2	1
CO4	3	2	2	2	2	2	1
CO5	3	3	3	3	3	2	2

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Different methods of teaching and demonstration to be used to attain the outcomes.
- Teacher-directed lecture class room processes with the aid of PowerPoint presentations could be used for theory.
- Video and Group Discussion may be used to teach various topics/ sub topics so that students are able to understand and grasp the concepts.
- Hand-on practices may be followed in the real environment as far as possible throughout the course.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.

- Incorporate formative and summative assessments to gauge student progress and provide targeted feedback.

2049235540	CIM and CNC PROGRAMMING	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Experiments/ 50% Experiments	Cycle II Experiments/ Another 50% Experiments	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

CA1 and CA2: All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

2049235540	CIM and CNC PROGRAMMING	L	T	P	C
Practicum		1	0	4	3

The experiment should be completed on the day of practice.
The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook / printed manual / file. The Circuit Diagram, Readings, Calculations and Graph/Result should be written by the student manually.
The detailed dates of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

Part	Description	Marks
	CAD	
A	Solid Modeling	25
B	Sectional View and Dimensioning / Slicing the model and generating the NC code	15
C	Print out	10
D	Practical Documents (As per the portions)	10
Total Marks		60

Cycle I: 1, 2, 3, 4 and 5.

SCHEME OF EVALUATION

Part	Description	Marks
	CNC Programming	
A	Create the CNC part program / part and setup the parameters on CAD/CAM software	25
B	Produce component / Generate the toolpath	15
C	Finishing / Print out	10
D	Practical Documents (As per the portions)	10
Total Marks		60

Cycle II: 6, 7, 8, 9 and 10.

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

2049235540	CIM and CNC PROGRAMMING	L	T	P	C
Practicum		1	0	4	3

Part	Description	Marks	
A	30 MCQ Questions	30x1 Marks	30 Marks
B	7 Questions to be answered out of 10 Questions	7x10 Marks	70 Marks
Total Marks			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation. After completion of all the exercises the practical test should be conducted as per end semester examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

Part	Description	Marks
	Solid Modeling & 3D Printing (or) **CNC Programming**	
A	Solid Modeling (or)	35
	Create the CNC part program / part and setup the parameters on CAD/CAM software (or)	
B	Sectional View and Dimensioning / Slicing the model and generating the NC code (or)	15
	Produce component / Generate the toolpath	
C	Print out (or) Finishing	10
D	Written Test (Theory Portions)	30
E	Viva Voce	10
Total Marks		100

SYLLABUS CONTENTS:

Unit I	COMPUTER AIDED DESIGN	Period
THEORY: **CAD: (definition and concepts)** CIM wheel, CAD definition, Shigley's design process – CAD activities – benefits of CAD - Graphics Workstation Geometric modeling techniques: Wire frame – Surface – Solid modeling. **Finite element methods: (concepts only)** Finite Element Analysis **PRACTICAL:**		3
Ex.No.	Name of the Experiment	
1	CAD: 3D Modeling of a Plummer Block Bearing	12
2	CAD: 3D Modeling of a Screw Jack	
Unit II	**COMPUTER AIDED MANUFACTURING**	**Period**
THEORY: **CAM (definition and concepts):** Functions of CAM – Benefits of CAM – Group Technology (concept only) – CAPP: Generative type (one method only) – Master Production Schedule (MPS) – Capacity planning – Materials Requirement Planning (MRP) – Shop Floor Control - Manufacturing Resources Planning (MRP-II) – JIT – guide lines of DFMA. **Additive Manufacturing (concepts**): Technologies: FDM, SLA and SLS.		3
Practical:		
Name of the Experiment		
Ex.No. 3 CAD: 3D Modelling of Geneva Wheel, generating STL and NC codes.		18
Ex. No. 4 CAD: 3D Modelling of Bushed Bearing, generating STL and NC codes.		
Ex. No. 5 CAD: 3D Modelling of Connecting Rod, generating STL and NC codes.		
UNIT III: NC MACHINES AND PART PROGRAMMING		
THEORY: **NC Machines (concepts):** Components of NC systems - working principle – machine axis conventions - adaptive control systems - DNC - CNC. **NC part programming:** CNC program procedure – coordinate system – types of motion control: point-to-point, paraxial and contouring - NC dimensioning – reference points – G codes - M codes – machine zero, work zero, tool zero and tool offsets. Tool information – speed – feed – macro – subroutines – canned cycles - **(concepts only)** Generating CNC codes from CAD models and post processing.		3

Unit IV	CNC MACHINES AND COMPONENTS	Period
THEORY: **CNC Machines (definition and concepts):** HTC, VMC, CNC EDM and CMM. **Components (definition and concepts):** Spindle drive: stepping motors – servo motors – slide ways –linear motion bearings – recirculation ball screw – ATC – tool magazine - feedback devices: encoders – linear and rotary transducers – in process probing. **PRACTICAL:**		3

Unit V	INTEGRATED MATERIAL HANDLING SYSTEM AND CNC MAINTENANCE	Period
THEORY: **AGV (definition and concepts):** Working principle – types - benefits – ASRS **FMS (definition and concepts):** FMS components – FMS layouts **CNC Maintenance (definition and concepts):** Preventive Maintenance – Maintenance schedule (Daily, Monthly, Quarterly, Half yearly and Annually)		3
	Revision + Test + Practice	15
	Total	**75**
PRACTICAL:		
Name of the Experiment:		
Ex. No. 6 CNC Lathe: Create a part program for Step, Taper and Radius Turning using Canned Cycles and produce the part on CNC machine.		12
Ex. No. 7 CNC Lathe: Create a part program for Grooving and Thread Cutting using Canned Cycles and produce the part on CNC machine.		

Ex. No	Name of the Experiment	
8	CNC Mill: Create a part program for Drilling, Tapping and Counter Sinking using Canned Cycles and produce the part on CNC machine	18
9	CNC Mill: Create a part program for Pattern Grooving using Subroutine/ Subprogram and produce the part on CNC machine	
10	CNC Mill: Create a part using CAM software, generate the tool path and CNC program for a milling process and take the printout.	

Suggested activity:

Apart from classroom and laboratory learning, teachers could use the following strategies to achieve the various outcomes of the course.

- Micro-projects/ additional exercises may be given to individual/ group of students to encourage self-learning, creativity and innovation.
- Online MCQ have to be conducted for all the five units.

Text and Reference Books:

- CAD/CAM/CIM , R.Radhakrishnan, S.Subramanian, New Age International Pvt. Ltd.
- CAD/CAM , Mikell P.Groover, Emory Zimmers, Jr.Prentice Hall of India Pvt., Ltd.
- NC Programming, S.K.Sinha, Galgotia Publications Pvt. Ltd.
- CAD/CAM Principles and Applications, Dr.P.N.Rao, Tata Mc Graw Hill Publishing Company Ltd.
- CAD/CAM, Ibrahim Zeid, Mastering Tata McGraw-Hill Publishing Company Ltd., New Delhi.
- Automation, Production Systems, and Computer-Integrated Manufacturing, Mikell P. Groover, Pearson Education Asia.
- Computer control of manufacturing systems, Yoram Koren, McGraw Hill Book.

List of equipment's:

No.	Name of the Equipment / Machinery	No. of Quantity
1	Personal computer (Pentium processor)	30
2	MS Windows OS (Version 2000 or above)	30
3	AutoCAD/ Autodesk Fusion/ CREO/ FreeCAD/ SOLIDWORKS software	30
4	CNC Simulation Software / CADCAM Software	30
5	CNC Machining Centre & Turning Centre	Each 2 No's
6	3D Printing software (CURA)	30
7	Laser jet printer	1

END SEMESTER EXAMINATIONS – PRACTICAL EXAM

Note:

All the exercises should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises/experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by the DOTE Exam section shall be used. The record of work done by the student should be submitted with a Bonafide Certificate.

SCHEME OF EVALUATION

Part	Description	Marks
	Solid Modeling & 3D Printing (or) **CNC Programming**	
A	Solid Modeling (or)	35
	Create the CNC part program/part and set the parameters on CAD/CAM software (or)	
B	Sectional View and Dimensioning / Slicing the model and generating the NC code (or)	15
	Produce component / Generate the toolpath	
C	Print out (or) Finishing	10
D	Written Test (Theory Portions)	30
E	Viva Voce	10
Total Marks		100

2049235654	Innovation & Start-ups	L	T	P	C
PRACTICUM		1	0	2	2

Introduction

The integration of Innovation and Start-ups concept within the syllabus is testament to the forward thinking nature of educational institutions. By introducing this concept, students are provided with a solid foundation upon which they can build their skills in Innovation and Start-ups. This course can bridge the gap between theory and practice. It allows students to apply the knowledge they have acquired in a real world context, thereby enhancing their understanding and retention of the above concept. This experimental learning approach not only fosters a deeper level of engagement but also trains student with practical skills necessary to navigate the complexities of the business world. This also empowers students to become an Innovator or Entrepreneur. With necessary tools and knowledge, educational institutions are preparing the next generation of entrepreneurs to tackle the challenges and opportunities that lie ahead. This syllabus will explore the different facets of innovation, including its importance, types and strategies for fostering a culture of innovation within organizations

Course Objectives

The objective of this course is to enable the students

- To understand the concept of Innovation and Start-ups.
- To acquire knowledge of Prototype development, IPR, Patents and Copyrights.
- To have practical experience in preparing Business plan for Start-ups.
- To visit the existing nearby industry to prepare a project report about the present challenges of that industry.
- To know the different funding supports available from Government and Non-Government schemes for Start-ups.

2049235654	Innovation & Start-ups	L	T	P	C
PRACTICUM		1	0	2	2

Course Outcomes

After successful completion of this course, the students should be able to

CO 1: Differentiate between Innovation and Start-ups

CO 2: Explain the importance of IPR, Patents and Copyrights.

CO 3: Describe the methodology to be adopted for preparing the Business Plan

CO 4: Gain practical experience by Industrial training and visiting the nearby industry

Co 5: Explore and identify various funding facilities available from Government and Non-Government Schemes for Start-ups

Pre-requisites:

There are no specific prerequisites for this course, although a basic understanding of business and technology concepts would be beneficial.

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	-	-	1	-	2	3	3
CO2	-	-	1	-	2	3	3
CO3	-	-	1	-	2	3	3
CO4	-	-	1	-	2	3	3
CO5	-	-	1	-	2	3	3

2049235654	**Innovation & Start-ups**	L	T	P	C
PRACTICUM		1	0	2	2

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

2049235654	**Innovation & Start-ups**	L	T	P	C
PRACTICUM		1	0	2	2

Assessment Methodology

	Continuous Assessment (40 marks)			**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	
Mode	Class Assessment (Unit I, II & Unit III)	Seminar Presentations (Unit IV)	Submission of Industry Visit Project Report (Unit V)	Practical Examination (Project)
Duration	2 hours	---	---	3 hours
Exam Marks	50	20	30	100
Converted to	10	10	20	60
Marks	**10**	**10**	**20**	**60**

Continuous Assessment - 40 marks

S. No	**Description**	**Marks**
CA 1	**Class Assessment (50 marks) - Unit – I,II & III** Written Examination - Theory Questions 10 questions out of 15 questions (10 x 3 marks :30 marks) 4 questions out of 6 questions (4 x 5 marks : 20 marks)	10 marks
CA 2	**Seminar Presentations (20 marks- each topic carries 10 marks) - Unit IV** Students should present any two topics with PPTs	10 marks
CA 3	Submission of Industry Visit Project Report - **(30 marks) - Unit V**	20 marks
	Total	**40 marks**

Syllabus Contents

2049235654	**Innovation & Start-ups**	L	T	P	C
PRACTICUM		1	0	2	2

UNIT I	**INTRODUCTION TO INNOVATION**	
An Introduction to Innovation and Creativity- Innovation in current Environment - Types of Innovation - Challenges of Innovation - Steps of Innovation Management - Divergent v/s Convergent thinking - Design thinking and Entrepreneurship.		6
UNIT II	**INCUBATION CLUBS, IPR, PATENTS AND COPYRIGHTS**	
Idea Generation - Incubation Clubs - Prototype Development - Marketing of Innovation - Management of Innovation - Creation of IPR -Types of IPR - Patents and Copyrights - Patents in India - Technological and Non-Technological Innovation Process.		6
UNIT III	**GOVERNMENT AND NON-GOVERNMENT FUNDING SCHEMES FOR START-UPS**	
An introduction to Start-up - Start-ups in India - Procedure for registration of Start-ups - Business Model- Business Plan - Case Studies - Opportunities and Challenges - Funding supports from Government Schemes -MUDRA, TANSEED, NEEDS, PMEGP, UYEGP – Non-Government Schemes - CSR Fund - Angel Investors - Venture Capitalist.		6
UNIT IV		
All the students have to select a minimum of 2 topics from the list given below. They are expected to collect the resources with the help of faculty assigned to them to prepare PPTs for presentation 1. Idea Generation. 2. Innovation Management. 3. Product Development. 4. Business Model Innovation. 5. Organizational Culture and Change Management. 6. Leadership and Innovation.		9

2049235654	**Innovation & Start-ups**	L	T	P	C
PRACTICUM		1	0	2	2

7. Barriers to Innovation. 8. Innovation Marketing. 9. E-Commerce success stories (any one). 10. Role of Start-ups in Higher Education. 11. Professional Networking in Building Brands. 12. How to start a start-up in India.	
UNIT V	**EXPOSURE TO INDUSTRY**
All the students should visit and study the nearby industries, incubation centres, start-ups etc., and select any one to prepare a project report which covers the Name of the Industry/Organization, Introduction of the Industry, Type of the Industry, Scope of the Industry, Plant Layout and Location, Details of Plant and Machineries, Process flow chart, Manufacturing Methods, Process of Manufacturing, Product Manufacturing, Quality Control, Marketing, Product selling - Conclusion.	**18**
Total	**45**

End Semester Examination - Project Exam

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairman Board of Examinations.

2049235654	**Innovation & Start-ups**	L	T	P	C
PRACTICUM		1	0	2	2

Detailed Allocation of Marks

S. No	Description	Marks
Part A	Written Examination – Unit –I,II & III Theory Questions i) 10 questions out of 15 questions (10 x 3 marks = 30 marks) ii) 3 questions either or pattern (3 x 5 marks = 15 marks)	45
Part B i)	Presentation of Industry Visit Project Report	25
ii)	Interaction and Evaluation	30
	TOTAL	**100**

2049235773	Industrial Training	Summer Vacation	C
Internship			2

Introduction

Industrial training is a crucial component of the diploma engineering curriculum, designed to bridge the gap between theoretical knowledge and practical application. Typically conducted during vacation periods, this two-week training program provides students with hands-on experience in their respective engineering fields. The primary objectives are to enhance practical skills, familiarize students with industry standards, and prepare them for future employment.

Two-week industrial training during vacation periods is an invaluable part of diploma engineering education. It not only equips students with practical skills but also provides a comprehensive understanding of the industry, preparing them for successful engineering careers.

Objectives

1. Practical Exposure: Students gain direct exposure to real-world engineering practices, tools, and technologies.
2. Skill Enhancement: The training helps in developing technical and soft skills that are essential for professional growth.
3. Industry Insight: Students learn about the working environment, operational procedures, and challenges faced by industries.
4. Professional Networking: The training offers opportunities to interact with industry professionals, which can be beneficial for career prospects.
5. Application of Knowledge: It allows students to apply classroom knowledge to solve practical problems, enhancing their understanding and retention of engineering concepts.

Structure of the Training Program

- Orientation: Introduction to the company, its operations, and safety protocols.
- Project Assignment: Students are assigned specific projects or tasks relevant to their field of study.

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Internship			2

- Supervision and Mentorship: Industry professionals guide and mentor students throughout the training.
- Skill Development Workshops: Sessions on technical skills, software tools, and industry best practices.
- Assessment and Feedback: Performance evaluations and constructive feedback to help students improve.

Benefits for Students

- Enhanced Employability: Practical experience makes students more attractive to potential employers.
- Confidence Building: Working in a real-world setting boosts confidence and professional demeanor.
- Clarified Career Goals: Exposure to various roles and responsibilities helps students define their career paths.

Course Outcomes

CO 1: Demonstrate proficiency in using industrial machinery, tools, and software.

CO 2: Able to identify, analyze, and solve engineering problems using industry-standard methods and practices.

CO 3: Gain a comprehensive understanding of industrial manufacturing processes, quality control, and safety practices.

CO 4: Exhibit improved communication, teamwork, and professional behavior in an industrial setting.

CO 5: Apply theoretical concepts learned in their coursework to practical engineering tasks and projects.

Duties Responsibilities of the Faculty Mentor.

One faculty mentor should be assigned for every 30 students by the HOD / Principal. Faculty mentors shall play a crucial role in overseeing and guiding students during their industrial training program in Diploma engineering.

Pre-Training Responsibilities:

1. Orientation and Preparation:

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Internship			2

- Conduct orientation sessions to familiarize students with the objectives, expectations, and guidelines of the industrial training program.
- Assist students in understanding the importance of industrial training in their academic and professional development.

2. Placement Coordination:
   - Collaborate with the placement cell or industry liaison office to secure suitable training placements for students that align with their academic specialization and career interests.
   - Facilitate communication between the institution and host organizations to ensure smooth coordination of training arrangements.
3. Training Plan Development:
   - Help students develop a detailed training plan outlining learning objectives, tasks, and expected outcomes for the training period.
   - Guide students in setting SMART (Specific, Measurable, Achievable, Relevant, Time-bound) goals for their training experience.

During Training Responsibilities:

4. Monitoring and Support:
   - Regularly monitor the progress of students during their industrial training. Maintain communication with both students and industry supervisors to track performance and address any issues that may arise.
   - Provide ongoing support and guidance to students, offering advice on technical challenges, professional conduct, and workplace etiquette.
5. Technical Guidance:
   - Offer technical guidance and mentorship related to the specific engineering discipline or specialization of the students. Help them apply theoretical knowledge to practical situations encountered in the industry.
6. Problem-Solving Assistance:
   - Assist students in overcoming obstacles or challenges encountered during their training. Encourage them to develop problem-solving skills and resilience in real-world engineering scenarios.

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Internship			2

7. Feedback and Evaluation:
    - Provide constructive feedback on students' performance based on reports, assessments, and observations gathered from industry supervisors.
    - Evaluate students' achievements in relation to their training objectives and competencies developed during the program.

Post-Training Responsibilities:

8. Reflection and Debriefing:
    - Conduct debriefing sessions with students to reflect on their training experiences, discuss lessons learned, and identify areas for further improvement.
    - Help students articulate their learning outcomes and how these experiences contribute to their professional growth.
9. Documentation and Reporting:
    - Ensure comprehensive documentation of students' training activities, achievements, and feedback received from industry supervisors.
    - Prepare reports summarizing students' performance and submit these to relevant departments or committees for review and assessment.
10. Career Counseling:
    - Provide career guidance and counseling to students based on their industrial training experiences. Assist them in leveraging these experiences for future job applications or further academic pursuits.
11. Continuous Improvement:
    - Collaborate with industry partners to continuously improve the quality and relevance of the industrial training program.
    - Incorporate feedback from students and industry supervisors to enhance the effectiveness of future training placements.

By fulfilling these duties and responsibilities, faculty mentors contribute significantly to the overall educational experience and professional development of Diploma engineering students during their industrial training program.

2049235773	Industrial Training	Summer Vacation	C
Internship			2

Instructions to the students

Before Starting Industrial Training:

1. **Orientation and Preparation:**
    - Attend orientation sessions conducted by the institution or faculty mentors to understand the objectives, expectations, and guidelines of the industrial training program.
    - Familiarize yourself with the specific policies, procedures, and safety regulations of the host organization where you will be undergoing training.
2. Setting Goals:
    - Set clear and specific goals for your industrial training period. Define what skills, knowledge, and experiences you aim to gain during this time.
    - Discuss your goals with your faculty mentor and seek their guidance in developing a training plan that aligns with your career aspirations.
3. Professional Attire and Conduct:
    - Dress appropriately and professionally according to the standards of the industry and host organization.
    - Maintain a positive attitude, demonstrate punctuality, and adhere to workplace etiquette and norms.

During Industrial Training:

4. Learning and Engagement:
    - Actively engage in all assigned tasks and projects. Seek opportunities to learn new skills and technologies relevant to your field of study.
    - Take initiative in asking questions, seeking clarification, and participating in discussions with supervisors and colleagues.
5. Adaptability and Flexibility:
    - Adapt to the work environment and demonstrate flexibility in handling various responsibilities and challenges that arise during your training.
    - Be open to different roles and tasks assigned to you, as this will broaden your experience and skill set.

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Internship			2

6. Professionalism and Communication:
    - Communicate effectively with supervisors, colleagues, and clients as required. Practice clear and concise verbal and written communication.
    - Demonstrate professionalism in all interactions, respecting confidentiality, and adhering to company policies and procedures.
7. Safety and Compliance:
    - Prioritize safety at all times. Familiarize yourself with safety protocols, procedures, and emergency exits in the workplace.
    - Follow all safety guidelines and regulations to ensure your well-being and that of others around you.

After Completing Industrial Training:

8. Reflection and Documentation:
    - Reflect on your training experience. Evaluate what you have learned, the challenges you faced, and how you have grown professionally.
    - Maintain a journal or log documenting your daily activities, achievements, and lessons learned during the training period.
9. Feedback and Evaluation:
    - Seek feedback from your industry supervisor and faculty mentor on your performance and areas for improvement.
    - Use constructive feedback to enhance your skills and competencies for future career opportunities.
10. Career Planning:
    - Use your industrial training experience to inform your career planning and decision-making process.
    - Discuss your career goals and aspirations with your faculty mentor or career counselor for guidance on next steps after completing your diploma.

By following these instructions, Diploma engineering students can make the most of their industrial training experience, gain valuable insights into their chosen field, and prepare themselves effectively for future professional endeavors.

Attendance Certification

2049235773	Industrial Training	Summer Vacation	C
Internship			2

Every student has to get their attendance certified by the industrial supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the institution faculty mentor.

Training Reports

The students have to prepare reports: The report in the form of a diary to be submitted to the concerned faculty mentor of the institution. This will be reviewed while awarding Internal assessment.

Industrial Training Diary

Students are required to maintain the record of day-to-day work done. Such a record is called Industrial training Diary. Students have to write this report regularly. All days for the week should be accounted for clearly giving attendance particulars (Presence, absence, Leave, Holidays etc.). The concern of the Industrial supervisor is to periodically check these progress reports.

In addition to the diary, students are required to submit a comprehensive report on training with details of the organisation where the training was undergone after attestation by the supervisors. The comprehensive report should incorporate study of plant / product / process / construction along with intensive in-depth study on any one of the topics such as processes, methods, tooling, construction and equipment, highlighting aspects of quality, productivity and system. The comprehensive report should be completed in the last week of Industrial training. Any data, drawings etc. should be incorporated with the consent of the Organisation.

Scheme of Evaluation

2049235773	**Industrial Training**	Summer Vacation	C
Internship			2

Internal Assessment

Students should be assessed for 40 Marks by industry supervisor and polytechnic faculty mentor for the Internal Assessment.

Sl. No.	Description	Marks
A	Punctuality and regularity. (Attendance)	10
B	Level / proficiency of practical skills acquired. Initiative in learning / working at site	10
C	Self expression / communication skills. Interpersonal skills / Human Relation.	10
D	Report and Presentation.	10
	Total	40

End Semester Examination - Project Exam

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairman Board of Examinations after the completion of industrial training. The marks scored will be converted to 60 marks for the End Semester Examination.

Scheme of Evaluation

Sl. No.	Description	Marks
A	Daily Activity Report and Attendance certificate.	20
B	Comprehensive report on Internship, Relevant Internship Certificate from the concerned department.	30
C	Presentation by the student at the end of the Internship.	30
D	Viva Voce	20
Total		100

2049235341	APPLIED ROBOTICS	L	T	P	C
Practicum		1	0	4	3

Rationale

Robotics is an interdisciplinary branch of electronic engineering and mechanical engineering. Robotics involves design, construction, operation, and use of robots. The goal of robotics is to design machines that can help and assist humans. Robotics integrates fields of mechanical engineering, electrical engineering, information engineering, Mechatronics, electronics, bioengineering, computer engineering, control engineering, software engineering, mathematics, etc. In Recent days' industrial robots are gaining more importance in all type of industries due to the introduction of digital manufacturing. A strong foundation of industrial robots will be an added advantage in the digital manufacturing platform.

Course Objectives

On successful completion of the course, the students must be able to

- Recognize the role robots in industries
- Compare various types of material handling techniques.
- Study the working of various industrial robot installations.
- Explain the economics associated with robotisation of industries.
- Select the robot based on industrial requirements.
- Explain the applications of machine vision in industries.

Course Outcomes

After successful completion of this course, the students should be able to
CO1: Understand the various types of Industrial, field and service Robots and their characteristics and capabilities.
CO2: Familiarize with the operation of Robots and processes involved.
CO3: Design basic to complex hydraulic and pneumatic circuits, demonstrating an understanding of system requirements and constraints.
CO4: Familiarize with the applications of various field and service Robots.
CO5: Select the right Robot with required configurations and specifications for applications.

Pre-requisites

Knowledge about the principles of robotics.

2049235341	APPLIED ROBOTICS	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	2	2	3	1	2
CO2	3	2	3	3	3	1	2
CO3	3	2	3	3	3	1	3
CO4	3	2	3	3	3	1	3
CO5	3	2	3	3	3	1	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Massive open online courses (MOOCs) may be used to teach various topics.
- The topics that are relatively simpler or descriptive are to be given to the students for **self-directed learning** and assess the outcomes through classroom seminars or group discussions.
- Teachers must ensure to create opportunities for co-curricular activities.
- Videos and simulations may be used to teach various topics.
- Encourage students to refer to different textbooks and case studies to have deeper understanding of the subject.
- Observe and continuously monitor the performance of the student in the laboratory.
- Instruct students about emerging trends in industrial robotics and create awareness about the development in robotics through seminars and guest lectures.

2049235341	APPLIED ROBOTICS	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Experiments/ 50% Experiments	Cycle II Experiments/ Another 50% Experiments	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

CA1 and CA2: All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The experiment should be completed on the day of practice.

Practicum		1	0	4	3

The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook / printed manual / file. The Circuit Diagram, Readings, Calculations and Graph/Result should be written by the student manually.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

Scheme of Evaluation

Writing Program	-	20 Marks
Execution / Simulation	-	20 Marks
Result	-	10 Marks
Practical Documents	-	10 Marks
Total	**-**	**60 Marks**

CA 3: A written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		**Marks**	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

CA 4: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be

conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern

2049235341	APPLIED ROBOTICS	L	T	P	C
Practicum		1	0	4	3

scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Writing Program	-	20 Marks
Execution / Simulation	-	30 Marks
Result	-	10 Marks
Written Test	-	30 Marks
Viva Voce	-	10 Marks
Total	-	**100 Marks**

Note: For the written test 30 MCQ shall be asked from the theory portions.

2049235341	APPLIED ROBOTICS	L	T	P	C
Practicum		1	0	4	3

Unit I	**INTRODUCTION**	
Need and importance of robots - structure and classification of industrial robots, characteristics of industrial robot, Load handling capacity, general considerations in Robotic material handling applications, Robot work cell – Robot centred cell		3
Ex.No	Name of the Experiment	
1	Simple Teach Pendant Program(TPP) to check robot positional data. (Ex: Drawing a rectangle shape in the world frame)	12
2	Real time programming (online TPP) for palletizing and De-palletizing operation	
UNIT II	**INDUSTRIAL APPLICATIONS**	
Robots in Arc welding, Robots in Spot welding: Robot selection factors for welding. Application of robot in spray painting, assembly operation, cleaning.		3
Ex.No	Name of the Experiment	12
3	TPP/Offline program for parts assembly	
4	TPP/Offline program for drilling operation	
UNIT III	**ROBOTS FOR INSPECTION**	

2049235341	APPLIED ROBOTICS	L	T	P	C

Robotic vision systems- Robot vision – Need, Applications - image acquisition – illumination techniques - Image representation, object recognition and categorization, depth measurement, image data compression (All topics brief introduction only), Vision based Part Inspection.		3
Ex.No	Name of the Experiment	
5	TPP/Offline program for vision based inspection	12
6	TPP/Offline program for deburring operation.	
Unit IV	**FIELD AND SERVICE ROBOTS**	
Introduction to swarm Robots – challenges and benefits of swarm systems – Cooperative manipulation (Introduction), Challenges in cooperative manipulation - Robots in agriculture – Medical robotic systems – Cleaning and lawn moving robots - The role of Robots in education – Introduction to Underwater robots and its application – Introduction to UAV.		3
Ex.No	Name of the Experiment	
7	Program and simulate machine loading and unloading practice with time delay.	12
8	Program and simulate coordinated identification, inspection, and part assembly	
Unit V	**SELECTION OF ROBOTS AND ECONOMICS OF ROBOTISATION**	
Selection of Robots - Factors influencing the choice of a robot - Socio-Economic aspect of robotisation. Economical aspects for robot design, Safety for the robot, and standards. Economics analysis for robotics – cost data required for the analysis – methods of economic analysis – payback method – equivalent uniform annual cost method – return on investment method (Introduction with examples)		3
Ex.No	Name of the Experiment	
9	TPP/Offline program for spray painting practice.	12
10	Line follower robot Programming.	

Text Books:

1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education, 2009.
2. Mikell P. Groover et. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, Special Edition, (2012).
3. Ganesh S Hegde, "A textbook on Industrial Robotics", University science press, 3rd edition, 2017.

Practicum		1	0	4	3

4. Bruno Siciliano, OussamaKhatib, —Springer Handbook of Robotics‖, Springer-Verlag Berlin Heidelberg 2008.
5. Yangsheng Xu Huihuan Qian Xinyu Wu, "Household and Service Robots", Elsevier Ltd, 2015.

Reference Books:

6. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd., 2006.
7. 2. Fu K S, Gonzalez R C, Lee C.S.G, "Robotics: Control, Sensing, Vision and Intelligence",McGraw Hill, 1987. https://www.robots.com/applications.
8. AleksandarLazinica, —Mobile Robots Towards New Applications‖, Advanced Robotic Systems International, 2006.
9. Gregory Dudek,Michael Jenkin, —Computational Principles of Mobile Robotics‖, 2nd edition, Oxford University Press, 2010.
10. L Marques,A de Almeida,Mo Tokhi,GSVirk, —Advances in Mobile Robotics‖, World Scientific Publishing Co. Pte. Ltd. 2008.

Suggested Student Activity: In addition to classroom and laboratory learning, **student-centric co-curricular activities** can be undertaken to accelerate the attainment of various outcomes of the course.

- Students should conduct the following activities in groups, prepare a report of about 5 – 10 pages, and collect the physical evidence for the internal assessment.
- Conduct an internet survey and make a list of leading manufacturers of industrial robots and other automation tools.
- Identify the industrial standards followed in robots.
- Read the safety precautions to be followed for the installation of robot cells.
- Prepare a presentation or report on troubleshooting techniques.

Equipment / Facilities required for conducting the Practical Course

1. 6 Axis Articulated Robot
    a. Material Handling - 1 No
    b. General Purpose (Welding, Assembly, Drilling) - 1 No
2. Conveyor System - 1 No
3. Assembly Workbench with fixture
4. A mounted vision system with software (Free open source Robot simulation software)
5. Mobile robot kit - 5 No's

2049235341	APPLIED ROBOTICS	L	T	P	C
Practicum		1	0	4	3

END SEMESTER EXAMINATION – PRACTICAL EXAM
BOARD EXAMINATION

Duration: 3 Hours. **Max. Marks: 100**

Note:

All the exercises should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises / experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by the DOTE Exam section shall be used. The record of work done by the student should be submitted with a Bonafide Certificate.

DETAILLED ALLOCATION OF MARKS

Writing Program	-	20 Marks
Execution / Simulation	-	30 Marks
Result	-	10 Marks
Written Test	-	30 Marks
Viva Voce	-	10 Marks
Total	-	**100 Marks**

2049235342	BIG DATA AND ANALYTICS	L	T	P	C
Practicum		1	0	4	3

Rationale

Big Data and Analytics are increasingly essential in today's world, playing a pivotal role in transforming industries, driving business strategies, and fostering innovation. This course helps the learner to understand the basic concepts of big data and analytics. This course covers on big data technologies used for storage, analysis and manipulation of data. The student will learn about fundamentals of Hadoop, Map Reduce, Pig, Hive, R and have practicals on the same.

Course Objectives

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

- Knowledge about Big data Technologies and tools used for Big data.
- Implement and work on tools to handle large volume of data in parallel and distributed environments.
- Familiarize with Hadoop distributions, configuring Hadoop and performing File management tasks.

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Understand fundamental concepts of Big Data and its technologies.

CO2: Analyze the Big Data framework like Hadoop to efficiently store and process Big Data to generate analytics.

CO3: Implement Big Data Activities using Pig, Hive and Hbase.

CO4: Experiment MapReduce in Hadoop frameworks.

CO5: Resolve problems associated with big data with the features of R programming.

Pre-requisites

Basic knowledge in programming.

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	2	2	1	1	2
CO2	3	2	3	1	1	1	2
CO3	3	2	3	1	1	1	3
CO4	3	2	3	1	1	1	3
CO5	3	2	2	1	1	1	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

2049235342	BIG DATA AND ANALYTICS	L	T	P	C
Practicum		1	0	4	3

Instructional Strategy

- Massive open online courses (MOOCs) may be used to teach various topics.
- The topics that are relatively simpler or descriptive are to be given to the students for **self-directed learning** and assess the outcomes through classroom seminars or group discussions.
- Teachers must ensure to create opportunities for co-curricular activities.
- Videos and simulations may be used to teach various topics.
- Encourage students to refer to different textbooks and case studies to have deeper understanding of the subject.
- Observe and continuously monitor the performance of the student in the laboratory.
- Instruct students about emerging trends in industrial robotics and create awareness about the development in robotics through seminars and guest lectures.

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Experiments/ 50% Experiments	Cycle II Experiments/ Another 50% Experiments	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

2049235342	BIG DATA AND ANALYTICS	L	T	P	C
Practicum	BIG DATA AND ANALYTICS	1	0	4	3

Note:

CA1 and CA2: All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The experiment should be completed on the day of practice.

The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook / printed manual / file. The Circuit Diagram, Readings, Calculations and Graph/Result should be written by the student manually.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

Scheme of Evaluation

Writing Program	-	20 Marks
Execution / Simulation	-	20 Marks
Result	-	10 Marks
Practical Documents	-	10 Marks
Total	**-**	**60 Marks**

Practicum		1	0	4	3

CA 3: A written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		**Marks**	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

CA 4: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be

conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern and scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Writing Program	-	20 Marks
Execution / Simulation	-	30 Marks
Result	-	10 Marks
Written Test	-	30 Marks
Viva Voce	-	10 Marks
Total	-	**100 Marks**

Note: For the written test 30 MCQ shall be asked from the theory portions.

2049235342	BIG DATA AND ANALYTICS	L	T	P	C
Practicum		1	0	4	3

Unit I	INTRODUCTION TO BIG DATA AND ANALYTICS	
Introduction to Big data, Conventional Data vs Big data, Big data architecture, Big data platforms, Nature of data, Analytic processes and tools, 5 V's of Big data, Big data analytical method, Intelligent data analysis, Big data analytics life cycle		3
UNIT II	**HADOOP**	
Introducing Hadoop, Need of Hadoop, limitations of RDBMS, RDBMS versus Hadoop, Distributed computing challenges, History of Hadoop, Hadoop overview, Use case of Hadoop, Hadoop distributors, HDFS (Hadoop Distributed File System) , Processing data with Hadoop.		3
UNIT III	**PIG, HIVE, HBASE**	
Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.		3
Unit IV	**MAPREDUCE**	
Map Reduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression. Hadoop 2 (YARN): Architecture – Managing resources and applications with Hadoop YARN (Yet another Resource Negotiator), Interacting with Hadoop Eco systems.		3
Unit V	**INTRODUCTION TO R PROGRAMMING**	
Introduction to R – Overview of modern data analytic tools, Introduction to R, R Graphical User Interfaces - Features of R Language, Vectors, Filtering, Creating Matrices , Applying Functions to Matrix Rows and Columns, Lists , Creating List , General List Operations, Data Frames , Creating Data Frames , Matrix like Operations in Frames , Applying Functions to Data Frames ,Reading and Writing Files.		3

Ex.No	Name of the Experiment	
1	Create a database using MySQL and modify tables using the CREATE, ALTER, and DROP commands.	40
2	Data manipulation in MySQL: Inserting Data (INSERT), Updating Data (UPDATE), Deleting Data (DELETE)	
3	Data Retrieval and Formatting in MySQL: Joins (INNER JOIN, LEFT JOIN, RIGHT JOIN, FULL JOIN), Using Subqueries	
4	Data Retrieval and Formatting in MySQL: Using Functions (String, Numeric, Date), Grouping Data (GROUP BY, HAVING)	

5	Experiment on Hadoop Map-Reduce/PySpark: Program to implement word count program using MapReduce	
6	Experiment on Hadoop Map-Reduce/PySpark: Implementing simple algorithms in Map-Reduce: Matrix multiplication.	
7	Experiment on Hadoop Map-Reduce/PySpark: MapReduce program to find the grades of student's.	
8	Count the Number of List Elements in R	
9	Convert matrix to list in R	
10	Count the Number of Words in a String using R	
	Introduction and Revision	20

Text Books:

1. Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publication, 2015.
2. Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
3. Norman Matloff , "The Art of R Programming: A Tour of Statistical Software Design", NoStarch Press.

Reference Books:

4. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", 1st Edition, Wiley and SAS Business Series,2012.
5. Nathan Marz and James Warren, "BIG DATA- Principles and Best Practices of Scalable Real-time Systems"..
6. Chris Eaton, Dirk Deroos et. al., "Understanding Big data", Indian Edition, McGraw Hill, 2015..
7. Vignesh Prajapati, "Big Data Analytics with R and Hadoop", 1st Edition, Packet Publishing Limited, 2013.

Suggested Student Activity: In addition to classroom and laboratory learning, **student-centric co-curricular activities** can be undertaken to accelerate the attainment of various outcomes of the course.

- Students should conduct the following activities in groups, prepare a report of about 5 – 10 pages, and collect the physical evidence for the internal assessment.
- Conduct an internet survey and make a list of leading manufacturers of industrial robots and other automation tools.
- Identify the industrial standards followed in robots.
- Read the safety precautions to be followed for the installation of robot cells.
- Prepare a presentation or report on troubleshooting techniques.

2049235342	BIG DATA AND ANALYTICS	L	T	P	C
Practicum		1	0	4	3

Equipment / Facilities required for conducting the Practical Course

HARDWARE

1. Desktop Computers – 30 Nos
2. Printer – 1 Nos

SOFTWARE

1. Apache Hadoop
2. MySQL
3. R Programming

END SEMESTER EXAMINATION – PRACTICAL EXAM
BOARD EXAMINATION

Duration: 3 Hours. **Max. Marks: 100**

Note:

All the exercises should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises / experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by the DOTE Exam section shall be used. The record of work done by the student should be submitted with a Bonafide Certificate.

DETAILLED ALLOCATION OF MARKS

Writing Program	-	20 Marks
Execution / Simulation	-	30 Marks
Result	-	10 Marks
Written Test	-	30 Marks
Viva Voce	-	10 Marks
Total	-	**100 Marks**

1020235542	Systems Applications and Product (SAP)	L	T	P	C
PRACTICUM		1	0	4	3

Introduction:

SAP stands for Systems, Applications, and Products. The practical use of SAP was first seen when data related to accounts and payroll was stored in an electrical device with specific programs to use the database logically and practically. ERP software is one of the most critical aspects of SAP software. To understand why the SAP Course is so important and popular, one needs to know about the areas where it works and the other aspects attached to SAP. Almost 80% of medium and small-sized organizations have joined the list of SAP services alongside large organizations.

Course Objectives:

After completing this subject, the student will be able to

- Equip with the skills and knowledge of SAP
- Develop and maintain SAP applications using various programming language.
- Understand the TDA/SAP process
- Understand the key steps in the TDA/SAP process.
- Be able to communicate the TDA/SAP process to others.

Course Outcomes

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

CO1: Understand the fundamental concepts of Enterprise Resource Planning (ERP) and SAP.

CO2: Establish a strong foundation in ABAP programming.

CO3: Develop skills in managing data structures using the ABAP Data Dictionary.

CO4: Introduce Object-Oriented ABAP concepts.

CO5: Master the creation of various types of ABAP reports.

Pre-requisites:

Knowledge of basics of Engineering and Industrial engineering

1020235542	Systems Applications and Product (SAP)	L	T	P	C
PRACTICUM		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	-	-	-	-	3	1	3
CO2	-	-	-	-	3	3	3
CO3	-	-	-	1	-	3	2
CO4	-	1	3	3	2	3	2
CO5	-	2	3	3	3	3	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- The instructional strategy for teaching SAP in polytechnic colleges emphasizes practical application and industry relevance.
- Through a curriculum aligned with the state technical education board, the syllabus is broken down into manageable units, prioritizing topics pertinent to Indian engineering contexts.
- Engage and Motivate: Instructors should actively engage students to boost their learning confidence
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an *engaging* learning experience.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.
- Continuous feedback mechanisms ensure the refinement and effectiveness of the instructional approach.

1020235542	Systems Applications and Product (SAP)	L	T	P	C
PRACTICUM		1	0	4	3

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises	Cycle II Exercises	All Portions	All Exercises	All Exercises Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

  Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each

exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

Each experiment should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook or a printed manual or a file documents. The Program, Procedure, Sketch and Output should be written by the student manually. The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim / Procedure	10
B	Steps / Execution	20
C	Report / Presentation	20
TOTAL		50
D	Practical Documents (As per the portions)	10
		60

Cycle I: 1, 2, 3, 4 and 5.

Cycle II: 6, 7, 8, 9 and 10.

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

1020235542	Systems Applications and Product (SAP)	L	T	P	C
PRACTICUM		1	0	4	3

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Aim / Procedure	10
B	Steps / Execution	20
C	Report / Presentation	20
D	Result	10
E	Written Test (Theory Portions)	30
F	Viva Voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

Syllabus Contents

Theory Portion- Unit I : SAP:	
Introduction–SAP - SAP r/3 architecture - central system – distributed	8

presentation - 2-tier configuration - 3-tier configuration. System landscape and flow - single system landscape - two system landscape - three system landscape - multi system landscape. Installation of sap - installation concepts on windows & UNIX and quick sizing - naming convention, software kit, sap licensing - installation procedure – windows application server for unix sap system - r/3 directory structure, kernel gui administrator – optimization – security. Operation modes - manual switching of op modes - exceptional mode – monitoring.	
Practical Exercises	
Exercise 1: Creating and Maintaining Master Records, Architecture - Logon and Password Security, Protecting Special Users	5
Exercise 2: Creating and Maintaining Single and Mass Users and User Groups - Copying, Deleting.	5
Exercise 3: Creating and Maintaining Single and Mass Users and User Groups Locking / Unlocking Users.	5
Exercise 4: Create/Maintaining Authorization/Profile Manually	5
Exercise 5: Create/Maintaining Roles/Generating Profiles by using PFCG.	5
Theory Portion - Unit II : SAP General Administration:	
General Administration – client administration - client maintenance - copying client within r/3 system (local). copying client between r/3 systems (remote) - export/import - protecting client. Monitoring and verifying a client copy - deleting client - tips and troubleshooting.General administration - transport management system - tms terminology and concepts - configuring tms and checking transport directory - configuring transport domain, domain controller and group - configuring virtual sap system and displaying configuration - including sap systems in the transport domain - creating consolidation and delivery routes - maintaining sap systems without common transport directory - configuring external systems - locking and unlocking tms for a sap system - deleting sap system from the transport domain - deleting tms configuration. Change and Transport System - releasing and transporting change request and tasks - customizing, workbench, transport	7

1020235542	Systems Applications and Product (SAP)	L	T	P	C
PRACTICUM		1	0	4	3

organizer - importing change requests. Spool Administration - print related terminology in os/sap level - setting local, remote and front-end printing - logical and real spool server - managing spool requests using output controller - connecting output devices to window system – saplpd, TemSE, Authorization.	
Practical Exercises	
Exercise 6: Creating Consolidation and Delivery Routes- Maintaining SAP Systems without Common Transport Directory - Configuring External System.	5
Exercise 7: Locking and Unlocking TMS for a SAP System.	5
Exercise 8: Deleting SAP System from the Transport Domain.	5
Exercise 9: Deleting TMS Configuration From the Transport Domain.	5
Exercise 10: Connecting Output Devices to Window System.	5
Assessment Test and Revision	10
Total	75

Text and Reference Books:

1. Sushil Markandeya , Kaushik Roy, SAP ABAP: Hands-On Test Projects with Business Scenarios, Apress, 2014.
2. Martin Murray, Jawad Akhtar, Materials Management with SAP ERP: Functionality and Technical Configuration, SAP Press, First Edition, 2016.
3. Sudipta Malakar, SAP/ ABAP/ HANA Programming, BPB Publication, 2018

Web Reference:

- https://www.youtube.com/watch?v=1jFQMadZLfs
- https://www.coursera.org/sap
- Free SAP Training | openSAP
- SAP Help Portal

1020235542	Systems Applications and Product (SAP)	L	T	P	C
PRACTICUM		1	0	4	3

END SEMESTER EXAMINATIONS – PRACTICAL EXAM

Note:

All the exercises/experiments should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises / experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by the DOTE Exam section shall be used. The practical document prepared by the student should be submitted with a Bonafide Certificate.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim / Procedure	10
B	Steps / Execution	20
C	Report / Presentation	20
D	Result	10
E	Written Test (Theory Portions)	30
F	Viva Voce	10
TOTAL MARKS		100

Regulation 2023

2049 - Diploma in Robotics and Automation (Full Time – Regular)

2149 – Diploma in Robotics and Automation (Sandwich)

1144 – Diploma in Automation and Robotics (Full Time – Regular)

VI SEMESTER SYLLABUS

6000236111	Advanced Engineering Mathematics	L	T	P	C
THEORY		3	0	0	3

Introduction

Mathematics is essential for engineering students to understand core engineering subjects. It provides the framework for engineers to solve problems in engineering domains. This course is designed to bridge the gap between diploma mathematics and B.E/B.Tech mathematics in matrix algebra, differential calculus, vector calculus, differential equations, and Laplace transforms.

Course Objectives

The objective of this course is to enable the students to

1. Understand the concepts of eigen-values and eigen-vectors of matrices.
2. Learn the notation of partial differentiation and determine the extremities of functions of two variables.
3. Acquire knowledge in vector calculus which is significantly used to solve engineering problems.
4. Formulate and solve differential equations.
5. Understand Laplace transformation and its engineering applications.

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Find eigenvalues and corresponding eigenvectors of a square matrix.

CO2: Apply the knowledge of partial differentiation to evaluate Jacobian and extremities of two variable functions.

CO3: Evaluate the gradient of a scalar field and the divergence and curl of vector fields.

CO4: Solve ordinary differential equations using various techniques.

CO5: Use Laplace transforms to solve first-order ordinary differential equations.

Pre-requisites

Matrices, Determinants, Differentiation, Integration and Vector Algebra.

6000236111	Advanced Engineering Mathematics	L	T	P	C
THEORY		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	1	1	1	3
CO2	3	3	2	1	1	1	3
CO3	3	3	2	1	1	1	3
CO4	3	3	2	1	1	1	3
CO5	3	3	2	1	1	1	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- A theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome-based.
- All demonstrations/Hands-on practices might be under a simulated environment.
- Use an inducto-deductive approach to achieve the desired learning objectives.
- Use open-ended questions to nurture the problem-solving and reasoning skills among students.
- Support and guide the students for self-study.
- State the need for mathematics with engineering studies and provide real-life examples.

6000236111	Advanced Engineering Mathematics	L	T	P	C
THEORY		3	0	0	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

(5 X 10 Marks = 50 Marks).

Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

6000236111	Advanced Engineering Mathematics	L	T	P	C
THEORY		3	0	0	3

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

Syllabus Contents

Unit I	EIGENVALUES AND EIGENVECTORS	
Characteristic equation – Eigen-values of 2×2 and 3×3 real matrices – Eigen-vectors of 2×2 real matrices – Properties of eigen-values (excluding proof) – Cayley-Hamilton theorem (excluding proof) – Simple problems.		7
Unit II	**FUNCTIONS OF SEVERAL VARIABLES**	
Partial derivatives of two variable and three variable functions (up to second order) – Homogeneous functions and Euler's theorem (excluding proof) – Jacobian matrix and determinant – Maxima and minima of functions of two variables – Simple problems.		7
Unit III	**VECTOR CALCULUS**	
Scalar field and Vector field – Vector differential operator – Gradient of a scalar field – Directional derivative – Divergence and curl of a vector field (excluding properties) – Solenoidal and irrotational vector fields – Simple problems.		7
Unit IV	**DIFFERENTIAL EQUATIONS**	

6000236111	Advanced Engineering Mathematics	L	T	P	C
THEORY		3	0	0	3

Differential equation – Formation – Order and degree – Solution of a differential equation – Equations of first order and first degree – Variable separable method – Leibnitz's Linear equations – Second order equations of the form $(^2+\ +)=$ where , , and are constants and the auxiliary equation $^2+\ +\ =0$ has only real roots) – Complementary function – Particular integral – General solution – Simple problems.		7
Unit V	**LAPLACE TRANSFORMS**	
Definition of Laplace transform – Laplace transforms of standard functions - Linearity and change of scale property (excluding proofs) – First shifting property – Laplace transforms of derivatives – Properties (excluding proofs) – Inverse Laplace transforms – Properties (excluding proofs) – Solving first order ordinary differential equation using Laplace transforms – Simple problems.		7
	Revision + Test	10
	TOTAL HOURS	45

Suggested list of Students Activity,

- Demonstrate the applications of eigen-values in stability analysis, decouple of three-phase systems and vibration analysis.
- Demonstrate maxima and minima of two variable functions using GeoGebra graphing calculator.
- Demonstrate solenoidal vector field and irrotational vector field using engineering applications.
- Demonstrate the applications of differential equations in solving engineering problems.
- Presentation /Seminars by students.
- Quizzes.

Reference Books:

1. John Bird, Higher Engineering Mathematics, Routledge, 9th Edition, 2021.

6000236111	Advanced Engineering Mathematics	L	T	P	C
THEORY		3	0	0	3

2. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.
3. Arumugam, S., Thangapandi Isaac, A., & Somasundaram, A., Differential Equations and Applications, Yes Dee Publishing Pvt. Ltd., 2020.
4. Duraipandian, P., & Kayalal Pachaiyappa, Vector Analysis, S Chand and Company Limited, 2014.
5. Narayanan, S., & Manicavachagom Pillai T.K., Calculus Volume I and II, .Viswanathan Publishers Pvt. Ltd., 2007.

Web Reference

1. https://www.khanacademy.org/math/
2. https://www.mathportal.org/
3. https://openstax.org/subjects/math/
4. https://www.mathhelp.com/
5. https://www.geogebra.org/
6. https://www.desmos.com/
7. https://phet.colorado.edu/

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hours. **Maximum Marks: 100**

Note: Answer Ten questions by selecting Two questions from each unit. Each question carries 10 marks.

Instruction to the question setters.

Each unit should have four questions. Each question carries 10 Marks. Each question may have two subdivisions only.

6000236112	Entrepreneurship	L	T	P	C
THEORY		3	0	0	3

Introduction

Development of a diploma curriculum is a dynamic process responsive to the society and reflecting the needs and aspirations of its learners. Fast changing society deserves changes in educational curriculum particularly to establish relevance to emerging socio-economic environments; to ensure equity of opportunity and participation and finally promote concern for excellence. In this context the course on entrepreneurship and start ups aims at instilling and stimulating human urge for excellence by realizing individual potential for generating and putting to use the inputs relevant to social prosperity and thereby ensuring good means of living for every individual, providing jobs and developing the Indian economy.

Course Objectives

After completing this subject, the student will be able to

- Acquire entrepreneurial spirit and resourcefulness
- Familiarize Acquire knowledge about the business idea and product selection
- Analyze the banking and financial institutions
- Understand the pricing policy and cost analysis
- Get knowledge about the business plan preparation

Course Outcomes

CO1: Explain the process of entrepreneurship

CO2: Analyse the importance of generation of ideas and product selection

CO3: Familiarization of various financial and non financial schemes

CO4: Acquire various cost components to arrive pricing of the product

CO5: Learn the preparation of project feasibility report

Pre-requisites

Knowledge of basics of Engineering and Industrial engineering

6000236112	Entrepreneurship	L	T	P	C
THEORY		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	-	-	-	-	3	1	3
CO2	-	-	-	-	3	3	3
CO3	-	-	-	1	-	3	2
CO4	-	1	3	3	2	3	2
CO5	-	2	3	3	3	3	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice- activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real- world scenarios when possible.

6000236112	Entrepreneurship	L	T	P	C
THEORY		3	0	0	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

(5 X 10 Marks = 50 Marks).

Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be

6000236112	Entrepreneurship	L	T	P	C
THEORY		3	0	0	3

kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

Syllabus Contents

Unit I	**Entrepreneurship – Introduction and Process**	
Concept of entrepreneurship - Importance, Myths about Entrepreneurship, Pros and Cons of Entrepreneurship, Process of Entrepreneurship, , Competencies and characteristics of an entrepreneur -, Ethical Entrepreneurship, Entrepreneurial Values and Attitudes, Creativity, Innovation and entrepreneurship- Entrepreneurs - as problem solvers, Mindset of an employee and an entrepreneur, - Risk Taking-Concepts		7
Unit II	**Business Idea**	
Types of Business: Manufacturing, Trading and Services, Stakeholders: sellers, vendors and consumers and Competitors, E- commerce Business Models, business idea generation -Types of Resources - Human, Capital and Entrepreneurial tools and resources, etc.,- setting business goals- Patent, copyright and Intellectual property rights, Customer Relations and Vendor Management, -Business Ideas vs. Business Opportunities, Opportunity – SWOT ANALYSIS of a business idea - Business Failure – causes and remedies.- Types of business risks,		7

6000236112	Entrepreneurship	L	T	P	C
THEORY		3	0	0	3

Unit III	Banking	
Size and capital based classification of business enterprises- Role of financial institutions, Role of Government policy, Entrepreneurial support systems, Incentive schemes for state government, and Incentive schemes for Central governments.		7
Unit IV	**Pricing and Cost Analysis**	
Types of Costs - Variable - Fixed- Operational Costs - Break Even Analysis - for single product or service, -financial Business Case Study, Understand the meaning and concept of the term Cash Inflow and Cash Outflow- Pricing- Calculate Per Unit Cost of a single product, , Understand the importance and preparation of Income Statement, Prepare a Cash Flow Projection- Factors affecting pricing.- GST.		7
Unit V	**Business Plan Preparation**	
Feasibility Report – Technical analysis, financial analysis- Market Research - Concept, Importance and Process- tools for market research- Market Sensing and Testing, Marketing and Sales strategy, Digital marketing, Branding - Business name, logo, tag line, Promotion strategy, Business Plan Preparation, -Concept and Importance, , Execution of Business Plan.		7
	Revision + Test	10
	TOTAL HOURS	45

Suggested list of Students Activity.

1. Students can explore app development or web design. They'll learn about technology, user experience, and marketing.
2. Hosting events, workshops, or conferences allows students to practice project management, networking, and marketing skills.
3. Encourage students to address social or environmental issues through innovative business solutions. This fosters empathy and creativity.
4. Part of entrepreneurship clubs or organizations provides networking opportunities, mentorship, and exposure to real-world challenges.

6000236112	Entrepreneurship	L	T	P	C
THEORY		3	0	0	3

5. Competitions like business plan contests or pitch events allow students to showcase their ideas and receive feedback.
6. Students can create and sell handmade crafts, artwork, or other products. This teaches them about production, pricing, and customer relations.
7. Students can provide consulting services in areas they're knowledgeable about, such as social media marketing or financial planning.
8. Encourage students to create and manage their own small business or offer freelance services. This hands-on experience helps them understand various aspects of entrepreneurship.

Text and Reference Books:

1. G.K. Varshney, Fundamentals of Entrepreneurship, Sahitya Bhawan Publications, Agra., 2019.
2. H.Nandan, Fundamentals of Entrepreneurship, Prentice Hall India Learning Private Limited, Third Edition, 2013.
3. R.K. Singal, Entrepreneurship Development & Management, S K Kataria and Sons, 2013.

Web Reference:

- https://ocw.mit.edu/courses/15-390-new-enterprises-spring-2013/resources/lecture-1/
- https://onlinecourses.nptel.ac.in/noc20_ge08/preview

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hours. **Maximum Marks: 100**

Note: Answer Ten questions by selecting Two questions from each unit. Each question carries 10 marks.

Instruction to the question setters.

Each unit should have four questions. Each question carries 10 Marks. Each question may have two subdivisions only.

6000236113	Project Management	L	T	P	C
THEORY		3	0	0	3

Introduction

Project management is the systematic application of knowledge, skills, tools, and techniques to project activities to meet specific project requirements. It involves planning, organizing, and managing resources to achieve project goals within defined scope, time, and budget constraints. Project management encompasses several key processes and phases, including initiation, planning, execution, monitoring and controlling, and closing. It is essential across various industries to ensure projects are completed successfully, efficiently, and effectively, aligning with organizational objectives and stakeholder expectations. Project managers play a crucial role in leading teams, managing risks, ensuring quality, and communicating with stakeholders to drive project success.

Course Objectives

After completing this subject, the student will be able,

- To understand the concept, characteristics and elements of projects.
- To understand the stages in Project Life Cycle.
- To appreciate the need for Project Portfolio Management System.
- To know the considerations in choosing appropriate project management structure.
- To understand the components of techno-economic feasibility studies.
- To know about the detailed project report
- To learn about project constraints.
- To understand the techniques of evaluation.
- To get insight into the Social Cost Benefit Analysis Method.
- To know how to construct project networks using PERT and CPM.
- To learn how to crash project networks
- To understand the meaning of project appraisal.
- To understand the meaning of project audits.
- To know the qualities of an effective project manager.
- To understand the stages in the Team Development model.

Course Outcomes

6000236113	Project Management	L	T	P	C
THEORY		3	0	0	3

CO 1: Explain the principles of Project Management

CO 2: Create and manage project schedules.

CO 3: Create structure and manage the project commitments.

CO 4: Acquire to Gain enterprise support.

CO 5: Prepare a Detailed Project Report (DPR).

Pre-requisites

Basic Knowledge.

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	3	1
CO2	3	-	-	-	1	3	1
CO3	3	-	-	1	1	3	1
CO4	3	-	-	-	1	3	1
CO5	3	-	-	1	1	3	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

6000236113	Project Management	L	T	P	C
THEORY		3	0	0	3

Instructional Strategy

- It is advised that teachers take steps to pique pupils' attention and boost their curiosity to learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

6000236113	Project Management	L	T	P	C
THEORY		3	0	0	3

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

(5 X 10 Marks = 50 Marks).

Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

Syllabus Contents

Unit I	Project Management – An Overview, Project Portfolio Management System and Structure, Steps in Defining Project and Project Delays	
Project – Classification – Importance of Project Management – An Integrated Approach – Project Portfolio Management System – The Need – Choosing the appropriate Project Management Structure: Organizational considerations and project considerations – steps in defining the project – project Rollup – Process breakdown structure – Responsibility Matrices – External causes of delay and internal constraints.		7

6000236113	Project Management	L	T	P	C
THEORY		3	0	0	3

Unit II	Various Stages and Components of Project Feasibility Studies, Phases of a Project, Stages in Project Life Cycle and Project Constraints	
Project feasibility studies - Opportunity studies, General opportunity studies, specific opportunity studies, pre-feasibility studies, functional studies or support studies, feasibility study – components of project feasibility studies – Managing Project resources flow – project planning to project completion: Pre-investment phase, Investment Phase and operational phase – Project Life Cycle – Project constraints.		7
Unit III	**Project Evaluation under Certainty and Uncertainty, Project Evaluation, Commercial and Social Cost Benefit Analysis**	
Project Evaluation under certainty - Net Present Value (Problems - Case Study), Benefit Cost Ratio, Internal Rate of Return, Urgency, Payback Period, ARR – Project Evaluation under uncertainty – Methodology for project evaluation – Commercial vs. National Profitability – Social Cost Benefit Analysis, Commercial or National Profitability, social or national profitability.		7
Unit IV	**Developing Project Network using PERT and CPM, Project Appraisal and Control Process.**	
Developing a Project Plan - Developing the Project Network – Constructing a Project Network (Problems) – PERT – CPM – Crashing of Project Network (Problems - Case Study) – Resource Leveling and Resource Allocation – how to avoid cost and time overruns – Steps in Project Appraisal Process – Project Control Process – Control Issues – Project Audits – the Project Audit Process – project closure – team, team member and project manager evaluations.		7

Unit V	Project Managing Versus Leading of Project, Qualities of Project Manager and Managing Project Teams, Team Building Models and Performance Teams and Team Pitfalls.

6000236113	Project Management	L	T	P	C
THEORY		3	0	0	3

Managing versus leading a project - managing project stakeholders – social network building (Including management by wandering around) – qualities of an effective project manager – managing project teams – Five Stage Team Development Model – Situational factors affecting team development – project team pitfalls.	7
Revision + Test	10
TOTAL HOURS	45

Suggested list of Students Activity,

Project Simulation and Role-Playing:

- Activity: Participate in simulated project scenarios where students take on different roles within a project team (e.g., project manager, team member, stakeholder).
- Purpose: This helps students understand the dynamics of project management, including leadership, communication, and team collaboration.

Case Study Analysis:

- Activity: Analyze real-world case studies of successful and failed projects.
- Purpose: This activity enables students to apply theoretical knowledge to practical situations, identify best practices, and learn from the challenges and solutions implemented in real projects.

Project Plan Development:

- Activity: Develop a comprehensive project plan for a hypothetical or real project, including scope, schedule, budget, risk management, and quality management plans.
- Purpose: This allows students to practice creating detailed and structured project plans, honing their skills in planning and organizing project activities.

Group Project:

- Activity: Work in teams to manage a project from initiation to closure, simulating a real project environment.

6000236113	Project Management	L	T	P	C
THEORY		3	0	0	3

- Purpose: Group projects help students learn how to work collaboratively, manage group dynamics, and apply project management tools and techniques in a team setting.

Project Management Software Training:

- Activity: Gain hands-on experience with project management software such as Microsoft Project, Asana, or Trello.
- Purpose: This activity equips students with practical skills in using technology to plan, track, and manage project tasks and resources efficiently.

Reference Books:

1. Clifford F. Gray And Erik W. Larson, Project Management – The Managerial Process, Tata Mcgraw Hill.
2. Dragan Z. Milosevic, Project Management Toolbox: Tools And Techniques For The Practicing Project Manager,
3. Gopalakrishnan, P/ Ramamoorthy, V E, Textbook Of Project Management, Macmillan India. Ltd.
4. Harold Kerzner, Project Management: A Systems Approach To Planning, Scheduling, And Controlling, Eighth Edition, John Wiley & Sons
5. Jason Charvat, Project Management Methodologies: Selecting, Implementing, And Supporting Methodologies And Processes For Projects, John Wiley & Sons
6. Kevin Forsberg, Ph.D, Hal Mooz, Visualizing Project Management: A Model For Business And Technical Success, Second Edition, Pmp And Howard Cotterman, John Wiley & Sons.

Web Reference

https://youtu.be/pc9nvBsXsuM

NPTEL Courses

https://youtu.be/PqQqTAu_FiM

6000236113	Project Management	L	T	P	C
THEORY		3	0	0	3

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hours. **Maximum Marks: 100**

Note: Answer Ten questions by selecting Two questions from each unit. Each question carries 10 marks.

Instruction to the question setters.

Each unit should have four questions. Each question carries 10 Marks. Each question may have two subdivisions only.

6000236114	Finance Fundamentals	L	T	P	C
THEORY		3	0	0	3

Introduction

This course gives a deep insight into the finance fundamentals such as money management and the process of acquiring needed funds. It also encompasses the oversight, creation, and study of money, banking, credit, investments, assets, liabilities that make up financial systems and improves overall financial literacy.

Course Objectives

The objective of this course is to

1. Identify different ways to save money for future
2. Understand various techniques to raise capital
3. Get acquainted with the essential terminologies used in finance language
4. Get exposed to different types of budgeting
5. Instill the concept of costing and its impact on profitability

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Manage financial resources effectively to achieve personal goals

CO2: Explain the procedure for Business Funding

CO3: Exhibit financial literacy through the usage of different terminologies appropriate to the context

CO4: Differentiate the types of budgeting and allocate the resources

CO5: Apply the idea of marginal costing in decision making

Pre-requisites

Knowledge of basic mathematics

CO/PO Mapping

6000236114	Finance Fundamentals	L	T	P	C
THEORY		3	0	0	3

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	1	-	2
CO2	3	-	-	-	1	-	2
CO3	3	-	-	-	1	-	2
CO4	3	-	-	-	1	-	2
CO5	3		-	-	1	-	2

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice- activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real- world scenarios when possible.

6000236114	Finance Fundamentals	L	T	P	C
THEORY		3	0	0	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

(5 X 10 Marks = 50 Marks).

Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

6000236114	Finance Fundamentals	L	T	P	C
THEORY		3	0	0	3

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

Syllabus Contents

UNIT I	Personal Finance	
Personal Finance – Meaning, Objectives and advantages – Individual Perspective – Family Perspective – Time Value of Money – Personal Savings: Meaning, Different modes of Saving – Bank Deposit, Online Investments, Insurance, Stocks, Gold, Real Estate – Returns Vs Risk – Financial Discipline – Setting Alerts for commitments (With Real time Examples).		7
UNIT II	**Business Funding**	
Sources: Personal Savings – Borrowings - Venture Capital – Venture Capital Process – Commercial Banks – Government Grants and Scheme.		7
UNIT III	**Finance language**	
Capital – Drawing – Income – Expenditure – Revenue Vs Capital Items – Assets – Fixed Assets – Current Assets – Fictitious Assets – Liabilities – Long-term Liabilities – Current Liabilities – Internal Liabilities – External Liabilities – Shareholders fund: Equity Share capital, Preference Share Capital, Reserve &		7

6000236114	Finance Fundamentals	L	T	P	C
THEORY		3	0	0	3

Surplus – Borrowings: Debentures, Bank Loan, Other Loan – Depreciation – Reserve Vs Provision.		
UNIT IV	**Budgeting**	
Budgetary Control – Meaning – Preparation of various budgets – Purchase budget – Sales Budget – Production budget – Cash Budget – Flexible budgets. (With Problems)		7
UNIT V	**Marginal Costing**	
Marginal Costing – Meaning – Marginal Costing Vs Absorption Costing – Concepts of Variable Cost, Fixed Cost and Contribution – PV Ratio – Break Even Point – Margin of Safety – Key Factor – Application of Marginal Costing in decision making – Make or Buy – Shutdown or Continue – Exploring New Markets (With Problems)		7
Revision + Test		10

Suggested list of Students Activity,

Financial Statement Analysis:

- Activity: Analyze and interpret financial statements, including balance sheets, income statements, and cash flow statements of different companies.
- Purpose: This activity helps students understand the financial health and performance of organizations, developing skills in financial analysis and critical thinking.

Investment Portfolio Management:

- Activity: Create and manage a simulated investment portfolio, making decisions on asset allocation, stock selection, and diversification.
- Purpose: This allows students to apply theoretical concepts in a practical setting, learning how to evaluate investment opportunities and manage financial risk.

6000236114	Finance Fundamentals	L	T	P	C
THEORY		3	0	0	3

Case Study Analysis:

- Activity: Examine real-world case studies involving financial decisions made by companies, such as capital budgeting, mergers and acquisitions, and financial restructuring.
- Purpose: Case studies provide insights into the application of finance principles in business scenarios, enhancing problem-solving and decision-making skills.

Classroom Discussions and Debates:

- Activity: Participate in discussions and debates on current financial issues, market trends, and economic policies.
- Purpose: Engaging in discussions helps students stay informed about the latest developments in finance, develop their communication skills, and form well-rounded opinions on financial matters.

Reference Books:

1. Banking Theory, Law & Practice - Dr.L.Natarajan, Margham Publications.
2. Corporate Accounting by T.S.Reddy and Dr.A.Murthy, Margham Publications.
3. Management Accounting by T.S.Reddy and Dr.Y.Hariprasd Reddy, Margham Publications.
4. Cost Accounting by T.S.Reddy and Dr.Y.Hariprasd Reddy, Margham Publications.

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hours. **Maximum Marks: 100**

Note: Answer Ten questions by selecting Two questions from each unit. Each question carries 10 marks.

Instruction to the question setters.

Each unit should have four questions. Each question carries 10 Marks. Each question may have two subdivisions only.

2049236111	INDUSTRIAL ENGINEERING	L	T	P	C
PRACTICUM		3	0	0	3

Introduction

In the Indian Economy, Industries and enterprises always find a prominent place. After globalization, the government of India has announced a liberalization policy of starting an enterprise which resulted in the mushroom growth of industries. The present day students should be trained not only in manufacturing processes but also in managing activities of industries. Training must be imparted to students not only to shape them as technicians but also as good managers. The knowledge about plant, safety, work study techniques, personnel management and financial management will definitely mould the students as managers to suit the industries. Due to the presence of such personalities the industries will leap for better prosperity and development.

Course Objectives

The objective of this course is to enable the student to

- To study the different types of layout.
- To study the safety aspects and its impacts on an organization.
- To study different work measurement techniques.
- To study the staff selection procedure and training of them.
- To study capital and resources of capital.
- To study inventory control systems.
- To study engineering ethics and human values.

Course Outcomes

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

CO1: Select the plant layout by incorporating plant safety procedure

CO2: Apply work study principles as a tool for plant management

CO3: Describe the principles of management used in industries

CO4: Apply various inventory control techniques in material management

CO5: Describe modern management techniques used in shop floor

Pre-requisites

Basic knowledge of industries and its practices (through Industrial Visits)

2049236111	INDUSTRIAL ENGINEERING	L	T	P	C
PRACTICUM		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3						
CO2	3			2			
CO3	3						
CO4	3			2			
CO5	3						

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Conduct group discussions on plant safety
- Encourage students to know about the share market details (BSE, NSE)
- Use PowerPoint presentations.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

2049236111	INDUSTRIAL ENGINEERING	L	T	P	C
PRACTICUM		3	0	0	3

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

(5 X 10 Marks = 50 Marks).

Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

Syllabus Contents.

Unit I	PLANT ENGINEERING AND PLANT SAFETY	
Plant Engineering : Plant – Selection of site of industry – Plant layout – types – process, product and fixed position – Plant maintenance – importance – Break down maintenance, preventive maintenance and scheduled maintenance. Plant Safety: Importance – Industrial safety and procedure-Improper handling-accident - causes and cost of an accident - accident proneness - prevention of accidents-Settlement of industrial disputes - Indian Factories Act 1948 and its provisions related to health, welfare and safety.		9

2049236111	INDUSTRIAL ENGINEERING	L	T	P	C
PRACTICUM		3	0	0	3

Unit II	METHOD STUDY AND WORK MEASUREMENT	
Method Study: Definition – Ergonomics-Basic procedure for conduct of method study – Tools used – Operation process chart, Flow process chart, two handed process chart- Man machine chart. Work Measurement: Definition – Basic procedure in making a time study – Cycle time and Total Time-Techniques of work measurement - Ratio delay study, Synthesis from standard data, analytical estimating, Predetermined Motion Time System(PMTS).		9
Unit III	**PRINCIPLES OF MANAGEMENT**	
Principles of Management: Definition of management – Administration - Organization – F.W. Taylor's and Henry Fayol's Principles of Management - Selection procedure – Training of workers – Apprentice training – On the job training and vestibule school training - wages and salary administration – Components of wages.		9
Unit IV	**FINANCIAL AND MATERIAL MANAGEMENT**	
Financial Management: Resources of capital – shares-preference and equity shares – debentures-Factory costing – direct cost – indirect cost – Factory overhead – Selling price of a product – Profit –. Depreciation – Causes –Methods - Straight line, sinking fund and percentage on diminishing value method Material Management: Objectives of good stock control system – ABC analysis of inventory – Procurement and consumption cycle – Minimum Stock, Lead Time, Reorder Level - Economic order quantity – problems –Supply chain Management - Purchasing Procedure- Bin card.		9
Unit V	**MODERN MANAGEMENT TECHNIQUES**	
5S concept - Just in Time(JIT) - Kaizen - ERP - Kanban - SQC - SPC - PPC - TPM - TQM - Quality tools - 7QC Tools - PDCA Cycle Six sigma - Industry 4.0 – Internet of things(IoT) - Cloud computing - AI and Machine Learning-Management Information System(MIS).		9
	Total	45

2049236111	INDUSTRIAL ENGINEERING	L	T	P	C
PRACTICUM		3	0	0	3

Suggested List of Students Activity

Presentation/seminars by the students on modern management techniques.

Explore various plants during industrial visits.

Find the selling price of a product using ladder diagrams.

Find depreciation values of vehicles.

Find standard time for a particular job (in lathe) using stop watch time study methods.

Reference

1. S.C.Sharma & T.R. Banga, Industrial Engineering and Management, 2nd Edition, Khanna Book Publishing, 2022.
2. S.Chand, Industrial Engineering and Production Management, 3rd Edition, S. Chand Publishing, 2018.
3. M.P.Poonia & S.C.Sharma, Industrial Safety and Maintenance Management,1 st Edition, Khanna Publishing, 2021.

Web-based Online Resources

- https://youtu.be/jFDWlKayrTc?si=oe4glWk9Qb18wxUx
- https://youtu.be/yhywrCChJBQ?si=7eXkcTyAsH8TNP6x

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hours. **Maximum Marks: 100**

Note: Answer Ten questions by selecting Two questions from each unit. Each question carries 10 marks.

Instruction to the question setters.

Each unit should have four questions. Each question carries 10 Marks. Each question may have two subdivisions only.

2049236341	ADVANCED AUTOMATION	L	T	P	C
Practicum		1	0	4	3

Rationale

Totally integrated automation is an engineering framework is widely used for implementing automation solutions across different industries. This enables the industries to avoid the conventional time consuming integration of various components in an automatic system. By adopting this platform, efficiency of the process will immensely improve and reduces the project cost. A course on this concept will introduce the tools used for designing, commissioning, operating maintaining and upgrading the existing automated system to the students.

Course Objectives

On successful completion of the course, the students must be able to

- Understand the fundamentals of Industry 4.0 and TIA platform.
- Explain various programmable automation systems used in industries and their applications.
- Familiarise with the fundamentals of SCADA and DCS systems.
- Recognise various communication protocols used in an automation system
- Study the advancement in manufacturing systems.

Course Outcomes

After successful completion of this course, the students should be able to
CO1: Explain the different functional blocks of totally integrated automation.
CO2: Apply the SCADA in the automation system design of various industrial processes.
CO3: Apply the knowledge of DCS in automation system design.
CO4: Demonstrate the different communication standards used in automation systems.
CO5: Discuss the principles of modern manufacturing technology.

Pre-requisites

Knowledge about the principles of automation.

2049236341	ADVANCED AUTOMATION	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	2	2	3	1	2
CO2	3	2	3	3	3	1	2
CO3	3	2	3	3	3	1	3
CO4	3	2	3	3	3	1	3
CO5	3	2	3	3	3	1	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Massive open online courses (MOOCs) may be used to teach various topics.
- The topics that are relatively simpler or descriptive are to be given to the students for **self-directed learning** and assess the outcomes through classroom seminars or group discussions.
- Teachers must ensure to create opportunities for co-curricular activities.
- Videos and simulations may be used to teach various topics.
- Encourage students to refer to different textbooks and case studies to have deeper understanding of the subject.
- Observe and continuously monitor the performance of the student in the laboratory.
- Instruct students about emerging trends in industrial robotics and create awareness about the development in robotics through seminars and guest lectures.

2049236341	ADVANCED AUTOMATION	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Experiments/ 50% Experiments	Cycle II Experiments/ Another 50% Experiments	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

CA1 and CA2: All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

The experiment should be completed on the day of practice.

The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook / printed manual / file. The Circuit Diagram, Readings, Calculations and Graph/Result should be written by the student manually.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

Scheme of Evaluation

Writing Program	-	20 Marks
Execution / Simulation	-	20 Marks
Result	-	10 Marks
Practical Documents	-	10 Marks
Total	**-**	**60 Marks**

CA 3: A written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

CA 4: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be

2049236341	ADVANCED AUTOMATION	L	T	P	C
Practicum		1	0	4	3

conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern and

scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Hardware Connection	-	15 Marks
Writing Program	-	20 Marks
Execution / Simulation	-	20 Marks
Result	-	10 Marks
Written Test	-	30 Marks
Viva Voce	-	05 Marks
Total	**-**	**100 Marks**

Note: For the written test 30 MCQ shall be asked from the theory portions.

2049236341	ADVANCED AUTOMATION	L	T	P	C
Practicum		1	0	4	3

Unit I	**TOTALLY INTEGRATED AUTOMATION**	
Overview of Industry 4.0 - Need for TIA - Types: Factory Automation and Process Automation - TIA Architecture - Components of TIA systems: Integrated Engineering, Industrial data Management, Industrial Management, Industrial Communication, Industrial Security, Safety Integrated - Selection of TIA Components		3
UNIT II	**SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)**	
Introduction, definition and history of SCADA –SCADA system architecture – elements of SCADA. Features of SCADA - Functions of MTU - Functions of RTU - Developer and runtime packages –Tools – Tags – Graphics - Alarm logging – Tag logging – Trends – History – Report generation.		3
UNIT III	**DISTRIBUTED CONTROL SYSTEMS (DCS)**	
Introduction –Hardware Architecture of DCS (Processor, Power supply, I/O modules, Communication bus, Operator and Engineering station) - Application of DCS System - Local control unit- Programming language – Communication facilities – operator interface – engineering interfaces - Comparison between PLC, SCADA and DCS.		3
Unit IV	**COMMUNICATION PROTOCOLS OF PLC, HMI & SCADA**	

Networking standards & IEEE Standard - RS 232-423-485 standards - Proprietary and open Protocols – Industrial field buses: Foundation Field bus, Process bus and Ethernet - OLE/OPC –DDE – MPI bus system for PLC - Integration of Profibus and HMI - Interfacing of SCADA with PLC, drive, and other field device.		3
Unit V	**FACTORY AUTOMATION**	
Classification and Overview of Manufacturing Systems, Manufacturing Cells, GT and Cellular Manufacturing - Flexible Manufacturing Systems concept - Computer Integrated Manufacture - CNC, intelligent automation.		3
Ex.No	Name of the Experiment	
1	Set up Arduino and connect to a network.	60
2	Write a program to transmit a data to a cloud server.	
3	Control a light bulb using Arduino.	
4	Set up Raspberry Pi and connect to a network.	
5	Build a temperature monitoring system using Raspberry Pi.	
6	Create Wireless network of sensors using ZigBee.	
7	Establish the remote connection between PLC and the cloud using an IIoT protocol (Ex: MQTT).	
8	Remotely monitor the status of the PLC program using an IIoT gateway.	
9	Publish new functionalities on the HMI screen using an IoT protocol	
10	Predict machine maintenance and analyse upfront which alarm is ON through IoT protocol.	

Text Books:

22. John.W.Webb& Ronald A. Reis, "Programmable logic controllers: Principles and Applications", Prentice Hall India.
23. Michael P. Lukas, "Distributed Control systems", "Van Nostrand Reinfold Company".

Reference Books:

24. Win CC Software Manual, Siemens.
25. RS VIEW 32 Software Manual, Allen Bradly.
26. CIMPLICITY SCADA Packages Manual, Fanuc India Ltd.

Suggested Student Activity: In addition to classroom and laboratory learning, **student-centric co-curricular activities** can be undertaken to accelerate the attainment of various outcomes of the course.

- Students should conduct the following activities in groups, prepare a report of about 5 – 10 pages, and collect the physical evidence for the internal assessment.
- Conduct an internet survey and make a list of leading manufacturers of industrial robots and other automation tools.
- Identify the industrial standards followed in robots.
- Read the safety precautions to be followed for the installation of robot cells.
- Prepare a presentation or report on troubleshooting techniques.

Equipment / Facilities required for conducting the Practical Course (Given for Batch of 30 – For Batch of 15 (Relatively reduce the quantity))

1. Arduino kit with Wi-Fi network shield - 20 Nos
2. Raspberry Pi - 10 No
3. ZigBee modules - 10 Nos
4. PLC with IoT gateway (Virtual Box) - 2 No's
5. Computer - 30 No's

END SEMESTER EXAMINATION – PRACTICAL EXAM
BOARD EXAMINATION

Duration: 3 Hours. **Max. Marks: 100**

Note:

All the exercises should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises / experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by the DOTE Exam section shall be used. The record of work done by the student should be submitted with a Bonafide Certificate.

DETAILLED ALLOCATION OF MARKS

Hardware Connection	-	15 Marks
Writing Program	-	20 Marks
Execution / Simulation	-	20 Marks
Result	-	10 Marks
Written Test	-	30 Marks
Viva Voce	-	05 Marks
Total	**-**	**100 Marks**

2049236342	AUTOMATION SYSTEM DESIGN	L	T	P	C
Practicum		1	0	4	3

Rationale

Stiff competition, higher quality standards and growing concerns of safety & environmental damage have pushed the Industrial sector to adapt state-of-the-art Automation Techniques for effective utilization of resources and optimized performance of the process plants. Recent trend of merging control systems associated with both factory and process automation demands knowledge from diverse fields. Automation applications span plant automation, discrete and batch process control, embedded machine control and manufacturing production line automation. The industrial automation applications include automation of time critical systems that demand precise real time readings and control.

Course Objectives

On successful completion of the course, the students must be able to

- To design automated systems.
- To know about transfer lines and automated assembly
- Be exposed to pneumatic, electric, hydraulic and electronic systems in automation of mechanical operations.
- To know about the advancement in hydraulics and pneumatics

Course Outcomes

After successful completion of this course, the students should be able to
CO1: Illustrate the design and simulation of multiple actuator systems using pneumatic, electro-pneumatic, and PLCs.
CO2: Discuss the electronic control systems in metal machining and other manufacturing processes.
CO3: Familiarize with the applications of various emerging automation technologies.
CO4: Select the appropriate equipment with required configurations and specifications for applications.
CO5: Design control loops for various industrial processes.

Pre-requisites

Knowledge about the principles of robotics.

2049236342	AUTOMATION SYSTEM DESIGN	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	2	2	3	1	2
CO2	3	2	3	3	3	1	2
CO3	3	2	3	3	3	1	3
CO4	3	2	3	3	3	1	3
CO5	3	2	3	3	3	1	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Massive open online courses (MOOCs) may be used to teach various topics.
- The topics that are relatively simpler or descriptive are to be given to the students for **self-directed learning** and assess the outcomes through classroom seminars or group discussions.
- Teachers must ensure to create opportunities for co-curricular activities.
- Videos and simulations may be used to teach various topics.
- Encourage students to refer to different textbooks and case studies to have deeper understanding of the subject.
- Observe and continuously monitor the performance of the student in the laboratory.
- Instruct students about emerging trends in industrial robotics and create awareness about the development in robotics through seminars and guest lectures.

2049236342	AUTOMATION SYSTEM DESIGN	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Experiments/ 50% Experiments	Cycle II Experiments/ Another 50% Experiments	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

CA1 and CA2: All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

2049236342	AUTOMATION SYSTEM DESIGN	L	T	P	C
Practicum		1	0	4	3

The experiment should be completed on the day of practice.

The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook / printed manual / file. The Circuit Diagram, Readings, Calculations and Graph/Result should be written by the student manually.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

Scheme of Evaluation

Writing Program	-	20 Marks
Execution / Simulation	-	20 Marks
Result	-	10 Marks
Practical Documents	-	10 Marks
Total	**-**	**60 Marks**

CA 3: A written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

CA 4: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be

2049236342	AUTOMATION SYSTEM DESIGN	L	T	P	C
Practicum		1	0	4	3

conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern and the scheme of evaluation.

The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Writing Program	-	20 Marks
Execution / Simulation	-	30 Marks
Result	-	10 Marks
Written Test	-	30 Marks
Viva Voce	-	10 Marks
Total	-	**100 Marks**

Note: For the written test 30 MCQ shall be asked from the theory portions.

2049236342	AUTOMATION SYSTEM DESIGN	L	T	P	C
Practicum		1	0	4	3

Unit I	**FUNDAMENTALS OF INDUSTRIAL AUTOMATION**	
Fundamental concepts in manufacturing and automation: Definition of automation, Need for automation, Benefits of automation. Types of production and types of automation, automation strategies, levels of automation		3
UNIT II	**MATERIAL HANDLING AND TRANSPORTATION SYSTEMS**	
Concepts of material handling, principles and considerations in material handling systems design, • Types of Material handling equipment, applications, Analysis of MH Systems – Vehicle based & Conveyors.		3
UNIT III	**MANUFACTURING CELLS AND AUTOMATED ASSEMBLY**	
Storage system performance & Location strategies, ASRS & Carousel storage systems, features, applications, Engineering analysis of ASRS & Carousel systems. Automated assembly design for automated assembly, Types of automated assembly systems, Part feeding devices, Analysis of multi-station assembly machines. AS/RS, RFID system, AGVs, Modular fixturing. Flow line balancing		3
Unit IV	**PAC**	
PC-based hardware and software for Data Acquisition Systems (DAS) and Control, PC Based Data Acquisition System Design, Graphical programming for data acquisition, signal processing, Control, analysis & presentation using		3

Measurement and Automation Software, Developing data acquisition and instrument control applications using LabVIEW, PAC architecture using NI hardware and software.		
Unit V	**AUTOMATION SYSTEM INTEGRATION**	
Design of Instrumentation Loops, ISA Symbols & Diagrams, Implementation of control techniques using PLC, Distributed Control System (DCS) architecture, Introduction to SCADA.		3
Ex.No	Name of the Experiment	
1	Co-ordinated motion of multiple pneumatic actuators in a desired sequence using Cascade method	60
2	Co-ordinated motion of multiple actuator, electro – pneumatic systems in a desired sequence using hard – wire programmed control systems.	
3	Co-ordinated motion of multiple actuator, electro – pneumatic systems in a desired sequence using PLC.	
4	Interfacing of an LVDT with a PC for monitoring the displacement of machine slide and raising an alarm if the displacement exceeds specified limit.	
5	Inspection using Machine vision System.	
6	Control of speed, direction and number of revolutions of a stepper motor using controller/PC.	
7	Design a instrumentation using ISA symbols. (LABVIEW)	
8	Design Graphical programming for data acquisition, signal processing, Control. (LABVIEW/MATLAB)	

Text Books:

1. Mikell P Groover, "Automation Production Systems and Computer- Integrated Manufacturing" Pearson Education, New Delhi, 2011.
2. Mikell P. Groover et. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, Special Edition, (2012).
3. Bolton W, "Mechatronics ", Pearson Education.

Reference Books:

4. Industrial Instrumentation: Principles and Design by Tattamangalam R. Padmanabhan.
5. Process Control Systems: Application, Design, and Tuning 4th Edition by F. Gregg Shinskey, McGraw-Hill Professional.
6. Cascading Logic: A Machine Control Methodology for Programmable Logic Controllers, Gary Kirchof.

Suggested Student Activity: In addition to classroom and laboratory learning, **student-centric co-curricular activities** can be undertaken to accelerate the attainment of various outcomes of the course.

- Students should conduct the following activities in groups, prepare a report of about 5 – 10 pages, and collect the physical evidence for the internal assessment.
- Conduct an internet survey and make a list of leading manufacturers of industrial robots and other automation tools.
- Identify the industrial standards followed in robots.
- Read the safety precautions to be followed for the installation of robot cells.
- Prepare a presentation or report on troubleshooting techniques.

Equipment / Facilities required for conducting the Practical Course

6. 6 Axis Articulated Robot
    a. Material Handling - 1 No
    b. General Purpose (Welding, Assembly, Drilling) - 1 No
7. Conveyor System - 1 No
8. Assembly Workbench with fixture
9. A mounted vision system with software (Free open source Robot simulation software)
10. Mobile robot kit - 5 No's

END SEMESTER EXAMINATION – PRACTICAL EXAM
BOARD EXAMINATION

Duration: 3 Hours. **Max. Marks: 100**

Note:

All the exercises should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises / experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by the DOTE Exam section shall be used. The record of work done by the student should be submitted with a Bonafide Certificate.

DETAILLED ALLOCATION OF MARKS

Writing Program	-	20 Marks
Execution / Simulation	-	30 Marks
Result	-	10 Marks
Written Test	-	30 Marks

Viva Voce	-	10 Marks
Total	-	**100 Marks**

1020236116	Additive Manufacturing	L	T	P	C
THEORY		3	0	0	3

Introduction

This course is mainly designed to have a complete knowledge about Additive Manufacturing technologies which is a main component among the nine pillars of Industrie 4.0. This course is suitable for students opting for any pathway under Diploma in Mechanical Engineering stream. This course enhances the technical skills of students such as newer product design, testing and validation, problem solving, innovation, etc.

Course Objectives

1. To impart the knowledge of construction and working principles of additive manufacturing technologies, and their potential applications in design and manufacturing.
2. To familiarise with the materials used in AM processes and their applications

Course Outcomes

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

CO1: Explain the additive manufacturing technologies and rapid prototyping
CO2: Acquire the CAD model generation procedure for the AM processes
CO3: Explain extrusion and sheet metal based AM processes
CO4: Describe photo polymerization and powder based AM processes
CO5: Enlighten the various applications of AM processes

Pre-requisites

Knowledge of basic Science, Manufacturing Processes, Machine Tool Technology

1020236116	Additive Manufacturing	L	T	P	C
THEORY		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2		1	1		1
CO2	3			1			1
CO3	3			1			1
CO4	3			1			1
CO5	3			1	1		1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Prepare case study problems to the realistic situations, and real-world examples to make the sessions engaging.
- Additive Manufacturing processes can be displayed via online or offline mode to gain the interest for this course.
- Different methods of teaching such as debate and discussions can be used to enhance the students' centric learning.
- Organise demo sessions on the 3D printing machines that are available in the institution or can be call some vendor for giving demos

1020236116	Additive Manufacturing	L	T	P	C
THEORY		3	0	0	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

Answer five questions (5 X 10 Marks = 50 Marks).

1020236116	Additive Manufacturing	L	T	P	C
THEORY		3	0	0	3

Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

Syllabus Contents

Unit I	**Introduction to Additive Manufacturing (AM)**	
Additive Manufacturing - Overview – Need – History – Classification – working principles (concepts only) - Materials for AM – PLA, ABS, PMMA, ceramics, composites and liquid resins – AM processes - Advantages, Limitations and Challenges– Rapid Prototyping – Rapid Tooling.		6
Unit II	**Design for Additive Manufacturing**	
Basic concept – CAD model preparation - file formats - Part orientation – Support material generation – Model slicing – honeycomb structure - Digitization techniques – Model reconstruction – Slicing software - Reverse Engineering – RE		6

1020236116	Additive Manufacturing	L	T	P	C
THEORY		3	0	0	3

application in AM.		
Unit III	**Extrusion and Sheet metal based Processes**	
Fused Deposition Modeling (FDM) – construction, working principle, advantages – process parameters involved - Laminated Object Manufacturing (LOM) – construction, working principle, advantages - gluing and adhesive bonding - PolyJet - construction, working principle, advantages.		6
Unit IV	**Photo polymerization and Powder based Processes**	
Stereolithography process (SLA) – construction, photo curable materials, working principle, advantages – Selective Laser Sintering (SLS) - construction, working principle, advantages – Electron Beam Melting (EBM) - construction, working principle, advantages – Laser Engineered Net Shaping (LENS) - construction, working principle, advantages.		6
Unit V	**Applications of Additive Manufacturing**	
Applications of Additive manufacturing technologies – new product development - after sales and service - automobile, aerospace, consumer products, health care industries – customized implants, bio-organs, bio-bones, etc.		6
	Assessment Test and Revision with Student activity	15
	Total	45

Suggested list of Students Activity,

- Selected topics which are relatively simpler or descriptive in nature should be given to the students for self-learning and assess the development of competency through classroom presentations.
- Mini-projects may be given to a group of students for hand-on experiences.

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THEORY		3	0	0	3

- Massive open online courses (MOOCs) may be used to teach various topics/subtopics.

Reference Books:

1. Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", Third Edition, World Scientific Publishers, 2010.
2. Gebhardt A., "Rapid prototyping", Hanser Gardener Publications, 2003.
3. Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2007.
4. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.
5. Hilton P.D. and Jacobs P.F., "Rapid Tooling: Technologies and Industrial Applications", CRC press, 2000.
6. Tom Page "Design for Additive Manufacturing" LAP Lambert Academic Publishing, 2012.

Web Reference

What is 3D printing? How does a 3D printer work? Learn 3D printing
3D Printing - Applications, Types, Process, Advantages (vajiramandravi.com)
How a 3D Printer Works and What It Is Used for (spiceworks.com)
What is 3D Printing? - Technology Definition and Types - TWI (twi-global.com)
https://home.iitk.ac.in/~nsinha/Additive_Manufacturing%20I.pdf
https://web.mit.edu/tdp/www/whatis3dp.html
Briefing Note (birmingham.ac.uk)

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hrs. **Max. Marks: 100**

1020236116	Additive Manufacturing	L	T	P	C
THEORY		3	0	0	3

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

2049236351	Internship	540 Periods	C
PROJECT			12

Introduction

Internships in educational institutions are designed to provide students with practical experience in their field of study and to bridge the gap between academic knowledge and professional practice.

Objectives

After completing Internship, Interns will be able to,

- Apply the theoretical knowledge and skill during performance of the tasks assigned in internship.
- Demonstrate soft skills such as time management, positive attitude and communication skills during performance of the tasks assigned in internship.
- Document the Use case on the assigned Task.
- Enable interns to apply theoretical knowledge gained in the classroom to real-world practical applications.
- Provide hands-on experience in the industrial practices.
- Develop essential skills such as communication, organization, teamwork, and problem-solving.
- Enhance specific skills related to the intern's area of focus.
- Offer a realistic understanding of the daily operations and responsibilities.
- Provide opportunities to work under the guidance of experienced supervisors and administrators.
- Allow interns to explore different career paths.
- Help interns make informed decisions about their future career goals based on first hand experience.

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PROJECT			12

- Facilitate the establishment of professional relationships with supervisor, administrators, and other professionals in the field.
- Provide access to a network of contacts that can be beneficial for future job opportunities and professional growth.
- Foster personal growth by challenging interns to step out of their comfort zones and take on new responsibilities.
- Build confidence and self-efficacy through successful completion of internship tasks and projects.
- Give insight into the policies, regulations, and administrative practices.
- Allow interns to observe and understand the implementation of standards and policies in practice.
- Provide opportunities for constructive feedback from supervisors and mentors, aiding in the intern's professional development.
- Enable self-assessment and reflection on strengths, areas for improvement, and career aspirations.
- Encourage sensitivity to the needs and backgrounds of different groups, promoting inclusive and equitable industrial practices.

Course Outcomes

CO 1: Demonstrate improved skills.

CO 2: Exhibit increased professional behavior.

CO 3: Apply theoretical knowledge and principles in real-world practices.

CO 4: Develop and utilize assessment tools to evaluate the learning and practices.

CO 5: Engage in reflective practice to continually improve their learning and professional growth.

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PROJECT			12

Facilitating the Interns by an Internship Provider.

Orient intern in the new workplace. Give interns an overview of the organization, Explain

the intern's duties and introduce him or her to co-workers.

Develop an internship job description with clear deliverables and timeline.

Allow the interns in meetings and provide information, resources, and opportunities for professional development.

The interns have never done this kind of work before, they want to know that their work is measuring up to organizational expectations, hence provide professional guidance and mentoring to the intern.

Daily progress report of Intern is to be evaluated by industry supervisor. examine what the intern has produced and make suggestions. Weekly supervision meetings can help to monitor the intern's work.

Duties Responsibilities of the Faculty Mentor

To facilitate the placement of students for the internship

To liaison between the college and the internship provider

To assist the Industrial Training Supervisor during assessment

Instructions to the Interns

- Students shall report to the internship provider on the 1st day as per the internship schedule.
- Intern is expected to learn about the organization, its structure, product range, market performance, working philosophy etc.
- The interns shall work on live projects assigned by the internship provider.
- The Intern shall record all the activities in the daily log book and get the signature of the concerned training supervisor.

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PROJECT			12

- Intern shall have 100% attendance during internship programme. In case of unavoidable circumstances students may avail leave with prior permission from the concerned training supervisor of the respective internship provider. However, the maximum leave permitted during internship shall be as per company norms where they are working and intern shall report the leave sanctioned details to their college faculty mentor.
- The interns shall abide all the Rules and Regulations of internship provider
- Intern shall follow all the safety Regulations of internship provider.
- On completion of the internship, the intern shall report to the college and submit the internship certificate mentioning duration of internship, evaluation of interns by internship provider, Student's Diary and Comprehensive Training Report.

Attendance Certification

Every month students have to get their attendance certified by the industrial supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the institution supervisor. Regularity in attendance and submission of report will be duly considered while awarding the Internal Assessment mark.

Training Reports

The students have to prepare two types of reports: Weekly reports in the form of a diary to be submitted to the concerned staff in-charge of the institution. This will be reviewed while awarding Internal

Industrial Training Diary

Students are required to maintain the record of day-to-day work done. Such a record is called Industrial training Diary. Students have to write this report regularly. All days for the week should be accounted for clearly giving attendance particulars (Presence,

2049236351	Internship	540 Periods	C
PROJECT			12

absence, Leave, Holidays etc.). The concern of the Industrial supervisor is to periodically check these progress reports.

Comprehensive Training Report

In addition to the diary, students are required to submit a comprehensive report on training with details of the organisation where the training was undergone after attestation by the supervisors. The comprehensive report should incorporate study of plant/product/process/construction along with intensive in-depth study on any one of the topics such as processes, methods, tooling, construction and equipment, highlighting aspects of quality, productivity and system. The comprehensive report should be completed in the last week of Industrial training.

Any data, drawings etc. should be incorporated with the consent of the Organisation.

Scheme of Evaluation

Internal Assessment

Students should be assessed for 50 Marks by industry supervisor and polytechnic faculty mentor during 8th Week and 15th Week. The total marks (50 + 50) scored shall be converted to 40 marks for the Internal Assessment.

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PROJECT			12

Sl. No.	Description	Marks
A	Punctuality and regularity. (Attendance)	10
B	Level / proficiency of practical skills acquired. Initiative in learning / working at site	10
C	Ability to solve practical problems. Sense of responsibility	10
D	Self expression / communication skills. Interpersonal skills / Human Relation.	10
E	Report and Presentation.	10
Total		50

End Semester Examination - Project Exam

2049236351	Internship	540 Periods	C
PROJECT			12

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairman Board of Examinations after the completion of internship period (Dec - May). The marks scored will be converted to 60 marks for the End Semester Examination.

Sl. No.	Description	Marks
A	Daily Activity Report.	20
B	Comprehensive report on Internship, Relevant Internship Certificate from the concerned department.	30
C	Presentation by the student at the end of the Internship.	30
D	Viva Voce	20
Total		100

2049236353	**Fellowship**	540 Periods	C
PROJECT			12

Introduction

The Fellowship in the Diploma in Engineering program is designed to provide aspiring engineers with a comprehensive educational experience that combines theoretical knowledge with practical skills. This fellowship aims to cultivate a new generation of proficient and innovative engineers who are equipped to meet the challenges of a rapidly evolving technological landscape.

Participants in this fellowship will benefit from a robust curriculum that covers core engineering principles, advanced technical training, and hands-on projects. The program emphasizes interdisciplinary learning, encouraging fellows to explore various branches of engineering, from mechanical and civil to electrical, electronics & communication and computer engineering. This approach ensures that graduates possess a versatile skill set, ready to adapt to diverse career opportunities in the engineering sector.

In addition to academics, the fellowship offers numerous opportunities for professional development. Fellows will engage with industry experts through seminars, workshops, and internships, gaining valuable insights into real-world applications of their studies. Collaborative projects and research initiatives foster a culture of innovation, critical thinking, and problem-solving, essential attributes for any successful engineer.

By offering this fellowship, participants become part of a vibrant community of learners and professionals dedicated to advancing the field of engineering. The program is committed to supporting the growth and development of each fellow, providing them with the tools and resources needed to excel both academically and professionally.

The Fellowship in the Diploma in Engineering is more than just an educational endeavor; it is a transformative journey that equips aspiring engineers with the knowledge, skills, and experiences necessary to make significant contributions to society and the engineering profession.

2049236353	**Fellowship**	540 Periods	C
PROJECT			12

Objectives

After completing students will be able to,

- Provide fellows with a solid foundation in core engineering principles and advanced technical knowledge across various engineering disciplines.
- Equip fellows with hands-on experience through laboratory work, projects, and internships, ensuring they can apply theoretical knowledge to real-world scenarios.
- Promote interdisciplinary understanding by encouraging exploration and integration of different engineering fields, fostering versatility and adaptability in fellows.
- Encourage innovation and creativity through research projects and collaborative initiatives, enabling fellows to develop new solutions to engineering challenges.
- Facilitate professional growth through workshops, seminars, and interactions with industry experts, preparing fellows for successful careers in engineering.
- Develop critical thinking and problem-solving skills, essential for tackling complex engineering problems and making informed decisions.
- Strengthen connections between academia and industry by providing opportunities for internships, industry visits, and guest lectures from professionals.
- Foster leadership qualities and teamwork skills through group projects and collaborative activities, preparing fellows for leadership roles in their future careers.
- Instill a sense of ethical responsibility and awareness of the social impact of engineering practices, encouraging fellows to contribute positively to society.
- Promote a culture of lifelong learning, encouraging fellows to continually update their knowledge and skills in response to technological advancements and industry trends.
- Prepare fellows to work in a global engineering environment by exposing them to international best practices, standards, and cross-cultural experiences.

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PROJECT			12

Course Outcomes

CO 1: Demonstrate a strong understanding of core engineering principles and possess the technical skills necessary to design, analyze, and implement engineering solutions across various disciplines.

CO 2: Apply theoretical knowledge to practical scenarios, effectively solving engineering problems through hands-on projects, laboratory work, and internships.

CO 3: Exhibit the ability to conduct research, develop innovative solutions, and contribute to advancements in engineering through critical thinking and creative approaches to complex challenges.

CO 4: Understand and adhere to professional and ethical standards in engineering practice, demonstrating responsibility, integrity, and a commitment to sustainable and socially responsible engineering.

CO 5: Enhance strong communication skills, both written and verbal, and be capable of working effectively in teams, demonstrating leadership and collaborative abilities in diverse and multidisciplinary environments.

Important points to consider to select the fellowship project.

Selecting the right fellowship project is crucial for maximizing the educational and professional benefits of a Diploma in Engineering program.

- **Relevance to Future Plans**: Choose a project that aligns with your long-term career aspirations and interests. This alignment will ensure that the skills and knowledge you gain will be directly applicable to your desired career path.
- **Industry Relevance**: Consider the current and future relevance of the project within the industry. Opt for projects that address contemporary challenges or emerging trends in engineering.
- **Access to Facilities**: Ensure that the necessary facilities, equipment, and materials are available to successfully complete the project. Lack of resources can hinder the progress and quality of your work.

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PROJECT			12

- **Mentorship and Guidance**: Select a project that offers strong mentorship and support from experienced faculty members or industry professionals. Effective guidance is crucial for navigating complex problems and achieving project objectives.
- **Project Scope**: Assess the scope of the project to ensure it is neither too broad nor too narrow. A well-defined project scope helps in setting clear objectives and achievable milestones.
- **Feasibility**: Evaluate the feasibility of completing the project within the given timeframe and with the available resources. Consider potential challenges and ensure you have a realistic plan to address them.
- **Technical Skills**: Choose a project that allows you to develop and enhance important technical skills relevant to your field of study. Practical experience in using specific tools, technologies, or methodologies can be highly beneficial.
- **Soft Skills**: Consider projects that also offer opportunities to develop soft skills such as teamwork, communication, problem-solving, and project management.
- **Innovative Thinking**: Select a project that encourages creativity and innovative problem-solving. Projects that push the boundaries of traditional engineering approaches can be particularly rewarding.
- **Societal Impact**: Consider the potential impact of your project on society or the engineering community. Projects that address significant challenges or contribute to social good can be highly fulfilling and make a meaningful difference.

Guidelines to select Fellowship

- Ensure the program is accredited by a recognized accrediting body and has a strong reputation for quality education in engineering.
- Ensure it covers core engineering principles that align with your interests and career goals.
- Investigate the qualifications and experience of the faculty mentor. Look for programs with faculty who have strong academic backgrounds, industry experience, and active involvement in research.

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- Check if the program provides adequate hands-on training opportunities, such as laboratory work, workshops, and access to modern engineering facilities and equipment.
- Assess the program's connections with industry. Strong partnerships with companies can lead to valuable internship opportunities, industry projects, and exposure to real-world engineering challenges.
- Explore the availability of research opportunities. Participation in research projects can enhance your learning experience and open doors to innovative career paths.
- Look for programs that offer professional development resources, such as workshops, seminars, and networking events with industry professionals and alumni.
- Ensure the program provides robust support services, including academic advising, career counseling, mentorship programs, and assistance with job placement after graduation.
- Consider the cost of the program and available financial aid options, such as scholarships, grants, and fellowships. Evaluate the return on investment in terms of career prospects and potential earnings.
- Research the success of the program's alumni. High employment rates and successful careers of past graduates can indicate the program's effectiveness in preparing students for the engineering field.

Duties Responsibilities of the Faculty Mentor

Each student should have a faculty mentor for the Institute.

- Get the approval from the Chairman Board of Examinations with the recommendations of the HOD/Principal for the topics.
- Provide comprehensive academic advising to help fellows select appropriate specializations, and research projects that align with their interests and career goals.
- Guide fellows through their research projects, offering expertise and feedback to ensure rigorous methodology, innovative approaches, and meaningful contributions to the field.

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PROJECT			12

- Assist fellows in developing technical and professional skills through hands-on projects, laboratory work, and practical applications of theoretical knowledge.
- Offer career advice and support, helping fellows explore potential career paths, prepare for job searches, and connect with industry professionals and opportunities.
- Provide personal mentorship, fostering a supportive relationship that encourages growth, resilience, and a positive academic experience.
- Facilitate connections between fellows and industry professionals, alumni, and other relevant networks to enhance their professional opportunities and industry exposure.
- Ensure fellows have access to necessary resources, including research materials, lab equipment, software, and academic literature.
- Regularly monitor and evaluate the progress of fellows, providing constructive feedback and guidance to help them stay on track and achieve their goals.
- Instill and uphold high ethical and professional standards, encouraging fellows to practice integrity and responsibility in their work.
- Assist with administrative tasks related to the fellowship program, such as preparing progress reports, writing recommendation letters, and facilitating grant applications.
- Organize and participate in workshops, seminars, and other educational events that enhance the learning experience and professional development of fellows.
- Address any issues or conflicts that arise, providing mediation and support to ensure a positive and productive academic environment.

Instructions to the Fellowship Scholar

- Regularly meet with your faculty mentor for guidance on academic progress, research projects, and career planning. Be proactive in seeking advice and support from your mentor.
- Develop strong organizational skills. Use planners, calendars, and task management tools to keep track of assignments, project deadlines, and study schedules. Prioritize tasks to manage your time efficiently.

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PROJECT			12

- Take advantage of opportunities to participate in research projects and hands-on activities. These experiences are crucial for applying your theoretical knowledge and gaining practical skills.
- Focus on improving essential professional skills such as communication, teamwork, problem-solving, and leadership. Participate in workshops and seminars that enhance these competencies.
- Actively seek networking opportunities through industry events, seminars, and meetings. Establish connections with peers, alumni, and professionals in your field to build a strong professional network.
- Seek internships, co-op programs, or part-time jobs related to your field of study. Real-world experience is invaluable for understanding industry practices and enhancing your employability.
- Uphold high ethical standards in all your academic and professional activities. Practice integrity, honesty, and responsibility. Adhere to the ethical guidelines and standards set by your institution and the engineering profession.
- Adopt a mindset of lifelong learning. Stay updated with the latest developments and trends in engineering by reading industry journals, attending conferences, and taking additional courses.

Documents to be submitted by the student to offer fellowship.

- **Completed Application Form**: This is typically the standard form provided by the institution or fellowship program that includes personal information, educational background, and other relevant details.
- **Detailed CV/Resume**: A comprehensive document outlining your educational background, knowledge experience, interest in research experience, publications, presentations, awards, and other relevant achievements if any.
- **Personal Statement**: A document explaining your motivation for applying to the fellowship, your career goals, how the fellowship aligns with those goals, and what you intend to achieve through the program.

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PROJECT			12

- **Recommendation Letters**: Letters from faculty mentor, employer, or professionals who can attest to your academic abilities, professional skills, and suitability for the fellowship.
- **Proposal/Description**: A detailed proposal or description of the fellowship project or study you plan to undertake during the fellowship. This should include objectives, methodology, expected outcomes, and significance of the project.
- **Enrollment Verification**: Documentation verifying your current acceptance status in the academic institution or industry where the fellowship will be conducted.
- **Funding Information**: Details about any other sources of funding or financial aid you are receiving, if applicable. Some fellowships may also require a budget proposal for the intended use of the fellowship funds.
- **Samples of Work**: Copies of the relevant work that demonstrates your capabilities and accomplishments in your field.
- **Endorsement Letter**: A letter from your current academic institution endorsing your application for the fellowship, if required.
- **Ethical Approval Documents**: If your research involves human subjects or animals, you may need to submit proof of ethical approval from the relevant ethics committee.
- **Additional Documents**: Any other documents requested by the fellowship program required by the institution.

Attendance Certification

Every month students have to get their attendance certified by the supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the faculty mentor. Regularity in attendance and submission of report will be duly considered while awarding the Internal Assessment mark.

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PROJECT			12

Rubrics for Fellowship. Review I & II.

Sl. No.	Topics	Description
1	Alignment with Objectives	Assess how well the project aligns with the stated objectives and requirements. Determine if the student has addressed the key aspects outlined in the project guidelines.
2	Depth of Research:	Evaluate the depth and thoroughness of the literature review. Assess the student's ability to identify and address gaps in existing research.
3	Clarity of Objectives:	Check if the student has clearly defined and articulated the objectives of the project. Ensure that the objectives are specific, measurable, achievable, relevant, and time-bound (SMART).
4	Methodology and Data Collection:	Evaluate the appropriateness and justification of the research methodology. Assess the methods used for data collection and their relevance to the research questions.
5	Analysis and Interpretation:	Examine the quality of data analysis techniques used. Assess the student's ability to interpret results and draw meaningful conclusions.
6	Project Management:	Evaluate the project management aspects, including adherence to timelines and milestones. Assess the student's ability to plan and execute the project

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		effectively.
7	Documentation and Reporting:	Check the quality of documentation, including code, experimental details, and any other relevant materials. Evaluate the clarity, structure, and coherence of the final report.
8	Originality and Creativity:	Assess the level of originality and creativity demonstrated in the project. Determine if the student has brought a unique perspective or solution to the research problem.
9	Critical Thinking:	Evaluate the student's critical thinking skills in analyzing information and forming conclusions. Assess the ability to evaluate alternative solutions and make informed decisions.
10	Problem-Solving Skills:	Evaluate the student's ability to identify and solve problems encountered during the project. Assess adaptability and resilience in the face of challenges.

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INTERNAL MARKS - 40 Marks

As per the rubrics each topic should be considered for the Review I and Review II. Equal weightage should be given for all the topics. It should be assessed by a faculty mentor and the industrial professional or research guide.

Review 1 shall be conducted after 8th week and Review 2 shall be conducted after 14th week in the semester. Average marks scored in the reviews shall be considered for the internal assessment of 30 Marks.

Scheme of Evaluation

PART	DESCRIPTION	MARKS
A	Assessment as per the rubrics.	30
B	Attendance	10
Total		**40**

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PROJECT			12

END SEMESTER EXAMINATION - Project Exam

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairman Board of Examinations after the completion of fellowship. The marks scored will be converted to 60 marks for the End Semester Examination.

Sl. No.	Description	Marks
A	Daily Activity Report.	20
B	Comprehensive report of the Fellowship Work.	30
C	Presentation by the student.	30
D	Viva Voce	20
Total		100

2049236374	In-house Project	540 Periods	C
PROJECT			12

Introduction

Every student must do one major project in the Final year of their program. Students can do their major project in Industry or R&D Lab or in-house or a combination of any two for the partial fulfillment for the award of Diploma in Engineering.

For the project works, the Department will constitute a three-member faculty committee to monitor the progress of the project and conduct reviews regularly.

If the projects are done in-house, the students must obtain the bonafide certificate for project work from the Project supervisor and Head of the Department, at the end of the semester. Students who have not obtained the bonafide certificate are not permitted to appear for the Project Viva Voce examination.

For the projects carried out in Industry, the students must submit a separate certificate from Industry apart from the regular bonafide certificate mentioned above. For Industry related projects there must be one internal faculty advisor / Supervisor from Industry (External), this is in addition to the regular faculty supervision.

The final examination for project work will be evaluated based on the final report submitted by the project group **of not exceeding four students**, and the viva voce by an external examiner.

Objectives

Academic project work plays a crucial role in the education of Diploma in Engineering students, as it helps them apply theoretical knowledge to practical situations and prepares them for real-world engineering challenges.

- **Integration of Knowledge**: Consolidate and integrate theoretical knowledge acquired in coursework to solve practical engineering problems.
- **Skill Development**: Enhance technical skills related to the specific field of engineering through hands-on experience and application.
- **Problem-Solving Abilities**: Develop critical thinking and problem-solving abilities by addressing complex engineering issues within a defined scope.

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PROJECT			12

- **Project Management**: Gain experience in project planning, execution, and management, including setting objectives, timelines, and resource allocation.
- **Teamwork and Collaboration**: Foster teamwork and collaboration by working in multidisciplinary teams to achieve project goals and objectives.
- **Research Skills**: Acquire research skills by conducting literature reviews, gathering relevant data, and applying research methodologies to investigate engineering problems.
- **Innovation and Creativity**: Encourage innovation and creativity in proposing and developing engineering solutions that may be novel or improve upon existing methods.
- **Communication Skills**: Improve communication skills, both oral and written, by presenting project findings, writing technical reports, and effectively conveying ideas to stakeholders.
- **Ethical Considerations**: Consider ethical implications related to engineering practices, including safety, environmental impact, and societal concerns.
- **Professional Development**: Prepare for future professional roles by demonstrating professionalism, initiative, and responsibility throughout the project lifecycle.

Course Outcomes

CO 1: Demonstrate the ability to apply theoretical concepts and principles learned in coursework to solve practical engineering problems encountered during the project.

CO 2: Develop and enhance technical skills specific to the field of engineering relevant to the project, such as design, analysis, simulation, construction, testing, and implementation.

CO 3: Apply critical thinking and problem-solving skills to identify, analyze, and propose solutions to engineering challenges encountered throughout the project lifecycle.

CO 4: Acquire project management skills by effectively planning, organizing, and executing project tasks within defined timelines and resource constraints.

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PROJECT			12

CO 5: Improve communication skills through the preparation and delivery of project reports, presentations, and documentation that effectively convey technical information to stakeholders.

Important points to consider to select the In-house project.

- Selecting a project work in Diploma Engineering is a significant decision that can greatly influence your learning experience and future career prospects.
- Choose a project that aligns with your career aspirations and interests within the field of engineering. Consider how the project can contribute to your professional development and future opportunities.
- Ensure the project aligns with your coursework and specialization within the Diploma program. It should complement and build upon the knowledge and skills you have acquired in your studies.
- Evaluate the scope of the project to ensure it is manageable within the given timeframe, resources, and constraints. Avoid projects that are overly ambitious or impractical to complete effectively.
- Assess the availability of resources needed to conduct the project, such as equipment, materials, laboratory facilities, and access to relevant software or tools. Lack of resources can hinder project progress.
- Select a project that genuinely interests and motivates you. A project that captures your curiosity and passion will keep you engaged and committed throughout the project duration.
- Consider the availability and expertise of faculty advisors or industry mentors who can provide guidance and support throughout the project. Effective mentorship is crucial for success.
- Clearly define the learning objectives and expected outcomes of the project. Ensure that the project will help you achieve specific learning goals related to technical skills, problem-solving, and professional development.

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PROJECT			12

- Look for opportunities to propose innovative solutions or explore new methodologies within your project. Projects that encourage creativity can set you apart and enhance your learning experience.
- Consider ethical implications related to the project, such as safety protocols, environmental impact, and compliance with ethical guidelines in research and engineering practices.
- Evaluate whether the project offers opportunities for collaboration with peers, experts from other disciplines, or industry partners. Interdisciplinary projects can broaden your perspective and enhance your teamwork skills.
- Consider the potential impact of your project on society or the engineering community. Projects that address significant challenges or contribute to social good can be highly fulfilling and make a meaningful difference.

By carefully considering these points, Diploma Engineering students can make informed decisions when selecting project work that not only enhances their academic learning but also prepares them for successful careers in engineering.

Duties Responsibilities of the internal faculty advisor.

Each group should have an internal faculty advisor assigned by the HOD/Principal.

- The in-house project should be approved by the project monitoring committee constituted by the Chairman Board of Examinations.
- The in-house project should be selected in the fifth semester itself. Each in-house project shall have a maximum of four students in the project group.
- Provide comprehensive academic advising to help in the selection of appropriate in-house project that align with their interests and career goals.
- Offer expertise and feedback to ensure rigorous methodology, innovative approaches, and meaningful contributions to the field.
- Assist in developing technical and professional skills through hands-on projects, laboratory work, and practical applications of theoretical knowledge.

2049236374	In-house Project	540 Periods	C
PROJECT			12

- Provide personal mentorship, fostering a supportive relationship that encourages growth, resilience, and a positive academic experience.
- Facilitate connections between students and industry professionals, alumni, and other relevant networks to enhance their professional opportunities and industry exposure.
- Ensure students have access to necessary resources, including research materials, lab equipment, software, and academic literature.
- Regularly monitor and evaluate the progress of the in-house project, providing constructive feedback and guidance to help them stay on track and achieve their goals.
- Instill and uphold high ethical and professional standards, encouraging students to practice integrity and responsibility in their work.
- Assist in preparing progress reports, writing recommendation letters, and facilitating grant applications.
- Organize and participate in workshops, seminars, and other educational events that enhance the learning experience and professional development .
- Address any issues or conflicts that arise, providing mediation and support to ensure a positive and productive academic environment.

Instructions to the students.

- Regularly meet with your internal faculty advisor for guidance on academic progress, research projects, and career planning. Be proactive in seeking advice and support from your faculty advisor.
- Use planners, calendars, and task management tools to keep track of assignments, project deadlines, and study schedules. Prioritize tasks to manage your time efficiently.
- Take advantage of opportunities to participate in in-house projects and hands-on activities. These experiences are crucial for applying your theoretical knowledge and gaining practical skills.
- Focus on improving essential professional skills such as communication, teamwork, problem-solving, and leadership. Participate in workshops and seminars that enhance these competencies.

2049236374	In-house Project	540 Periods	C
PROJECT			12

- Actively seek networking opportunities through industry events, seminars, and meetings. Establish connections with peers, alumni, and professionals in your field to build a strong professional network.
- Seek internships, co-op programs, or part-time jobs related to your field of study. Real-world experience is invaluable for understanding industry practices and enhancing your employability.
- Uphold high ethical standards in all your academic and professional activities. Practice integrity, honesty, and responsibility. Adhere to the ethical guidelines and standards set by your institution and the engineering profession.
- Adopt a mindset of lifelong learning. Stay updated with the latest developments and trends in engineering by reading industry journals, attending conferences, and taking additional courses.

Documents to be submitted by the student for an in-house project.

Submit a printed report of your in-house project work along with the fabrication model / analysis report for the End Semester Examination.

Rubrics for In-House Project Work

Sl. No.	Topics	Description
1	Objectives	Clearly defined and specific objectives outlined. Objectives align with the project's scope and purpose.
2	Literature Review	Thorough review of relevant literature. Identification of gaps and justification for the project's contribution.

2049236374	**In-house Project**	540 Periods	C
PROJECT			12

3	Research Design and Methodology	Clear explanation of the research design. Appropriateness and justification of chosen research methods.
4	Project Management	Adherence to project timeline and milestones. Effective organization and planning evident in the project execution.
5	Documentation	Comprehensive documentation of project details. Clarity and completeness in recording methods, results, and challenges.
6	Presentation Skills	Clear and articulate communication of project findings. Effective use of visuals, if applicable.
7	Analysis and Interpretation	In-depth analysis of data. Clear interpretation of results in the context of research questions.
8	Problem-Solving	Demonstrated ability to identify and address challenges encountered during the project. Innovative solutions considered where applicable.
9	Professionalism and Compliance	Adherence to ethical standards in research. Compliance with project guidelines and requirements.
10	Quality of Work	Overall quality and contribution of the project to the field. Demonstrated effort to produce high-quality work.

SCHEME OF EVALUATION

The mark allocation for Internal and End Semester Viva Voce are as below.

Internal Marks (40 Marks)*

2049236374	In-house Project	540 Periods	C
PROJECT			12

Review 1 (10 Marks)	Review 2 (15 Marks)	Review 3 (15 marks)
Committee: 5 Marks. Supervisor: 5 Marks	Committee: 7.5 Marks Supervisor: 7.5 Marks	Committee: 7.5 Marks Supervisor: 7.5 Marks

Note: * The rubrics should be followed for the evaluation of the internal marks during reviews.

END SEMESTER EXAMINATION - Project Exam

The performance of each student in the project group would be evaluated in a viva voce examination conducted by a committee consisting of an external examiner and the project supervisor and an internal examiner.

End Semester (100)#			
Record (20 Marks)	Presentation (20 Marks)	Viva Voce (20 Marks)	Model / Analysis Report (40 Marks)
External: 10 Internal: 5 Supervisor: 5	External: 10 Internal: 5 Supervisor: 5	External: 10 Internal: 5 Supervisor: 5	External: 20 Internal: 10 Supervisor: 10

 # The marks scored will be converted to 60 Marks.

2149234274 2149237274	Industrial Training (SW)	540 Periods	C
PROJECT			12

Introduction

The main objective of the sandwich Diploma course is to mould a well-rounded technician acclimated with the industrial environment while being a student in the institution. The Sandwich Diploma Course study is pursued by students, in 7 Semesters of 3 ½ years duration, the subjects of 3 years-Full Time Diploma Course being regrouped for academic convenience.

While in the 4th semester students undergo Industrial Training for 6 months (December through May). They also do course work in the institution for one day in a week, While in the 7th semester they undergo another spell of 6 months (June through November) Industrial training.

The Apprenticeship (Amendment) Act 1973 is followed in regulating the Industrial training procedure for Sandwich Course.

Objectives

The main objective of industrial training for a diploma engineer is to provide practical, hands-on experience in real-world industrial settings, bridging the gap between academic learning and professional practice. This training aims to equip students with the skills, knowledge, and competencies required to effectively perform and succeed in the mechanical engineering industry.

Key aspects of this objective include:

- Enable students to apply the concepts and principles learned in the classroom to real-world engineering problems and scenarios.
- Develop essential technical skills.
- Enhance soft skills like communication, teamwork, problem-solving, and time management.
- Provide exposure to industrial machinery, tools, and equipment, along with the operational procedures and safety practices in a manufacturing or engineering environment.

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PROJECT			12

- Offer insights into the daily operations and responsibilities of technicians, preparing students for the transition from academic settings to professional work environments.
- Educate students on industry standards, quality control measures, and best practices in mechanical engineering and manufacturing processes.
- Help students explore various career paths within mechanical engineering, enabling them to make informed decisions about their future professional goals.
- Provide opportunities for networking with industry professionals and potential employers.
- Encourage creative thinking and innovation by challenging students to solve real-world engineering problems and improve existing processes or products.
- Instill a sense of professionalism, work ethics, and responsibility required in the engineering field.

Course Outcomes

CO 1: Demonstrate proficiency in using industrial machinery, tools, and software.

CO 2: Able to identify, analyze, and solve engineering problems using industry-standard methods and practices.

CO 3: Gain a comprehensive understanding of industrial manufacturing processes, quality control, and safety practices.

CO 4: Exhibit improved communication, teamwork, and professional behavior in an industrial setting.

CO 5: Apply theoretical concepts learned in their coursework to practical engineering tasks and projects.

Duties Responsibilities of the Faculty Mentor.

Faculty mentors play a crucial role in overseeing and guiding students during their industrial training program in Diploma engineering.

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PROJECT			12

Pre-Training Responsibilities:

1. Orientation and Preparation:
    - Conduct orientation sessions to familiarize students with the objectives, expectations, and guidelines of the industrial training program.
    - Assist students in understanding the importance of industrial training in their academic and professional development.
2. Placement Coordination:
    - Collaborate with the placement cell or industry liaison office to secure suitable training placements for students that align with their academic specialization and career interests.
    - Facilitate communication between the institution and host organizations to ensure smooth coordination of training arrangements.
3. Training Plan Development:
    - Help students develop a detailed training plan outlining learning objectives, tasks, and expected outcomes for the training period.
    - Guide students in setting SMART (Specific, Measurable, Achievable, Relevant, Time-bound) goals for their training experience.

During Training Responsibilities:

4. Monitoring and Support:
    - Regularly monitor the progress of students during their industrial training. Maintain communication with both students and industry supervisors to track performance and address any issues that may arise.
    - Provide ongoing support and guidance to students, offering advice on technical challenges, professional conduct, and workplace etiquette.
5. Technical Guidance:

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PROJECT			12

- Offer technical guidance and mentorship related to the specific engineering discipline or specialization of the students. Help them apply theoretical knowledge to practical situations encountered in the industry.

6. Problem-Solving Assistance:
   - Assist students in overcoming obstacles or challenges encountered during their training. Encourage them to develop problem-solving skills and resilience in real-world engineering scenarios.
7. Feedback and Evaluation:
   - Provide constructive feedback on students' performance based on reports, assessments, and observations gathered from industry supervisors.
   - Evaluate students' achievements in relation to their training objectives and competencies developed during the program.

Post-Training Responsibilities:

8. Reflection and Debriefing:
   - Conduct debriefing sessions with students to reflect on their training experiences, discuss lessons learned, and identify areas for further improvement.
   - Help students articulate their learning outcomes and how these experiences contribute to their professional growth.
9. Documentation and Reporting:
   - Ensure comprehensive documentation of students' training activities, achievements, and feedback received from industry supervisors.
   - Prepare reports summarizing students' performance and submit these to relevant departments or committees for review and assessment.
10. Career Counseling:
    - Provide career guidance and counseling to students based on their industrial training experiences. Assist them in leveraging these experiences for future job applications or further academic pursuits.

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PROJECT			12

11. Continuous Improvement:
    - Collaborate with industry partners to continuously improve the quality and relevance of the industrial training program.
    - Incorporate feedback from students and industry supervisors to enhance the effectiveness of future training placements.

By fulfilling these duties and responsibilities, faculty mentors contribute significantly to the overall educational experience and professional development of Diploma engineering students during their industrial training program.

Instructions to the students

Here are some instructions for Diploma engineering students undergoing industrial training during their academic duration:

Before Starting Industrial Training:

1. **Orientation and Preparation:**
    - Attend orientation sessions conducted by the institution or faculty mentors to understand the objectives, expectations, and guidelines of the industrial training program.
    - Familiarize yourself with the specific policies, procedures, and safety regulations of the host organization where you will be undergoing training.
2. Setting Goals:
    - Set clear and specific goals for your industrial training period. Define what skills, knowledge, and experiences you aim to gain during this time.
    - Discuss your goals with your faculty mentor and seek their guidance in developing a training plan that aligns with your career aspirations.
3. Professional Attire and Conduct:
    - Dress appropriately and professionally according to the standards of the industry and host organization.

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PROJECT			12

- Maintain a positive attitude, demonstrate punctuality, and adhere to workplace etiquette and norms.

During Industrial Training:

4. Learning and Engagement:
   - Actively engage in all assigned tasks and projects. Seek opportunities to learn new skills and technologies relevant to your field of study.
   - Take initiative in asking questions, seeking clarification, and participating in discussions with supervisors and colleagues.
5. Adaptability and Flexibility:
   - Adapt to the work environment and demonstrate flexibility in handling various responsibilities and challenges that arise during your training.
   - Be open to different roles and tasks assigned to you, as this will broaden your experience and skill set.
6. Professionalism and Communication:
   - Communicate effectively with supervisors, colleagues, and clients as required. Practice clear and concise verbal and written communication.
   - Demonstrate professionalism in all interactions, respecting confidentiality, and adhering to company policies and procedures.
7. Safety and Compliance:
   - Prioritize safety at all times. Familiarize yourself with safety protocols, procedures, and emergency exits in the workplace.
   - Follow all safety guidelines and regulations to ensure your well-being and that of others around you.

After Completing Industrial Training:

8. Reflection and Documentation:

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PROJECT			12

- Reflect on your training experience. Evaluate what you have learned, the challenges you faced, and how you have grown professionally.
- Maintain a journal or log documenting your daily activities, achievements, and lessons learned during the training period.

9. Feedback and Evaluation:
   - Seek feedback from your industry supervisor and faculty mentor on your performance and areas for improvement.
   - Use constructive feedback to enhance your skills and competencies for future career opportunities.
10. Career Planning:
    - Use your industrial training experience to inform your career planning and decision-making process.
    - Discuss your career goals and aspirations with your faculty mentor or career counselor for guidance on next steps after completing your diploma.

By following these instructions, Diploma engineering students can make the most of their industrial training experience, gain valuable insights into their chosen field, and prepare themselves effectively for future professional endeavors.

Attendance Certification

Every month students have to get their attendance certified by the industrial supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the institution supervisor. Regularity in attendance and submission of report will be duly considered while awarding the Internal Assessment mark.

Training Reports

The students have to prepare two types of reports: Weekly reports in the form of a diary to be submitted to the concerned faculty mentor of the institution. This will be reviewed while

2149234274 2149237274	Industrial Training (SW)	540 Periods	C
PROJECT			12

awarding Internal assessment. The details of the activity during the training will be monitored by the Faculty mentor through the faculty advisor and student.

The feedback shall be given to the HOD / Principal for further necessary action.

Industrial Training Diary

Students are required to maintain the record of day-to-day work done. Such a record is called Industrial training Diary. Students have to write this report regularly. All days for the week should be accounted for clearly giving attendance particulars (Presence, absence, Leave, Holidays etc.). The concern of the Industrial supervisor is to periodically check these progress reports.

Comprehensive Training Report

In addition to the diary, students are required to submit a comprehensive report on training with details of the organisation where the training was undergone after attestation by the supervisors. The comprehensive report should incorporate study of plant / product / process / construction along with intensive in-depth study on any one of the topics such as processes, methods, tooling, construction and equipment, highlighting aspects of quality, productivity and system. The comprehensive report should be completed in the last week of Industrial training. Any data, drawings etc. should be incorporated with the consent of the Organisation.

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PROJECT			12

Scheme of Evaluation

Internal Assessment

Students should be assessed for 40 Marks by industry supervisor and polytechnic faculty mentor during 3rd Month and 5th Month. The total marks (40 + 40) scored shall be converted to 40 marks for the Internal Assessment.

Sl. No.	Description	Marks
A	Punctuality and regularity. (Attendance)	10
B	Level / proficiency of practical skills acquired. Initiative in learning / working at site	10
C	Self expression / communication skills. Interpersonal skills / Human Relation.	10
D	Report and Presentation.	10
Total		40

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PROJECT			12

End Semester Examination - Project Exam

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairman Board of Examinations after the completion of internship period of six months. The marks scored will be converted to 60 marks for the End Semester Examination.

Sl. No.	Description	Marks
A	Daily Activity Report.	20
B	Comprehensive report on Internship, Relevant Internship Certificate from the concerned department.	30
C	Presentation by the student at the end of the Internship.	30
D	Viva Voce	20
Total		100

2049235773	Mini Project (Sandwich Course Only)	L	T	P	C
PROJECT		0	0	4	2

Introduction

Every student must do one mini project in the sandwich diploma program. Students can do their project in Industry or R&D Lab or in-house or a combination of any two for the partial fulfillment for the award of Diploma in Engineering.

For the project works, the Department will constitute a three-member faculty committee to monitor the progress of the project and conduct reviews regularly.

If the projects are done in-house, the students must obtain the bonafide certificate for project work from the Project supervisor and Head of the Department, at the end of the semester. Students who have not obtained the bonafide certificate are not permitted to appear for the Project Viva Voce examination.

For the projects carried out in Industry, the students must submit a separate certificate from Industry apart from the regular bonafide certificate mentioned above. For Industry related projects there must be one internal faculty advisor / Supervisor from Industry (External), this is in addition to the regular faculty supervision.

The final examination for project work will be evaluated based on the final report submitted by the project group **of not exceeding four students**, and the viva voce by an external examiner.

Objectives

Academic project work plays a crucial role in the education of Diploma in Engineering students, as it helps them apply theoretical knowledge to practical situations and prepares them for real-world engineering challenges.

- **Integration of Knowledge**: Consolidate and integrate theoretical knowledge acquired in coursework to solve practical engineering problems.
- **Skill Development**: Enhance technical skills related to the specific field of engineering through hands-on experience and application.
- **Problem-Solving Abilities**: Develop critical thinking and problem-solving abilities by addressing complex engineering issues within a defined scope.
- **Project Management**: Gain experience in project planning, execution, and management, including setting objectives, timelines, and resource allocation.

2049235773	Mini Project (Sandwich Course Only)	L	T	P	C
PROJECT		0	0	4	2

- **Teamwork and Collaboration**: Foster teamwork and collaboration by working in multidisciplinary teams to achieve project goals and objectives.
- **Research Skills**: Acquire research skills by conducting literature reviews, gathering relevant data, and applying research methodologies to investigate engineering problems.
- **Innovation and Creativity**: Encourage innovation and creativity in proposing and developing engineering solutions that may be novel or improve upon existing methods.
- **Communication Skills**: Improve communication skills, both oral and written, by presenting project findings, writing technical reports, and effectively conveying ideas to stakeholders.
- **Ethical Considerations**: Consider ethical implications related to engineering practices, including safety, environmental impact, and societal concerns.
- **Professional Development**: Prepare for future professional roles by demonstrating professionalism, initiative, and responsibility throughout the project lifecycle.

Course Outcomes

CO 1: Demonstrate the ability to apply theoretical concepts and principles learned in coursework to solve practical engineering problems encountered during the project.

CO 2: Develop and enhance technical skills specific to the field of engineering relevant to the project, such as design, analysis, simulation, construction, testing, and implementation.

CO 3: Apply critical thinking and problem-solving skills to identify, analyze, and propose solutions to engineering challenges encountered throughout the project lifecycle.

CO 4: Acquire project management skills by effectively planning, organizing, and executing project tasks within defined timelines and resource constraints.

CO 5: Improve communication skills through the preparation and delivery of project reports, presentations, and documentation that effectively convey technical information to stakeholders.

2049235773	Mini Project (Sandwich Course Only)	L	T	P	C
PROJECT		0	0	4	2

Important points to consider to select the mini project.

- Selecting a project work in Diploma Engineering is a significant decision that can greatly influence your learning experience and future career prospects.
- Choose a project that aligns with your career aspirations and interests within the field of engineering. Consider how the project can contribute to your professional development and future opportunities.
- Ensure the project aligns with your coursework and specialization within the Diploma program. It should complement and build upon the knowledge and skills you have acquired in your studies.
- Evaluate the scope of the project to ensure it is manageable within the given timeframe, resources, and constraints. Avoid projects that are overly ambitious or impractical to complete effectively.
- Assess the availability of resources needed to conduct the project, such as equipment, materials, laboratory facilities, and access to relevant software or tools. Lack of resources can hinder project progress.
- Select a project that genuinely interests and motivates you. A project that captures your curiosity and passion will keep you engaged and committed throughout the project duration.
- Consider the availability and expertise of faculty advisors or industry mentors who can provide guidance and support throughout the project. Effective mentorship is crucial for success.
- Clearly define the learning objectives and expected outcomes of the project. Ensure that the project will help you achieve specific learning goals related to technical skills, problem-solving, and professional development.
- Look for opportunities to propose innovative solutions or explore new methodologies within your project. Projects that encourage creativity can set you apart and enhance your learning experience.
- Consider ethical implications related to the project, such as safety protocols, environmental impact, and compliance with ethical guidelines in research and engineering practices.

2049235773	Mini Project (Sandwich Course Only)	L	T	P	C
PROJECT		0	0	4	2

- Evaluate whether the project offers opportunities for collaboration with peers, experts from other disciplines, or industry partners. Interdisciplinary projects can broaden your perspective and enhance your teamwork skills.
- Consider the potential impact of your project on society or the engineering community. Projects that address significant challenges or contribute to social good can be highly fulfilling and make a meaningful difference.

By carefully considering these points, Diploma Engineering students can make informed decisions when selecting project work that not only enhances their academic learning but also prepares them for successful careers in engineering.

Duties Responsibilities of the internal faculty advisor.

Each group should have an internal faculty advisor assigned by the HOD/Principal.

- The project should be approved by the project monitoring committee constituted by the Chairman Board of Examinations.
- The project should be selected in the sixth semester itself. Each project shall have a maximum of four students in the project group.
- Provide comprehensive academic advising to help in the selection of appropriate project that align with their interests and career goals.
- Offer expertise and feedback to ensure rigorous methodology, innovative approaches, and meaningful contributions to the field.
- Assist in developing technical and professional skills through hands-on projects, laboratory work, and practical applications of theoretical knowledge.
- Provide personal mentorship, fostering a supportive relationship that encourages growth, resilience, and a positive academic experience.
- Facilitate connections between students and industry professionals, alumni, and other relevant networks to enhance their professional opportunities and industry exposure.
- Ensure students have access to necessary resources, including research materials, lab equipment, software, and academic literature.
- Regularly monitor and evaluate the progress of the project, providing constructive feedback and guidance to help them stay on track and achieve their goals.

2049235773	Mini Project (Sandwich Course Only)	L	T	P	C
PROJECT		0	0	4	2

- Instill and uphold high ethical and professional standards, encouraging students to practice integrity and responsibility in their work.
- Assist in preparing progress reports, writing recommendation letters, and facilitating grant applications.
- Organize and participate in workshops, seminars, and other educational events that enhance the learning experience and professional development .
- Address any issues or conflicts that arise, providing mediation and support to ensure a positive and productive academic environment.

Instructions to the students.

- Regularly meet with your internal faculty advisor for guidance on academic progress, research projects, and career planning. Be proactive in seeking advice and support from your faculty advisor.
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- Focus on improving essential professional skills such as communication, teamwork, problem-solving, and leadership. Participate in workshops and seminars that enhance these competencies.
- Actively seek networking opportunities through industry events, seminars, and meetings. Establish connections with peers, alumni, and professionals in your field to build a strong professional network.
- Seek internships, co-op programs, or part-time jobs related to your field of study. Real-world experience is invaluable for understanding industry practices and enhancing your employability.
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2049235773	Mini Project (Sandwich Course Only)	L	T	P	C
PROJECT		0	0	4	2

- Adopt a mindset of lifelong learning. Stay updated with the latest developments and trends in engineering by reading industry journals, attending conferences, and taking additional courses.

Documents to be submitted by the student for a project.

Submit a printed report of your project work along with the fabrication model / analysis report for the End Semester Examination.

Rubrics for Mini Project Work

Sl. No.	Topics	Description
1	Objectives	Clearly defined and specific objectives outlined. Objectives align with the project's scope and purpose.
2	Literature Review	Thorough review of relevant literature. Identification of gaps and justification for the project's contribution.
3	Research Design and Methodology	Clear explanation of the research design. Appropriateness and justification of chosen research methods.
4	Project Management	Adherence to project timeline and milestones. Effective organization and planning evident in the project execution.
5	Documentation	Comprehensive documentation of project details. Clarity and completeness in recording methods, results, and challenges.
6	Presentation Skills	Clear and articulate communication of project findings. Effective use of visuals, if applicable.

2049235773	Mini Project (Sandwich Course Only)	L	T	P	C
PROJECT		0	0	4	2

7	Analysis and Interpretation	In-depth analysis of data. Clear interpretation of results in the context of research questions.
8	Problem-Solving	Demonstrated ability to identify and address challenges encountered during the project. Innovative solutions considered where applicable.
9	Professionalism and Compliance	Adherence to ethical standards in research. Compliance with project guidelines and requirements.
10	Quality of Work	Overall quality and contribution of the project to the field. Demonstrated effort to produce high-quality work.

SCHEME OF EVALUATION

The mark allocation for Internal and End Semester Viva Voce are as below.

Internal Mark Split (40 Marks)*		
Review 1 (10 Marks)	Review 2 (15 Marks)	Review 3 (15 marks)
Committee: 5 Marks. Supervisor: 5 Marks	Committee: 7.5 Marks Supervisor: 7.5 Marks	Committee: 7.5 Marks Supervisor: 7.5 Marks

Note: * The rubrics should be followed for the evaluation of the internal marks during reviews.

2049235773	**Mini Project (Sandwich Course Only)**	L	T	P	C
PROJECT		0	0	4	2

END SEMESTER EXAMINATION - Project Exam

The performance of each student in the project group would be evaluated in a viva voce examination conducted by a committee consisting of an external examiner and the Department project supervisor and an internal examiner.

End Semester (100)#			
Record (20 Marks)	Presentation (20 Marks)	Viva Voce (20 Marks)	Model / Analysis Report (40 Marks)
External: 10 Internal: 5 Supervisor: 5	External: 10 Internal: 5 Supervisor: 5	External: 10 Internal: 5 Supervisor: 5	External: 20 Internal: 10 Supervisor: 10

 # The marks scored will be converted to 60 Marks.