1020235440	MAINTENANCE, REPAIR AND SERVICE	L	T	P	C
PRACTICUM		1	0	4	3

Introduction:

To meet out Globalization, technological advances and to sustain, we have to explore the knowledge about machine tools covering the various operations and Maintenance skill sets required for the development of a nation and its people.

Course Objectives:

1. To enable the student to understand the principles, functions and practices adopted in industry for the successful management of maintenance activities.
2. To explain different maintenance categories like preventive maintenance, condition monitoring and repair of machine tool.
3. To illustrate some of the simple instruments used for condition monitoring in industry.
4. To Understand the Repairs procedure and Service methods followed in the industry.

Course Outcomes

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

CO1: Describe about Maintenance principles, types of Maintenance and Maintenance planning.

CO2 : Explain the Maintenance Economics and Maintenance organization.

CO3 : Demonstrate the necessary skills for fixing and testing of different components and drives used in the Industry

CO4 : Explain the Repairs and service methodology followed in the Industry

CO5 : Demonstrate the necessary skills for Repairing and servicing of different Machine Tools used in the Industry

Pre-requisites:

Applied science, Basic workshop practice, Manufacturing Process, Machine Tool theory.

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PRACTICUM		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1		1	3	1		
CO2	1		1	3	-		
CO3	1		1	3	1		
CO4	1		1	3	-		
CO5	1		1	3	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 ina simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

1020235440	MAINTENANCE, REPAIR AND SERVICE	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 Units	All Exercises	All Exercises
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
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 exercise / 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.

1020235440	MAINTENANCE, REPAIR AND SERVICE	L	T	P	C
PRACTICUM		1	0	4	3

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 a printed manual or a file with documents. The procedure and sketch should be written by the student manually in the documents.

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.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Tools required	10
B	Procedure / Sketch / Setting / Tool Handling	20
C	Alignment test / Dismantling / Assembling	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.

1020235440	MAINTENANCE, REPAIR AND SERVICE	L	T	P	C
PRACTICUM		1	0	4	3

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ from the complete theory portions.	30 X 1 Mark	30 Marks
Part – B	Seven 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.

Syllabus Contents

Theory Portion	
Unit I: Maintenance: Basic principles of maintenance planning – Importance of Maintenance - objectives and principles of planned maintenance activity - importance and benefits of sound maintenance systems – Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization. Maintenance – Types – Preventive, Breakdown, Scheduled – Comparison – Maintenance Schedule – Maintenance Economics – Condition Monitoring – Cost Comparison – With and Without condition monitoring – Introduction to TPM – TPM Pillars	8
Practical Exercises	
1. Testing of Lathe machine alignments and prepare a test chart. a) Level of lathe. b) True running of spindle. c) Alignment of both centres. d) Parallelism of main spindle to saddle movements	4

1020235440	MAINTENANCE, REPAIR AND SERVICE	L	T	P	C
PRACTICUM		1	0	4	3

2. Testing of Pillar type drilling machine alignments and prepare a test chart. a) Level of the Drilling machine. b) True running of Spindle Taper. c) Squareness of Spindle axis with Table	4
3. Dismantle and assemble the tailstock of the lathe. Identify the troubles and mention the corrective measures.	4
4. Dismantle and assemble of D C Motor. Identify the troubles and mention the corrective measures.	4
5. Dismantle and assemble the Hydraulic cylinder. Identify the troubles and mention the corrective measures.	4
6. Dismantling and assembly of Directional control valve. Identify the troubles and mention the corrective measures.	4
Theory Portion	
Unit II : Repair and Service: Repair methods of the machine components - Failure analysis - Logical fault location – Sequential fault location – Equipment records – Job order system – Use of computers in maintenance – Repair cycle. Transmission systems - Belt drive - chain drive - gear drive. Tools required for the installation and maintenance.	7
Practical Exercises	
7. Bearing: Inspection, Removal, Cleaning, lubrication and refitting of bearings. Dismantle and assemble the bearing from a shaft assembly unit.	4
8. Couplings: Maintenance, Repair and replacement and alignment of shaft. Installation and alignment of driving and driven shafts using Plummer block bearings.	4
9. Belts: Mounting of belts and checking of slip. Installation of belt drives using Motor, V belt and driving and driven pulley.	4
10. Chain drive: Tighten and replace the chain. Installation of chain drives using motor, sprocket and chain drive.	4
11. Gear drives : (i) Checking of correct meshing (ii) Checking of wear of teeth (iii) Checking of crack / damage.	4
12. Dismantling, inspecting and assembling of constant mesh gear box and find out the gear ratios.	4
Assessment Test and Revision	12
Total	75

1020235440	MAINTENANCE, REPAIR AND SERVICE	L	T	P	C
PRACTICUM		1	0	4	3

Suggested List of Students Activity:

1. Observe the Lathe, drilling, Milling, Grinding and CNC machine of the institute and study its Operation and Maintenance manual .
2. List the possible Breakdown maintenance procedure that can be done on that machine.

TEXT BOOKS / REFERENCE BOOKS

1. Srivastava S K., "Industrial Maintenance Management", 7th Edition, S. Chand and Co 2019.
2. Venkataraman K "Maintenance Engineering and Management", 11th Edition, PHI Learning Pvt. Ltd., 2017.
3. Bhattacharya S N., "Installation, Servicing and Maintenance" , 10th Edition, S. Chand and Co., 2019.

END SEMESTER EXAMINATION – PRACTICAL EXAM

Note:

All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

Allocation Marks for End Semester Exam

Part	Description	Marks
A	Aim & Tools required	10
B	Procedure / Sketch / Setting / Tool Handling	20
C	Alignment test / Dismantling / Assembling	20
D	Troubles / Report / Test Chart /	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.

1020235440	MAINTENANCE, REPAIR AND SERVICE	L	T	P	C
PRACTICUM		1	0	4	3

Equipment / Facilities required to conduct the Practical Course.

S.No	Name of the Equipment's	Quantity Required
1	Tail stock	2 Nos
2	AC Induction motor	2 Nos
3	DC Motor	2 Nos
4	Lathe	2 Nos
5	Drilling Machine	2 Nos
6	Milling Machine	2 Nos
7	Surface Grinder	1 No.
8	Tool & Cutter Grinder	1 No.
9	Bearing with shaft assembly unit	2 Nos
10	Plummer block	2 Nos
11	Abrasive belt grinder	1 No.
12	Belt drive conveyor unit	2 Nos
13	Counter mesh gear box	1 No.
14	Steering gear box	1 No.
15	Magnetic stand with dial indicator	4 Nos.
16	Straight edge	2 Nos
17	Spirit level	2 Nos
18	Test Mandrels	2 Nos

1020235541	CNC PROGRAMMING	L	T	P	C
PRACTICUM		1	0	4	3

Introduction

Computer Numerical Control (CNC) programming is a vital subject for diploma engineering students, focusing on the automation of machine tools through computer systems. CNC technology is foundational in modern manufacturing, allowing for precision, efficiency, and the ability to produce complex parts with minimal human intervention.

Proficiency in CNC programming opens up numerous career opportunities in various industries such as automotive, aerospace, manufacturing, and more. CNC programmers and operators are essential for creating high-quality, precision-engineered products.

This course equips students with the knowledge and skills necessary to excel in the dynamic and technologically advanced field of CNC machining, making them valuable assets in the engineering and manufacturing sectors.

Course Objectives

The objective of this course is to prepare the student,

- To understand the fundamentals of CNC
- To explain the construction and tooling of the CNC machine
- To Programme Production Jobs for CNC Turning Centre for different operations
- To Programme production jobs for CNC Vertical Machining Centre for different operations
- To operate a CNC lathe
- To operate a CNC milling machine

Course Outcomes

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

CO1: Recall safety procedure to be followed while working in CNC Machines.

CO2: Create CNC part program for cylindrical components using CNC Turning Centre

CO3: Produce components using CNC Turning centre

CO4: Create CNC part program for rectangular components using CNC Machining Centre

CO5: Produce components using CNC Machining centre

1020235541	CNC PROGRAMMING	L	T	P	C
PRACTICUM		1	0	4	3

Pre-requisites

Knowledge of CNC Machines, Tools and accessories.

CO/PO Mapping

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

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 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.
- Incorporate formative and summative assessments to gauge student progress and provide targeted feedback.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.

1020235541	**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 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
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.

1020235541	CNC PROGRAMMING	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 part program, procedure, sketch and output should be written by the student manually in the documents.

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.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Tools Required	10
B	Writing Part Program	20
C	Editing Program in machine and Component	20
TOTAL		50
D	Practical Documents (As per the portions)	10
		60

Cycle I: 1, 2, 3 and 4.

Cycle II: 5, 6, 7, 8 and 9.

- **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.

1020235541	CNC PROGRAMMING	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 & Tools Required	10
B	Writing Part Program	20
C	Simulation	10
D	Editing Program in machine and Component	20
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.

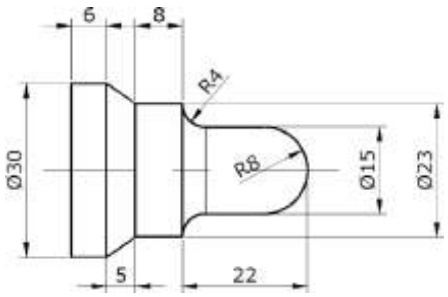
1020235541	CNC PROGRAMMING	L	T	P	C
PRACTICUM		1	0	4	3

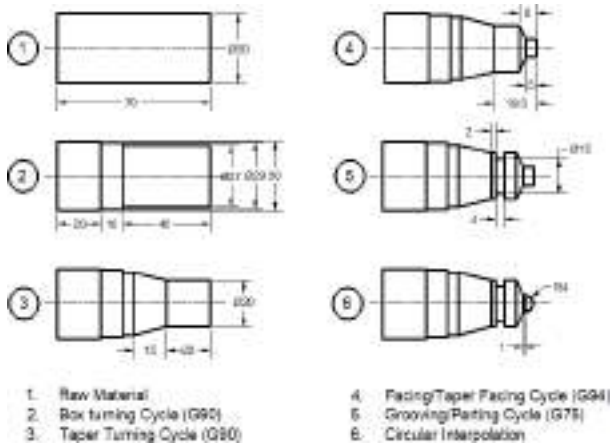
Syllabus contents

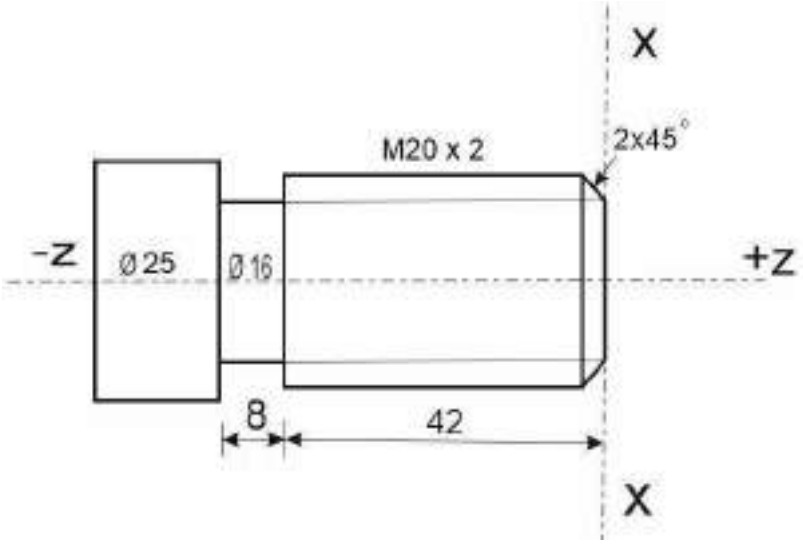
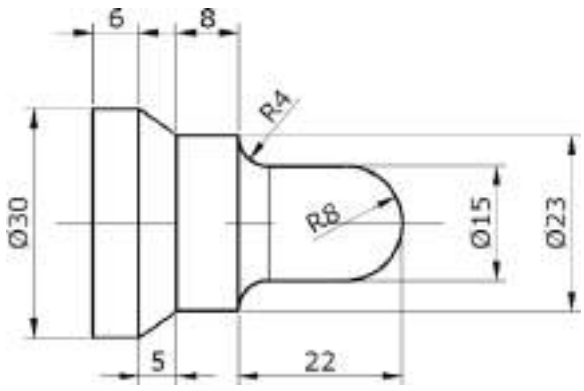
THEORY	Hours
Introduction to NC, CNC and DNC – Components of a CNC system: Program, Machine Control Unit, and Machine Tool – Tooling for CNC – ISO Designation for Tooling – Tool Material Selection – Tool Inserts. Steps involved in CNC Programming: Process Planning, Part Programming, Program Entry, Program Verification, and Production – Manual Part Programming, Data required for Manual Part Programming – Coordinate system – Designation of axes – Datum points and Reference Points – NC Dimensioning: Absolute, and Incremental - CNC Programming procedure – Format of a program. CNC Part Programming for Turning Centres – Axes system used for turning - Preparatory functions (G-Codes) for turning Centres – Auxiliary functions (M-Codes) for turning centres – Tool function codes – Speed function codes – Feed Specification codes - Rapid Positioning – Tool nose radius compensation - Linear Interpolation – Circular Interpolation/Filleting. Canned/Fixed Cycles: Box turning cycle (G90) - Taper turning (G90) – Facing/Taper facing cycle (G94) – Grooving/Parting cycle (G75) – Single threading cycle (G92) and Multiple threading cycle (G76) – Multiple turning cycle or Stock removal cycle (G70 & G71) – Peck drilling cycle (G74) – Boring/Taper Boring cycle (G90) CNC Part Programming for Machining Centres – Axes system used for Machining centres - Preparatory functions (G-Codes) for Machining Centres – Auxiliary functions (M-Codes) for Machining centres – Preset – Cutter radius compensation – Tool length compensation - Linear Interpolation – Circular Interpolation. Canned Cycles: Drilling cycle (G81) – Counter sinking/Counter boring (G82) – Tapping cycle (G84) – Reaming Cycle (G85) – Boring Cycle (G86) – Peck	15

1020235541	CNC PROGRAMMING	L	T	P	C
PRACTICUM		1	0	4	3

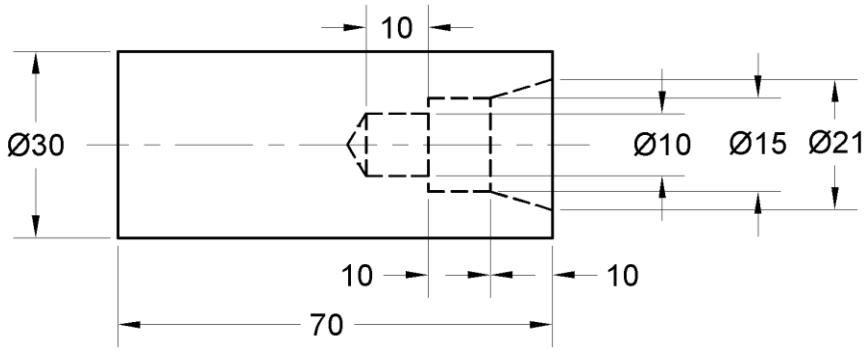
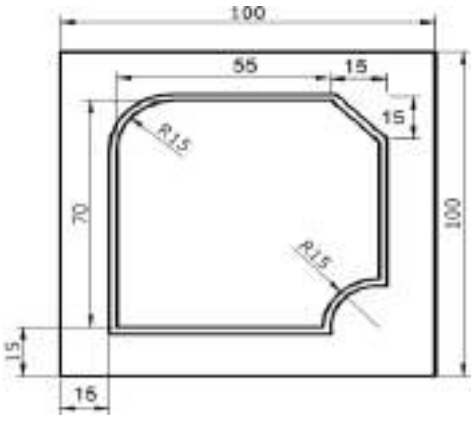
drilling cycle (G83) – Sub Program – Mirroring – Circular Pocketing (G170 & G171) – Rectangular Pocketing (G172 & G173).

Ex.No	Name of the Experiment	
1.	Write a Part Program for producing the component shown below in the turning center, simulate it and produce the component – Using Linear and Circular Interpolation. Raw Material Size: φ 30 mm dia x 41 mm length. Component Diagram: 	5
2.	Write a Part Program for producing the component shown below in the turning center, simulate it and produce the component – Using Box turning cycle, Facing cycle, and Grooving cycle (G90, G94, and G75). Raw Material Size: φ 30 mm dia x 70 mm length Component Diagram: Note: Facing 0.5 mm (20 mm to 19.5 mm)	5

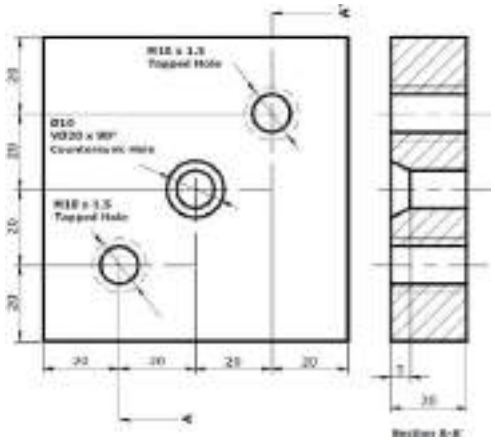
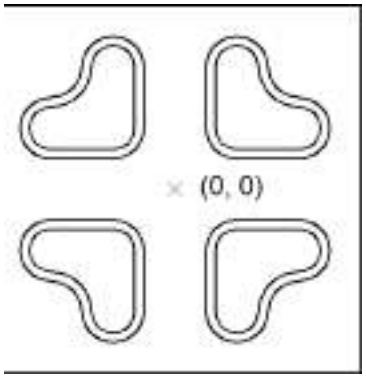
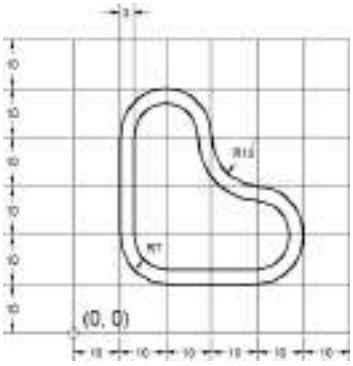


3.	Write a Part Program for producing the component shown below in the turning center, simulate it and produce the component – Using the threading cycle (G92/G76). Raw Material Size: φ 25 mm dia x 70 mm length Component Diagram: 	5
4.	Write a Part Program for producing the component shown below in the turning center, simulate it and produce the component – Using multiple turning cycle (G70 & G71). Raw Material Size: φ 30 mm dia x 41 mm length Component Diagram: 	5

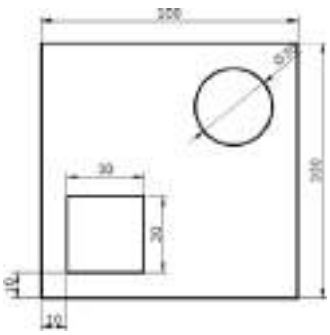
1020235541	CNC PROGRAMMING	L	T	P	C
PRACTICUM		1	0	4	3

5.	Write a Part Program for producing the component shown below in the turning center, simulate it and produce the component – Using Peck drilling and Boring cycles (G74 & G90) Raw Material Size: φ 30 mm dia x 70 mm lengthComponent Diagram: Steps: (1). Pilot Drill – 3 mm dia, (2). Drill 10 mm dia, (3). Boring to 15 mm dia, (4). Taper Boring to 21 mm dia  	5
6.	Write a Part Program for producing the component shown below in the Machining center, simulate it and produce the component – Using Linear and Circular Interpolation Raw Material Size: 100 mm x 100 mm x 15 mm Component Diagram:  	5

1020235541	CNC PROGRAMMING	L	T	P	C
PRACTICUM		1	0	4	3

7.	Write a Part Program for producing the component shown below in the Machining center, simulate it and produce the component – Using Peck drilling, Reaming, Tapping and counter-sinking cycles Raw Material Size: 80 mm x 80 mm x 20 mm Component Diagram: 	5
8.	Write a Part Program for producing the component shown below in the Machining center, simulate it and produce the component – Using Mirroring function Raw Material Size: 120 mm x 120 mm x 20 mm Component Diagram:  	5

1020235541	CNC PROGRAMMING	L	T	P	C
PRACTICUM		1	0	4	3

9.	Write a Part Program for producing the component shown below in the Machining center, simulate it and produce the component – Using Circular and Rectangular Pocketing Raw Material Size: 100 mm x 100 mm x 20 mm Component Diagram: 	5
	Revision + Test	15
	Total	75

Textbook:

1. S.K. Sinha, CNC Programming, Galgotia Publications Pvt Ltd., 2011
2. P. M. Agrawal, and V. J. Patel, CNC Fundamentals and Programming, First Edition, Charotar Publishing House Pvt. Limited, 2009.
3. Pawan Negi, Mangey Ram, and Om Prakash Yadav, Basics of CNC Programming, River Publishers, 2019
4. Peter Smid, CNC Control Setup for Milling and Turning Mastering CNC Control Systems, Industrial Press, 2010.

Website links for reference:

1. https://www.youtube.com/watch?v=_5r2XR1h1aQ
2. https://www.youtube.com/watch?v=eJ432X2dR9A

1020235541	CNC PROGRAMMING	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 & Tools Required	10
B	Writing Part Program	20
C	Simulation	10
D	Editing Program in machine and Component	20
E	Written Test	30
F	Viva Voce	10
	TOTAL	100

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

LIST OF EQUIPMENT

1. CNC Turning centre - 2 No.
2. CNC Milling Centre - 2 No.
3. CNC Simulation Software
4. Computer - 30 Nos.

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.

1020235542	**Systems Applications and Product (SAP)**	L	T	P	C
PRACTICUM		1	0	4	3

- 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	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 logbook 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.

1020235542	**Systems Applications and Product (SAP)**	L	T	P	C
PRACTICUM		1	0	4	3

- **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

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.

1020235542	**Systems Applications and Product (SAP)**	L	T	P	C
PRACTICUM		1	0	4	3

Syllabus Contents

Theory Portion- Unit I : SAP:	
Introduction–SAP - SAP r/3 architecture - central system – distributed 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.	8
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 andtroubleshooting. 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	7

1020235542	**Systems Applications and Product (SAP)**	L	T	P	C
PRACTICUM		1	0	4	3

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 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

1020235542	**Systems Applications and Product (SAP)**	L	T	P	C
PRACTICUM		1	0	4	3

Web Reference:

- https://www.youtube.com/watch?v=1jFQMadZLfs
- https://www.coursera.org/sap
- Free SAP Training | openSAP
- SAP Help Portal

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

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

1020235543	**INDUSTRIAL IOT**	L	T	P	C
PRACTICUM		1	0	4	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 enable the student to

- Understand the application of IIoT in automation of commercial and real world applications.
- Summarize the functions of various types of sensors.
- Understand the Designing Industrial IOT Systems for various applications.
- Facilitate the students to design simple IIoT concepts.

Course Outcomes:

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

CO1: Explain the basic computing features of the Arduino platform and programming.CO2: Adapt to the Arduino platform and display their name in the LCD display.

CO3: Perform LED blinking and LED pattern creation with push button control with Arduino.

CO4: Perform IR sensor interfacing, ultrasonic sensor interfacing and soil moisture interfacing with ESP32.

CO5: Design a system that integrates ultrasonic sensors for accurate distance measurement.

Pre-requisites:

Applied Physics

1020235543	INDUSTRIAL IOT	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	-	1	3	-	-	-
CO3	3	-	1	3	-	-	-
CO4	3	-	1	3	-	-	-
CO5	3	-	1	3	-	-	-

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

Instructional Strategy:

- It is advised that teachers take steps to increase the students' 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.
- Incorporate formative and summative assessments to measure student progress and provide targeted feedback.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.

1020235543	**INDUSTRIAL IOT**	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
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 / printed manual / file. 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 logbook 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 & Tools Required	10
B	Procedure / Steps	20
C	Execution	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.

1020235543	INDUSTRIAL IOT	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 & Tools Required	10
B	Procedure / Steps	20
C	Execution	20
D	Output / Result	10
E	Written Test	30
F	Viva Voce	10
	TOTAL	100

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

1020235543	**INDUSTRIAL IOT**	L	T	P	C
PRACTICUM		1	0	4	3

Syllabus Contents

Theory Portion		
UNIT I: INTRODUCTION TO INDUSTRIAL IOT (IIOT) SYSTEMS		**Period**
The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0 revolutions, Support System for Industry 4.0, Smart Factories.		7
UNIT II: IMPLEMENTATION SYSTEMS FOR IIOT		
Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems.		8
Practical Exercises:		
1	To implement LED Blink and LED pattern with Arduino	5
2	Creating different LED patterns and controlling with push button switches.	5
3	Automated LED light control based on input from IR sensor and LDR	5
4	To display your name in a LCD 16 x2 display with Arduino.	5
5	Controlling servo motors with the help of joystick	5
6	Measurement of temperature and Pressure using ESP32	5
7	Calculate the distance to an object with the help of an Ultrasonic sensor and display it on a LCD	5
8	Design a system that integrates ultrasonic sensors for accurate distance measurement in the identified areas.	5
9	integrate sensors such as GPS, accelerometers, and panic Basic Burglar alert security system with the help of PIR sensor and Buzzer	5
10	Modules and sensor interfacing - Interfacing IR sensor and LED with ESP32	5
	Revision + Continuous Assessment	10
	Total Period	75

1020235543	INDUSTRIAL IOT	L	T	P	C
PRACTICUM		1	0	4	3

Suggested List of Students Activity:

1. Each students to write and submit the assignment on the topic 'Contrast IT and OT'
2. Four students can be grouped as a batch and practice an additional experiment to interface any one of the Arduino compatible sensors with Arduino and observe the behaviour of sensors.
3. Introduction to Arduino platform and programming
4. Study on various sensors and actuators.

Text and Reference Books:

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, Introduction to IoT, First Edition, Cambridge University Press, 2022.
2. Alasdair Gil Christ, Industry 4.0: The Industrial Internet of Things, A press, Publications, 2016.
3. Sudan Jha, Usman Tariq, Gyanendra Prasad Joshi, Vijender Kumar Solanki, Industrial Internet of Things: Technologies, Design, and Applications, CRC Press, 2022.

Web-based/Online Resources:

https://onlinecourses.nptel.ac.in/noc20_cs69/preview

Equipment / Facilities required to conduct the Practical Course.

S.No	Name of the Equipment's	Quantity Required
1.	Arduino UNO set	15
2.	ESP32 set -Type C	15
3.	LED Bulb	15
4.	Resistor	15
5.	Push button	15
6.	Servo motor 5V DC	15
7	DC motor	15
8	5V DC Relay	15

1020235543	INDUSTRIAL IOT	L	T	P	C
PRACTICUM		1	0	4	3

9	Mini Breadboard	15
10	16 X 2 LCD Display with TTL	15
11	Gas sensor MQ2	15
12	IR Sensor	15
13	Temperature sensor DHT11 module	15
14	Ultrasonic sensor HC-SR04	15
15	Joystick module	15
16	Jumper wires - 3 nos.	As Required

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 & Tools Required	10
B	Procedure / Steps	20
C	Execution	20
D	Output / Result	10
E	Written Test	30
F	Viva Voce	10
	TOTAL	100

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

1020235544	ADVANCED WELDING TECHNOLOGIES	L	T	P	C
PRACTICUM		1	0	4	3

Introduction:

This syllabus outlines advanced welding technologies that covers various welding processes and techniques. The course is divided into 3 units that cover topics like introductory welding concepts, common arc and resistance welding processes, welding metallurgy, and weldment inspection and testing. The course aims to impart knowledge of advanced welding practices, welding process parameters, and the comparative merits of different welding methods. Students should learn to select the appropriate welding technique for various joint types and understand how to produce quality weldments.

Course Objectives:

1. To learn various concepts related to welding and its applications.
2. To have practical purview of various welding processes, welding standards, and advanced welding processes.
3. Familiarise with the working of the various welding processes.

Course Outcomes:

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

CO1: Explain the physics of Welding

CO2: Identify the appropriate Welding technique for the components

CO3: Select proper techniques to identify the welding defects

CO4: Acquire skills on advanced welding techniques

CO5: Demonstrate the necessary skills to identify the defects in welding.

Pre-requisites:

Knowledge of metal joining procedure

1020235544	ADVANCED WELDING TECHNOLOGIES	L	T	P	C
PRACTICUM		1	0	4	3

CO/PO Mapping

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

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

Instructional Strategy:

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

1020235544	**ADVANCED WELDING TECHNOLOGIES**	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 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 experiment.

This documentation can be carried out in a separate notebook / printed manual / file. The Steps, Procedure, Sketch and 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 logbook and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Joint Preparation	20
B	Procedure	20
C	Weld bead	10
TOTAL		50
D	Practical Documents (As per the portions)	10
		60

Cycle - I Exercises 1, 2, 3, 4, and 5.

Cycle - II Exercises 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.

1020235544	ADVANCED WELDING TECHNOLOGIES	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	Joint Preparation	20
B	Procedure	20
C	Weld bead	10
D	Finish	10
E	Written Test	30
F	Viva Voce	10
	TOTAL	100

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

1020235544	ADVANCED WELDING TECHNOLOGIES	L	T	P	C
PRACTICUM		1	0	4	3

Syllabus contents

Theory Portion	Period
UNIT 1: Introduction and physics of welding Overview of welding processes and their classification, edge preparation, weld symbols – types of joints - weld nomenclature - electrode - codes – flux coating - modes of metal transfer – heat sources – types of welding arc - Arc characteristics - Voltage-current characteristics – welding efficiency - heat affected zone (HAZ) - welding techniques **UNIT 2: Arc, Gas and other welding processes** Fundamental principles - arc welding – carbon arc welding – shielded metal arc welding – submerged arc welding – TIG – MIG – plasma arc welding – electro slag welding - advantages, limitations and applications; Oxy-acetylene welding – air-acetylene welding – advantages, limitations and applications. LASER beam welding, robot welding, solid state welding - diffusion bonding, explosive welding, ultrasonic welding, friction welding, forge welding - thermitwelding - atomic hydrogen welding - electron beam welding - under water welding - electric resistance welding, spot, seam – its advantages, disadvantages and applications. **UNIT 3: Welding defects and Inspection** Welding defects – causes and remedies – Weldability test - Weldability of metals like steels, stainless steels, aluminium, copper, nickel and titanium alloys – inspections – purpose – inspection methods – visual inspection - DPT – MPT – radiographic test – ultrasonic test – phased array ultrasonic test (PAUT) - case studies in testing of welded joints - Software in welding and importance.	15
Practice Arc welding basic exercises (for practice) : Lap joint, Butt joint, Corner joint, T-joint Gas welding basic exercises (for practice) : Lap joint, Butt joint, Corner joint, T-joint	10

1020235544	**ADVANCED WELDING TECHNOLOGIES**	L	T	P	C
PRACTICUM		1	0	4	3

Practical Exercises	
Exercises for Practical Exam.: 1. Make a butt and fillet joints by down hand welding (single V) using arc welding. 2. Make a butt and fillet joints by vertical welding using arc welding. 3. Welding of pipes using arc welding 4. Butt welding of thin sheets leftward, rightward and downward using gas welding. 5. Welding of tubes using gas welding. 6. TIG welding practice – butt joint. 7. MIG welding practice – butt joint. 8. Spot welding practice in thin sheets. 9. Inspection of welding – visual and magnetic particle test. 10. Inspection of welding – die penetrant test and ultrasonic test.	40
Revision + Test	10
Total	75

Suggested List of Students Activity:

- Observe the welding machine in the institute and study its specifications. List the possibility of different method of weld joints that can be used.
- Study the type of current used in the welding machine and draw the circuit diagram.
- Study the types of electrode used and its industrial applications.

1020235544	ADVANCED WELDING TECHNOLOGIES	L	T	P	C
PRACTICUM		1	0	4	3

Text and Reference Books:

1. Advance Welding Technology by S.A. Rizvi , S.K. Kataria & Sons. 4th, reprint 2019.
2. Welding Engineering and Technology by R.S. PARMAR, IIT, Delhi, Kanna Publishers, 1999.
3. Welding principles and practices by Edward R. Bohnart, Mc. Graw Hill Education, 2014.

WEB REFERENCE

- https://archive.nptel.ac.in/courses/112/103/112103263/#
- https://archive.nptel.ac.in/courses/112/103/112103244/
- https://archive.nptel.ac.in/courses/112/107/112107089/
- https://youtube.com/playlist?list=PLwdnzlV3ogoW9g44SFbiiCjyMOMPnNBL8&feature=shared

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	Joint Preparation	20
B	Procedure	20
C	Weld bead	10
D	Finish	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.

1020235545	INDUSTRIAL ROBOTICS	L	T	P	C
PRACTICUM		1	0	4	3

Introduction

It has been realized that rapid industrialization and globalization needs industries to be more competitive and deliver cost effective quality products. This needs industries to implement flexible manufacturing systems where Robotic technology plays a major role. Hence study of robotic technology is very essential, To acquire knowledge about the hydraulic and pneumatic systems and its functions of the components. Understand the control methods of automation.

Course Objectives

The objective of this course is to prepare the student,

- To understand the basics of robot components and process automation.
- To execute the Robot programming using simulation software.
- To execute the Robot programming and Execute.
- To perform the basics of robotics and simulation of software fixtures for material handling and industrial applications.
- To execute program for various applications in manufacturing by using robot programming and industrial safety systems.
- To learn about the software and hardware systems for industrial Robotics

Course Outcomes

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

CO1: Describe the components of Robot and its joints & links in Robot configuration,

CO2: Classify the robot controller Drives and grippers,

CO3: Explain industrial applications of robot in Manufacturing environment

CO4: Generate robot program for material handling applications

CO5: Execute / Simulate programs for various applications in manufacturing by using robot programming.

1020235545	INDUSTRIAL ROBOTICS	L	T	P	C
PRACTICUM		1	0	4	3

Pre-requisites

Knowledge of Basic Robot Engineering, Robot software, Robot programming .

CO/PO Mapping

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

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

Instructional Strategy

Active Learning: Activities for active learning can include think-pair-share strategies as well askin-esthetic learning environment. Teachers can start a discussion to make sure students take ownership over their own participation and talk through new ideas and skills with peers. Teachers guide students as they construct their own knowledge and understanding.

Hands-on-Training: Conduct demonstrations and hands on training is all about applying the knowledge you have learned in training into practice.

Real time Learning: Instructors encourage the students to implement the techniques in their own place / Lab through the Industry-Institute interactions.

1020235545	**INDUSTRIAL 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 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 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 experiment.

This documentation can be carried out in a separate notebook / printed manual / file. The Steps, Procedure, Sketch and 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 logbook and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Step / Procedure	10
B	Write Program	20
C	Edit Program / Simulate / Execution	20
TOTAL		50
D	Practical Documents (As per the portions)	10
		60

Cycle - I **Exercise 1, 2, 3, 4 and 5.**

Cycle - II **Exercise 6, 7, 8, 9, 10 and 11.**

- **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.

1020235545	INDUSTRIAL ROBOTICS	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 - Practical Exam

PART	DESCRIPTION	MARKS
A	Step / Procedure	10
B	Write Program	20
C	Edit Program / Simulate / Execution	20
D	Result / Finish / Accuracy	10
E	Written Test	30
F	Viva Voce	10
	TOTAL	100

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

1020235545	INDUSTRIAL ROBOTICS	L	T	P	C
PRACTICUM		1	0	4	3

Syllabus contents

THEORY	
Introduction – Definitions of Robot -Robot Anatomy – Basic configuration of Robotics – Robot Components – Manipulator, End effecter, Driving system, Controller and Sensors. Mechanical arm – Degrees of freedom – Links and joints – Types of joints – Joint notation scheme – Pitch, Yaw, Roll – Classification of robots – Work envelope, Work Volume. Robot controller – Configuration - Four types of controls – Open loop and closed loop controls – Speed of response and stability – Precision of movements: Spatial resolutions, accuracy and repeatability. Pneumatic drives – Hydraulic drives – Mechanical drives – Electrical drives –Stepper motors, DC Servo motors and AC Servo motors – Salient features – Applications and Comparisons of Drives. End effecters –Grippers – Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Two fingered and Three fingered Grippers, Internal and External Grippers, – End Of Arm Tooling (EOAT)- Selection and Design considerations Robot applications – Material handling – Press loading and unloading –Die casting – Machine tool loading and unloading – Spot welding – Arc welding – Spray painting – Assembling – Finishing – Automatic Guided Vehicle – Adopting robots to workstations – Requisite robot characteristics and Non requisite robot characteristics – Stages in selecting robots for industrial applications – Safety considerations for robot operations – Robotics in the future and characteristics task–Economical analysis of robots – Social implications.	15
Practice Study of Robot system, Study and practice in the robot simulation software .	6

1020235545	INDUSTRIAL ROBOTICS	L	T	P	C
PRACTICUM		1	0	4	3

Practical Exercise

Ex.No	Name of the Experiment	
1.	Programming using Position recording using Cartesian co-ordinate system - (No. of positions – 9).	4
2.	Programming using Position recording using Polar co-ordinate system - (No. of positions - 9).	4
3.	Programming using Loops and sub – routine.	4
4.	Pick and place of objects (No. of objects to be specified- 6).	4
5.	Pick and stack of objects (No. of objects to be specified- 6).	4
6.	Arc welding practice(Length. of weld to be specified).	4
7.	Programming using Spot welding practice - (No. of spots Minimum 3).	4
8.	Assembling practice (Simple assembling).	4
9.	Profile cutting practice (combination of lines and arcs).	4
10.	Programming for Spray painting practice - (Area - 300mm x 300mm).	4
11.	Programming using Machine loading and unloading practice with time delay.	4
Revision + Assessment		10
Total		75

Textbook:

1. Mikell P Groover, Mitchell Weiss, Roger N Nagel, Nicholas Odrey, and Ashish Dutta, Industrial Robotics – Technology, Programming and Applications, 2nd Edition, McGraw Hill, 2013.
2. Appuu Kuttan, Robotics, I.K. International Publishing House Pvt. Limited, 2013
3. Ganesh S. Hegde, A Textbook of Industrial Robotics, Second Edition, Laxmi Publications (P) Ltd., 2015
4. Nagarajan Ramachandran, Introduction to Industrial Robotics, Pearson India Education Services Pvt. Ltd., 2016

1020235545	INDUSTRIAL ROBOTICS	L	T	P	C
PRACTICUM		1	0	4	3

Website links for reference:

- https://www.youtube.com/playlist?list=PLyqSpQzTE6M_XM9cvjLLO_Azt1FkgPhpH
- https://www.youtube.com/playlist?list=PLFW6lRTa1g81AGUOky_xVhNVsudGwZxsY

LIST OF EQUIPMENTS

1. Robot simulation software or Robotic arm
2. Computer - 30 Nos.

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	Step / Procedure	10
B	Write Program	20
C	Edit Program / Simulate / Execution	20
D	Result / Finish / Accuracy	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.

1025235546	JIGS, FIXTURES AND PRESS TOOL DESIGN	L	T	P	C
PRACTICUM		1	0	4	3

INTRODUCTION

Jigs, fixtures and press tool design lab aims at designing a jig or a fixture or a suitable die set that is required when the job to be produced is repetitive in nature. It aims at reducing the various non productive cost such as locating and clamping The lab also aims to provide an insight to decide on make or buy decision for a particular product. The basic necessity of a tool designer is to produce drawings of a tool or a set of tool to produce workpiece in an efficient and cost effective method.

COURSE OBJECTIVE

- Students will be able to understand the purpose of using jigs and fixtures
- Students will be able to understand the various types of jigs and fixtures. Students will be able to differentiate between the jigs and fixtures.
- Students will be able to understand the importance of strip layout design while using sheet metals.
- Students will be able to understand the various operations that are done using sheet metals and various application of sheet metals
- Students will be able to understand the importance and procedure associated with die design.

COURSE OUTCOMES

CO1: Student should be able to recognize the importance of principles of clamping and locating and the manufacturing and cost advantages that are associated with it.

CO2: Student should be able to design and draw a suitable jig/fixture for a given component

CO3: Student should be able to design and draw a suitable progressive or compound die for a given component.

CO4: Student should be able to design and draw a suitable bending die / drawing die for a given component.

CO5: Student should be able to select a suitable material to design the tool/jig/fixture/various components of die set that serves the purpose.

1025235546	JIGS, FIXTURES AND PRESS TOOL DESIGN	L	T	P	C
PRACTICUM		1	0	4	3

Pre-requisites

Basic knowledge of manufacturing process, cutting tools, engineering drawing and basic mathematical knowledge .

CO/PO Mapping

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

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

Instructional Strategy

- To introduce the theory concept prior to each exercise.
- Whenever required suitable animation may be shown to clearly demonstrate the construction and working of various jigs, fixtures and press tools.
- The aim of the exercise done on that day can be clearly explained.
- Various calculations associated with the design shall be explained before commencement of drawing.
- The drawing shall be drawn using black board and the students may follow.
- The application of the component / equipment designed shall be provided.
- Provide constructive feedback on students' performance and suggest ways to improve, if required.

1025235546	JIGS, FIXTURES AND PRESS TOOL 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 Exercises	Cycle II Exercises	All Units	All Exercises	All Exercises
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
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- Exams should be conducted using drawing sheets. **Use of standard design data book is permitted for all exams.**
- **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 exercise / 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.

1025235546	JIGS, FIXTURES AND PRESS TOOL DESIGN	L	T	P	C
PRACTICUM		1	0	4	3

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 a printed manual or a file with documents. The observations, readings, calculations and sketches should be written by the student manually in the document.

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.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim	5
B	Calculation	15
C	Drawing	30
D	Practical Documents (As per the portions)	10
TOTAL MARKS		60

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

Cycle II: Exercises 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.

1025235546	JIGS, FIXTURES AND PRESS TOOL DESIGN	L	T	P	C
PRACTICUM		1	0	4	3

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ from the complete theory portions.	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**

- **CA4:** 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	5
B	Calculation	15
C	Drawing	40
D	Viva voce	10
E	Written test	30
TOTAL MARKS		**100**

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

SYLLABUS CONTENTS

THEORY		
Unit I	**DESIGN OF JIGS AND FIXTURES**	**Hours**

1025235546	JIGS, FIXTURES AND PRESS TOOL DESIGN	L	T	P	C
PRACTICUM		1	0	4	3

1.1	JIGS: Principle of location and clamping - Definition of jig - types of bushes- components of jigs - types of jigs- plate jig, indexing jig and leaf jig.	4
1.2	FIXTURES: Definition of fixture - difference between jig and fixture - components of fixture - types of fixture - turning and milling fixtures	4
PRACTICAL EXERCISES		
Ex.No	**NAME OF THE EXERCISE / EXPERIMENT**	**HOURS**
1.	Design and draft a plate jig to drill holes in any suitable component	4
2.	Design and draft a leaf jig to drill holes in any suitable component	4
3.	Design and draft an indexing jig to drill holes in the given component	4
4.	Design and draft a milling fixture to machine any given component	4
5.	Design and draft a turning fixture to machine any given component	4
Unit II	**BLANKING, BENDING AND DRAWING DIE**	
2.1	BLANKING DIE: Introduction to sheet metal cutting operations - die and punch clearance - types of die construction - progressive, compound and combination die - components required for designing a blanking die - design procedure - Strip layout	4
2.2	DRAWING DIE: Introduction to sheet metal drawing die - shallow and deep drawing - number of draws required -determining blank size - drawing force required - drawing die design procedure	4
2.3	BENDING DIE: Introduction to bending dies - bending methods - spring back -bend allowance - bending pressure - design procedure	4
PRACTICAL EXERCISES		
Ex.No	**NAME OF THE EXERCISE / EXPERIMENT**	**HOURS**
6.	From a mild steel sheet of 3 mm thick, 50 mm wide and 2 m long.	4

	Determine (i) strip layout (ii) number of parts that can be punched from the strip (iii)Percentage of stock used. Component may be chosen accordingly.	
7.	Design and draft a progressive die to make washer having 15 mm internal hole and 30 mm outside diameter which is to be made from 1.5 mm thick strip of C20 steel.	4
8.	Design and draft a compound die to make washer having 20 mm internal hole and 50 mm outside diameter which is to be made from 1.5 mm thick strip of C20 steel.	4
9.	Design and draft a drawing die to make a cup having 50 mm diameter and 75 mm deep is to be drawn from 2mm thick drawing steel with a tensile strength of 300 N/mm^2	4
10.	Design and draft the assembled view of bending (edge bending or v bending) die for a given component.	4
	Students Activity + Continuous Assessment	15
	TOTAL HOURS	**75**

List of student activity to be performed

Students may identify the various sheet metal operations that are carried out in various parts of automobiles and submit a report.

REFERENCES

1. Cyril Donaldson, George H Lecain VC Goold, Joyjeet Ghose., "Tool Design", McGraw-Hill Education (India) pvt ltd, 4th Edition.
2. P. H. Joshi – 'Jigs and Fixtures Design Manual' – McGraw Hill – 2002
3. J.R.Paquin and R.E.Crowley – 'Die Design Fundamentals' – Industrial Press, New York – 1979
4. E. K. Henriksen – 'Jig and Fixture Design Manual' – Industrial Press, New York – 1973
5. G.R.Nagpal, "Tool Engineering and Design", Khanna publishers January 2000

WEBSITES

4. https://www.themachinedesign.com/sheet-metal-operations-definition

1025235546	JIGS, FIXTURES AND PRESS TOOL DESIGN	L	T	P	C
PRACTICUM		1	0	4	3

5. https://fractory.com/sheet-metal-bending/

6. https://archive.nptel.ac.in/courses/112/105/112105127/

LIST OF EQUIPMENTS

1. Drawing boards / Suitable drawing tables of sufficient quantity.

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
A	Aim	5
B	Calculation	15
C	Drawing	40
D	Viva voce	10
E	Written test	30
TOTAL MARKS		**100**

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

1020235547	AUTOMOBILE TECHNOLOGY	L	T	P	C
PRACTICUM		1	0	4	3

Introduction:

Automobiles are one of the key areas of development in India facilitated by Multinational Companies. As automobiles are the Major sources of employing manpower a thorough knowledge on Automobile Engine construction and its functioning is required with due consideration on pollution control.

Course Objectives:

- Explain about the constructional details of an Automobile engine including cooling and lubrication system.
- Describe fuel feed systems for petrol and diesel engines with all devices involved in it.
- Explain the construction and functional features of the power transmission systems and various parts involved in it.
- Explain the functions of different types of steering, suspension and brake systems.
- Describe the different types of chassis and their functions.
- Familiarize electrical and electronic equipment used in automobiles.
- To understand the emerging trends of electric vehicles, hybrid electric vehicles and solar vehicles.
- To know the automobile emissions and its effects on the environment.

Course Outcomes

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

CO1: Explain the principles of cooling and lubrication systems for an IC engine

CO2: Describe fuel feed systems for petrol and diesel engines with all its components.

CO3:Illustrate the types of steering, suspension and brake systems based on the functions

CO4: Classify the types of Automobile Chassis and its sub systems based on their applications.

CO5: Explore the various Electrical Equipments used in an automobile system

Pre-requisites:

Basic knowledge about internal combustion engines.

1020235547	AUTOMOBILE TECHNOLOGY	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
CO2	3	-	-	3	-	-	1
CO3	3	-	-	3	-	-	0
CO4	3	-	-	3	-	-	1
CO5	3			3	-	-	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 ina simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

1020235547	**AUTOMOBILE TECHNOLOGY**	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 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 experiment.

This documentation can be carried out in a separate notebook / printed manual / file. The Steps, Procedure, Sketch and 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 logbook and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Procedure / Sketch / Setting / Tool Handling	20
B	Alignment test / Dismantling / Assembling	20
C	Troubles / Report / Test Chart	10
TOTAL		50
D	Practical Documents (As per the portions)	10
		60

Cycle - I Exercise 1, 2, 3, 4, 5 and 6.

Cycle - II Exercise 7, 8, 9, 10, 11 and 12.

- **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.

1020235547	AUTOMOBILE TECHNOLOGY	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 - Practical Exam

PART	DESCRIPTION	MARKS
A	Aim & Tools required	10
B	Procedure / Sketch / Setting / Tool Handling	20
C	Alignment test / Dismantling / Assembling	20
D	Troubles / Report / Test Chart	10
E	Written Test	30
F	Viva Voce	10
	TOTAL	100

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

1020235547	AUTOMOBILE TECHNOLOGY	L	T	P	C
PRACTICUM		1	0	4	3

Syllabus Contents

Theory Portion - Unit I	
Automobile Engines Basic Engine Components and its functions, Cooling systems – purpose – types. Lubrication systems – purpose.	2
Practical Exercises **Exercise 1:** Dismantling and assembling a four stroke petrol engine andidentification of parts. **Exercise 2:** Removing camshaft, replacing timing gears, removing valves, lapping and adjusting valve clearance.	8
Theory Portion - Unit II	
Types of fuel feed systems- S.U. Electrical fuel pump - petrol injection. Layout of diesel and petrol fuel feed system CRDI system - fuel injectors	2
Practical Exercises **Exercise 3:** Removing, servicing and replacing of fuel pump, oil pump & waterpump. **Exercise 4:** Removing, servicing & replacing MPFI system. **Exercise 5:** Dismantling and assembling of inline fuel injection pump / CRDIsystem.	12
Theory Portion - Unit III	
Transmission And Power Trains General arrangement of power transmission system -clutch – function – Components – Types - Single plate and multi plate –Clutch troubles and their causes. Gear box – purpose–constant mesh andsynchromesh-gear box troubles and their causes. Drive line – propeller shaft –Universal joint – . Differential – purpose – Construction and operation	4
Practical Exercises **Exercise 6:** Removing and replacing of pressure plate and clutch plate, fingers adjustment	8

1020235547	AUTOMOBILE TECHNOLOGY	L	T	P	C
PRACTICUM		1	0	4	3

Exercise 7: Dismantling, inspecting and assembling of constant mesh gear box and find out the gear ratios.	
Theory Portion - Unit IV	
Automobile Chassis Front axle – Types– Steering gears. Suspension system – Functions – Type of springs Brake system – functions – ABS.	3
Practical Exercises **Exercise 8:** Dismantling, assembling and adjusting of steering gear box.	4
Theory Portion - Unit V	
Electrical Equipment & Hybrid Electric Vehicles Battery – lead acid battery – Nickel alkaline battery – construction and operation of starter motor. Ignition system – Types – High tension magneto – electronic ignition – Ignition system troubles and remedies. Lighting system - Horn circuits – Wind screen wiper.	4
Practical Exercises **Exercise 9:** Test a battery with specific gravity test and charge the battery with constant amperage / voltage method. **Exercise 10:** Dismantling, overhauling and assembling of starter motor / alternator **Exercise 11:** Trace the automobile electrical system with respect to battery coil ignition system **Exercise 12:** Trace the automobile electrical system with respect to (i) horn relay circuit, (ii) Wiper circuit & explain with neat circuit diagram	16
Assessment Test + Revision	12
Total	75

TEXT BOOKS & REFERENCES

1. A Textbook of Automobile Engineering by R.K.Rajput, Second Edition 2016, Laxmi Publications.
2. Automotive Mechanics, William H.crouse and Donald .L. Anglin, Tata McGraw– Hill Publishing CompanyLtd, NewDelhi.
3. Automotive Mechanics, Joseph Heitner, East–west Press (P) Ltd, NewDelhi.

1020235547	AUTOMOBILE TECHNOLOGY	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 & Tools required	10
B	Procedure / Sketch / Setting / Tool Handling	20
C	Alignment Test / Dismantling / Assembling	20
D	Troubles / Report / Test Chart	10
E	Written Test	30
F	Viva Voce	10
	TOTAL	100

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

Equipment / Facilities required to conduct the Practical Course.

1. Automobile Mechanic's tools-Complete Set
2. Internal circlip plier, bearing puller
3. Feeler gauge to check valve clearance, hammer and accessories
4. Compressor to supply high pressure air to clean oil and water filters.
5. 4 stroke petrol engine - with all accessories
6. 4 stroke Diesel engine - with all accessories
7. Engine cylinder with liner and cylinder bore dial gauge
8. Oil pump and water pump.
9. MPFI and CRDI kit
10. Inline Fuel Injection Pump and Injectors
11. Clutch set arrangement with tools
12. Complete gear box with tools
13. Complete steering arrangement
14. Battery and charging set up.
15. Measuring instruments
16. Consumables - Sufficient quantity.

1020235654	INNOVATION & STARTUP	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.

1020235654	INNOVATION & STARTUP	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

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

1020235654	**INNOVATION & STARTUP**	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**

1020235654	**INNOVATION & STARTUP**	L	T	P	C
PRACTICUM		1	0	2	2

Syllabus Contents

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.		9

1020235654	**INNOVATION & STARTUP**	L	T	P	C
PRACTICUM		1	0	2	2

4. Business Model Innovation. 5. Organizational Culture and Change Management. 6. Leadership and Innovation. 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 Nameof 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**

1020235654	**INNOVATION & STARTUP**	L	T	P	C
PRACTICUM		1	0	2	2

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.

Detailed Allocation of Marks

S. No	Description	Marks
Part A i) ii)	Written Examination – Unit –I,II & IIITheory Questions 10 questions out of 15 questions (10 x 3 marks = 30 marks) 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**

1025235773	**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.
- Supervision and Mentorship: Industry professionals guide and mentor students throughout the training.

1025235773	INDUSTRIAL TRAINING	Summer Vacation	C
Internship			2

- Skill Development Workshops: Sessions on technical skills, software tools, and industrybest practices.
- Assessment and Feedback: Performance evaluations and constructive feedback to help students improve.

Benefits for Students

- Enhanced Employability: Practical experience makes students more attractive topotential 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:
    - Conduct orientation sessions to familiarize students with the objectives, expectations, and guidelines of the industrial training program.

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Internship			2

- 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.

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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.

1025235773	**INDUSTRIAL TRAINING**	Summer Vacation	C
Internship			2

Attendance Certification

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.

1025235773	**INDUSTRIAL TRAINING**	Summer Vacation	C
Internship			2

Scheme of Evaluation

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

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	**EIGEN VALUES AND EIGEN VECTORS**	
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

6000236111	ADVANCED ENGINEERING MATHEMATICS	L	T	P	C
THEORY		3	0	0	3

Unit IV	DIFFERENTIAL EQUATIONS	
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 $\left(aD^2 + bD + c\right)y = e^{nx}$ where a, b, c and n are constants and the auxiliary equation $am^2 + bm + c = 0$ 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 ofthree-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.

6000236111	ADVANCED ENGINEERING MATHEMATICS	L	T	P	C
THEORY		3	0	0	3

Reference Books:

1. John Bird, Higher Engineering Mathematics, Routledge, 9th Edition, 2021.
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.
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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 activitiesin 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 kept

6000236112	ENTREPRENEURSHIP	L	T	P	C
THEORY		3	0	0	3

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.

6000236112	ENTREPRENEURSHIP	L	T	P	C
THEORY		3	0	0	3

4. Part of entrepreneurship clubs or organizations provides networking opportunities, mentorship, and exposure to real-world challenges.
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.

6000236113	PROJECT MANAGEMENT	L	T	P	C
THEORY		3	0	0	3

Course Outcomes

CO 1: Explain the principles of Project ManagementCO

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 curiosityto 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		7

6000236113	PROJECT MANAGEMENT	L	T	P	C
THEORY		3	0	0	3

breakdown structure – Responsibility Matrices – External causes of delay and internal constraints.		
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

6000236113	PROJECT MANAGEMENT	L	T	P	C
THEORY		3	0	0	3

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.	
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.

6000236113	PROJECT MANAGEMENT	L	T	P	C
THEORY		3	0	0	3

Group Project:

- Activity: Work in teams to manage a project from initiation to closure, simulating a real project environment.
- 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 goalsCO2:

Explain the procedure for Business Funding

CO3: Exhibit financial literacy through the usage of different terminologies appropriateto 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

6000236114	FINANCE FUNDAMENTALS	L	T	P	C
THEORY		3	0	0	3

CO/PO Mapping

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 activitiesin 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 –		7

6000236114	FINANCE FUNDAMENTALS	L	T	P	C
THEORY		3	0	0	3

Shareholders fund: Equity Share capital, Preference Share Capital, Reserve & 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 onasset 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.

1020236115	INDUSTRY 4.0	L	T	P	C
THEORY		3	0	0	3

Introduction

Industry 4.0, also known as the Fourth Industrial Revolution, represents the current trend of automation and data exchange in manufacturing technologies. It integrates advanced technologies such as artificial intelligence (AI), the Internet of Things (IoT), cloud computing, and big data analytics to create "smart factories" that are highly efficient and adaptive.

Industry 4.0 is transforming the manufacturing landscape by leveraging advanced technologiesto create more efficient, flexible, and intelligent production processes. For diploma engineering students, understanding these concepts is crucial as they will play a key role in the future of engineering and manufacturing. Learning Industry 4.0 will not only enhance your technical skills but also prepare you for the evolving job market in the digital age.

Course Objectives

The objective of this course is to prepare the student,

- To understand the basics of Technology of Industry 4.0 and IoT
- To learn about the Artificial Intelligence and Application Domains
- To study Robotic Process Automation and programming.
- To understand the Augmented & Virtual Reality and its applications
- To learn and evolution of IoT, Sensors, and Actuators

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 ThingsCO2:
Explain the Artificial Intelligence (AI) and Future Prospects of AI.

CO3: Explain Robotic Process Automation (RPA) for Manufacturing Industry

CO4: Describe Augmented & Virtual Reality and its Applications.

CO5: Explain the applications of IoT, Sensors, and Actuators in industries

Pre-requisites

Basic Knowledge of Industry 4.0 and its applications

1020236115	**INDUSTRY 4.0**	L	T	P	C
THEORY		3	0	0	3

CO/PO Mapping

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

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

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	

1020236115	**INDUSTRY 4.0**	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.

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.

1020236115	**INDUSTRY 4.0**	L	T	P	C
THEORY		3	0	0	3

Syllabus Contents

Unit I:	**Introduction to Industry 4.0**	
Need – Reason for Adopting Industry 4.0 - Definition – Goals and Design Principles - Technologies of Industry 4.0 – Big Data – Artificial Intelligence (AI) –Industrial Internet of Things - Cyber Security – Cloud – Augmented Reality.		7
Unit II:	**Artificial Intelligence**	
Artificial Intelligence: Artificial Intelligence (AI) – What & Why? - History of AI - Foundations of AI -The AI - Environment - Societal Influences of AI - Application Domains and Tools - Associated Technologies of AI - Future Prospects of AI - Challenges of AI.		7
Unit III:	**Robotic Process Automation (RPA)**	
Robotic Process Automation (RPA): Introduction to RPA – Need for automation – Programming constructs in RPA – Robots and Softbots – RPA architecture and process methodologies - Industries best suited for RPA - Risks & Challenges with RPA.		7
Unit IV:	**Augmented & Virtual Reality**	
Augmented Reality: Definition - Tools for Augmented Reality – Hololens - Advantages and Challenges of AR - Applications of AR in Education, Industries - Mixed Reality. Virtual Reality: Definition – Types of Head Mounted Displays – Tools for Virtual Reality – Applications of VR in Education, Industries - Difference between VR and AR.		7

1020236115	**INDUSTRY 4.0**	L	T	P	C
THEORY		3	0	0	3

Unit V:	**IoT, Sensors and Actuators**
Evolution of IoT – Definition & Characteristics of IoT - Architecture of IoT – Technologies for IoT – Developing IoT Applications – Applications of IoT – Industrial IoT – Security in IoT Analog and Digital Sensors – Interfacing temperature sensor, ultrasound sensor and infrared (IR) sensor with Arduino – Interfacing LED and Buzzer with Arduino.	7
Assessment Test and Revision with Student activity	10
Total	45

Textbook:

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

Website links for reference:

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

1020236115	**INDUSTRY 4.0**	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.

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 Industry 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 institutionor 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).

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 application inAM.		6
Unit III	**Extrusion and Sheet metal based Processes**	
Fused Deposition Modeling (FDM) – construction, working principle, advantages – process parameters involved - Laminated Object Manufacturing (LOM) –		6

1020236116	ADDITIVE MANUFACTURING	L	T	P	C
THEORY		3	0	0	3

construction, working principle, advantages - gluing and adhesive bonding - PolyJet - construction, working principle, advantages.		
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.
- Massive open online courses (MOOCs) may be used to teach various topics/subtopics.

1020236116	ADDITIVE MANUFACTURING	L	T	P	C
THEORY		3	0	0	3

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 toolbox 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**

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.

1020236117	POWER PLANT ENGINEERING	L	T	P	C
THEORY		3	0	0	3

Introduction

Electrical power is the main resource for any type of industry. Economic growth of the nation essentially results in growth in the power sector. Various conventional power plants such as Hydro, Gas, Thermal, Diesel and Nuclear power plants are employed for power generation. Most of the power plants use Mechanical Engineering equipment and components. Hence, this course attempts to provide the basic knowledge of the components, operation and maintenance of power plants to the students and would also acquaint them with the latest technological advances taking place in this sector.

Course Objectives

The objective of this course is to enable the student to apply knowledge of mechanical engineering related to power generation systems, their control and economics in different types of power plants for their operation and maintenance.

Course Outcomes

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

CO1: Analyze economics of power plants and list factors affecting the power plants andinterpret the performance of power plants based on load variations

CO2: Identify elements and their functions and operation of thermal power plants.

CO3: Identify elements and their functions of hydro, Solar and wind power plant.

CO4: Identify elements and their functions and operations of nuclear power plants

CO5: Identify elements and their functions and operations of diesel and gas turbine power plants

Pre-requisites

Knowledge of Mathematics, Thermal Engineering, Mechanics of machines, Workshop technology, Fluid mechanics and fluid power.

1020236117	POWER PLANT ENGINEERING	L	T	P	C
THEORY		3	0	0	3

CO/PO Mapping

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

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

Instructional Strategy

1. The instructional strategy for teaching Powerplant Engineering in polytechnic colleges emphasizes practical application and industry relevance.
2. 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.
3. About 15 – 20% of the topics/ sub-topics which are relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the Cos through classroom presentations.
4. Before starting practical, the teacher should demonstrate the working of a power plant.
5. Show video/ animation films to explain the functioning of various power plants.

1020236117	POWER PLANT ENGINEERING	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.

Syllabus Contents

Unit I	**INTRODUCTION & ECONOMICS OF POWER PLANT**	
Power plant-Introduction, Classification - Location of power plant- Choice of Power plant-Terminology used in power plant: Peak load, Base load, Load factor, Load curve, demand factor- Various factor affecting the operation of power plant- Load sharing-cost of power tariff methods-factors involved in fixing of a tariff.		7
UNIT II	**THERMAL POWER PLANT**	
Thermal power plant -General layout – working-Site Selection– materials required for thermal power plant - High Pressure Boilers and classification - coal handling and its methods, stages in coal storage- Fuel burning-Stoker firing-overfeed stoker –underfeed stokers-chain grate stoker, Pulverized fuel handling system- Pulverization of coal-Ash handling system- Gravity system- electrostatic precipitation (ESP) system-Advantages and disadvantages-limitations of Thermal power plant.		7

1020236117	POWER PLANT ENGINEERING	L	T	P	C
THEORY		3	0	0	3

UNIT III	POWER FROM RENEWABLE ENERGY	
Hydroelectric power plant- Introduction, storage and poundage, Selection of sites for hydroelectric power plant-General layout and essential elements of Hydroelectric power plant and its working- Advantages and limitations of hydroelectric power plant. Solar power plant-Introduction-layout, Solar cell fundamentals & classification – maximum power point tracker (MPPT) and solar panel. Wind power plant: Introduction, -Factors affecting distribution of Wind energy, Variation of wind speed with height and time-Horizontal axis wind turbine (HAWT)-types of rotors-Vertical axis wind turbine- types of rotors- advantages and limitations of Wind power plant.		7
UNIT IV	**NUCLEAR POWER PLANT**	
Nuclear power plant-introduction-nuclear fuels, nuclear fission and fusion, workingof a nuclear power plant, types of reactors- pressurized water reactor- boiling water reactor- CANDU type reactor – fast breeder reactor - effect of nuclear radiation-different methods for nuclear waste disposal-low, medium and high-level waste disposal, Advantages -disadvantages- limitations- Safety measures for Nuclear Power plants.		7
UNIT V	**DIESEL POWER PLANT AND GAS TURBINE POWER PLANT**	
Diesel power plant- layout -Components and the working- Advantages -disadvantages- limitations. Gas turbine power plant- Schematic diagram & working of open and closed cycle gas turbine power plant, Components of Gas turbine– compressor, combustion chamber, gas turbine, vortex blading, gas turbine fuels, Gas turbine power plants in India- Advantages -disadvantages- limitations ofGas turbine power plant.		7
	Revision + Test	10
	Total	45

1020236117	POWER PLANT ENGINEERING	L	T	P	C
THEORY		3	0	0	3

Suggested list of Students Activity,

Other than 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. Students are advised to visit a nearby power plant to understand more about the subject and prepare a report consisting of
    a) Various advanced systems
    b) Various Standards
    c) Maintenance of components of power plant observed
2. Prepare/ Download the specifications of followings:
    a) Steam Power plant equipment and elements
    b) Gas turbine Power plant equipment and elements
    c) Hydro Power plant equipment and elements
    d) Diesel Power plant equipment and elements

Reference Books:

1. Power plant engineering, G. R. Nagpal, Khanna publishers.
2. Power plant engineering, Arora and Domkundwar, Dhanpat rai & CO (P) LTD.
3. Power Plant Engineering, Dr. P. C. Sharma, S. K. Kataria & Sons Publications.
4. Power plant engineering, P. K. Nag, McGraw Hill India.
5. A Text Book of Power Plant Engineering, R K Rajput, Laxmi Publications.

Web reference

- https://www.youtube.com/playlist?list=PLLy_2iUCG87BT8H9uMufjrcPF5e6Qd2bz
- https://www.youtube.com/watch?v=3dJAtHaSQ98
- https://www.youtube.com/watch?v=kbuLfXgw4Gs
- https://www.youtube.com/watch?v=68-o35vWTAc
- https://www.youtube.com/watch?v=vrp0ptd03mg

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.

1020236241	MEP EQUIPMENT SERVICING	L	T	P	C
PRACTICUM		1	0	4	3

Introduction:

MEP Equipment servicing is required in a large number of commercial and industrial applications. This content would be useful in identifying the defects and servicing of MEP equipments. The knowledge and skill of various equipments of HVAC systems, electrical systems and plumbing systems will be very useful in maintaining MEP systems in commercial buildings

Course Objectives:

- To know the types of equipment's in HVAC systems.
- To know the functions of HVAC systems, electrical systems and plumbing systems.
- Practice with servicing of HVAC equipment in the industry.
- Describe the procedure for maintaining of MEP equipment.
- Practicing and servicing of electrical and plumbing equipment.

Course Outcomes

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

1 : Describe the working of HVAC equipment in the industry.

CO 2 : Explain the function of electrical equipments and their periodic maintenance.CO

3 : Describe the functions of plumbing systems and their service procedure

CO 4 : Demonstrate the skills in identifying and rectifying the defects in MEP equipments.

CO 5 : Explain the service procedure for MEP equipments in the industry.

Pre-requisites:

Thermodynamics, fundamentals of refrigeration and air-conditioning, functions of HVAC components

1020236241	MEP EQUIPMENT SERVICING	L	T	P	C
PRACTICUM		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1			3			
CO2	1			3			
CO3	1			3			
CO4	1			3			
CO5	1			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 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 ina simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

1020236241	MEP EQUIPMENT SERVICING	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
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 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 experiment.

This documentation can be carried out in a separate notebook or a printed manual or a file with documents. The Procedure, Sketch and Result / Output should be written by the student manually in the documents.

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.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Tools required	10
B	Procedure / Sketch / Setting / Tool Handling	20
C	Adjustment / Dismantling / Assembling	20
TOTAL		50
D	Practical Documents (As per the portions)	10
		60

Cycle - I - Exercise 1, 2, 3,4 and 5.

Cycle - II - Exercise 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.

1020236241	MEP EQUIPMENT SERVICING	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 & Tools required	10
B	Procedure / Sketch / Setting / Tool Handling	20
C	Adjustment / Dismantling / Assembling	20
D	Troubles / Report	10
E	Written test (MCQ)	30
F	Viva Voce	10
TOTAL		100

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

1020236241	MEP EQUIPMENT SERVICING	L	T	P	C
PRACTICUM		1	0	4	3

Syllabus Contents

Theory Portion - Unit – I	
Basic concept of thermodynamics – heat – temperature – pressure. Introduction of central plant air conditioning – DX system – Chilled water system – Air handling unit – fan coil unit – chilled water pump - water cooled chiller – air cooled chiller – cooling tower – construction and working – Maintenance schedule – servicing procedure	9
Practical Exercises	
Exercise 1: Water heater a. Drain your tank and remove sediment. b. Check your anode rod regularly, as it's an important part of the water heater. c. If you notice your water heater leaking, it may be caused by a loose drain valve. Tighten with a wrench until snug. d. Test the temperature release valve. e. Insulate its pipes and the heater.	5
Exercise 2: Water pump a. Dismantle and assemble a pump from the chilled water pipe line. b. Dismantle and assemble of pump casing c. Alignment of pump-motor shaft	
Exercise 3: Cooling Tower a. Check the fan motor assembly b. Align the fan motor assembly c. Check the float valve operation d. Check the water nozzles and replace if blocked.	5
Exercise 4: Plumbing pump a. Dismantling and assembly of pump casing b. Check and replace shaft seal c. Check and replace impeller	5

1020236241	MEP EQUIPMENT SERVICING	L	T	P	C
PRACTICUM		1	0	4	3

Exercise 5: Fire Fighting pumps a. Check automatic start by opening a test line to reduce system pressure b. Verify that relief valves operate properly c. Check the fuel tank level for diesel pump d. Check the oil and fuel filter in the diesel engine e. Check the battery	5

Theory Portion - Unit – II	
Electrical system – basics of electricity – electrical equipments – generator – transformer – water heater – working and construction – servicing and maintenance procedure Plumbing system – basics of fluid flow – hot and cold water – drainage system – water treatment plant – pumps – valves – strainer - servicing and maintenance procedure.	6
Practical Exercises	
Exercise 6: Cleaning AC Unit. a. Filter cleaning b. Cooling coil cleaning c. Blower cleaning d. Condenser coil cleaning e. Condenser fan cleaning	5
Exercise 7: Checking AC unit a. Checking refrigerant pressure b. Check the drier . c. Check the compressor. d. Check the temperature control. e. Check the supply air flow rate and temperature	5

1020236241	MEP EQUIPMENT SERVICING	L	T	P	C
PRACTICUM		1	0	4	3

Exercise 8: Transformer a. Check the transformer oil level and top up if required b. Clean the breather. c. Check the bushing filled with oil to check oil level d. Check the leakage of oil from any point e. Check the oil pump f. Check air fan	5
Exercise 9: Genset (Engine Generator) a. Test Batteries b. Check intake and exhaust c. Inspect wiring / electrical system	5
Exercise 10: Genset (Engine Generator) a. Check filters and replace if necessary b. Check oil and replace as recommended c. Check fuel filter and replace if blocked d. Check and replace spark plugs	5
Assessment Test and Revision	10
Total	75

Text and Reference Books:

1. ASHRAE Hand book Heating, Ventilating, and Air-Conditioning SYSTEMS AND EQUIPMENT
2. The Institute of Plumbing – Plumbing Engineering Services Design Guide
3. Principles of Electrical Engineering and Electronics by V.K Mehta and Rohit Mehta

Web References

- https://www.youtube.com/watch?v=PVGWHysJj78
- https://www.youtube.com/watch?v=yEzCvjQ2sNY
- https://www.youtube.com/watch?v=q-Oooe0G7_c
- https://www.youtube.com/watch?v=Ct1WnU-q9Qs
- https://www.youtube.com/watch?v=-5ccNAHF7I8

1020236241	MEP EQUIPMENT SERVICING	L	T	P	C
PRACTICUM		1	0	4	3

- https://www.youtube.com/watch?v=f0tKsDjWgT8
- https://www.youtube.com/watch?v=KTn2khCDqyw
- https://www.youtube.com/watch?v=8jxRn-T_LCs
- https://www.youtube.com/watch?v=cDnrpCX58bQ
- https://www.youtube.com/watch?v=_FyePOpQkNo
- https://www.youtube.com/watch?v=3Z7cEPQGX3E
- https://www.youtube.com/watch?v=ouKCbxuW4r4

Equipment / Facilities required to conduct the Practical Course.

MEP Equipment List

1. Generator
2. Fire pumps
3. Sump pumps
4. Water treatment plant
5. Plumbing pumps, valves and strainer
6. Exhaust fans
7. Dx AC units
8. PAC units
9. Air cooled chiller
10. Water cooled chiller
11. Chilled water pumps
12. Cooling tower
13. Condenser water pumps
14. Air separator

Based on the requirement the quantity should be kept.

1020236241	MEP EQUIPMENT SERVICING	L	T	P	C
PRACTICUM		1	0	4	3

END SEMESTER EXAMINATION - 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

Part	Description	Marks
A	Aim & Tools required	10
B	Procedure / Sketch / Setting / Tool Handling	20
C	Adjustment / Dismantling / Assembling	20
D	Troubles / Report	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.

1020236242	MAINTENANCE OF MACHINE TOOLS	L	T	P	C
PRACTICUM		1	0	4	3

Introduction:

Diploma technocrats who are in the field of maintenance of machine tools should have a thorough knowledge about the dismantling and assembly procedure, installation, maintenanceand repair of the machines and know about the technology used for the prediction of premature failure of components in advance.

Course Objectives:

- To know the instruments used for maintenance
- To know the advanced maintenance techniques of machine tools to increase the duration of life of the machines.
- To know the procedure for dismantling and assembly of equipment.
- To know the instruments used for machine tool testing.
- To know the different alignment techniques and accuracy of machine tools.

Course Outcomes

CO1: Setup instrument for machine tool maintenance.

CO2: Acquire knowledge of maintenance and troubleshooting of Machines and its components

CO3: Acquire knowledge for dismantling and assembly of equipment's

CO4: Setup instrument for machine tool testing

CO5. Acquire knowledge on machine tool alignment and the manufacturing accuracy of machine tools.

Pre-requisites:

Basic workshop practice, Workshop practices, Machine Tool Technology

1020236242	MAINTENANCE OF MACHINE TOOLS	L	T	P	C
PRACTICUM		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3			3			3
CO2	3	3		3		3	3
CO3	3	3		3		3	3
CO4	3			3			3
CO5	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 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 ina simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

1020236242	MAINTENANCE OF MACHINE TOOLS	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
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 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 experiment.

This documentation can be carried out in a separate notebook or a printed manual or a file with documents. The Procedure, Sketch and Report / Output should be written by the student manually in the documents.

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.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Dismantling / Procedure	20
B	Troubleshooting procedure/ Geometrical test	20
C	Assembling & Inspection Report / Test Chart	10
TOTAL		50
D	Practical Documents (As per the portions)	10
Total Marks		60

Cycle - I - Exercise 1, 2, 3,4 and 5.

Cycle - II - Exercise 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.

1020236242	MAINTENANCE OF MACHINE TOOLS	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 & Tools Required	10
B	Dismantling / Procedure	20
C	Troubleshooting procedure/ Geometrical test	20
D	Assembling & Inspection Report / Test Chart	10
E	Written Test (Theory Portion)	30
F	Viva Voce	10
TOTAL		100

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

1020236242	MAINTENANCE OF MACHINE TOOLS	L	T	P	C
PRACTICUM		1	0	4	3

Syllabus Contents

Theory Portion	
MAINTENANCE ACTIVITY OF MACHINE TOOLS: Maintenance: Objective-Definition –Types of maintenance-Advantages of good maintenance-Disadvantages of bad maintenance-Instruments needed for maintenance. Maintenance of Lathe: Lathe maintenance-Drive belts- Adjusting belt tension, Gib adjustment(cross slide, Compound slide),Wiper pads, Adjusting the Tailstock clamp. **TESTING OF MACHINE TOOLS** Measuring Equipment and Tools used for testing of machine tools: Dial gauges – test mandrels – straight edges - squares- spirit levels- level measurement by water level- alignment by wire and measuring microscope. DETAILS FOR TESTING VARIOUS MACHINE TOOLS: Machine tool testing purpose-Types of geometrical checks on machine tools-Various test conducted on machine tools-Alignment test on lathe, surface grinding and milling machine.	15
Practical Exercises	
Maintenance:	
Exercise 1: Lathe maintenance-Drive belts- Adjusting belt tension, Gib adjustment (cross slide, Compound slide), Wiper pads checking, Adjusting the Tailstock clamp.	5
Exercise 2: Slotter maintenance- Diving Pulley alignment checking-Belt tension adjustment –Pinion gear inspection , table jib adjustment.	5
Exercise 3: Practice on oil removing & filling for a gear box. Inspection of the drained oil for contaminants & wear debris with focus on visual inspection. Preparation of coolants.	5
Exercise 4: Drawing and drafting of machine part as per requirement (in case of worn out/ modification)	5

1020236242	MAINTENANCE OF MACHINE TOOLS	L	T	P	C
PRACTICUM		1	0	4	3

Exercise 5: Dismantle, inspect and assemble the Lead screw and Half nut of the lathe.	5
Exercise 6: Dismantle, inspect and assemble the Three jaw chuck./Four jaw chuck	5
Exercise 7: Dismantle, inspect and assemble the Drill chuck.	5
Exercise 8: Surface roughness measurement on a machined component.	5
Machine Tool Alignment :	
Exercise 9: Conduct the following test for the surface grinding machine with horizontal grinding wheel spindle and prepare a test chart. a. Check the level of work table in longitudinal and transverse direction. b. Check the T-slots parallel with table movement. c. Check the T-slots square with transverse movement of table. d. Check the wheel spindle for true running and axial slip. e. Check the wheel spindle parallel with surface of table.	5
Exercise 10: Conduct the following test for the horizontal milling machine and prepare a test chart. a. Check the flatness of the work table surface in longitudinal and transverse direction b. Check the true running of the internal taper of main spindle c. Check the parallelism of the clamping surface of the work table in its longitudinal motion. d. Check the parallelism of the transverse movement of the work table to the main spindle in vertical and horizontal plane. e. Check the squareness of the table surface with column face.	5
Assessment Test and Revision	10
Total	75

1020236242	MAINTENANCE OF MACHINE TOOLS	L	T	P	C
PRACTICUM		1	0	4	3

Suggested List of Students Activity:

1. Students can visit the industry and workshops nearby and observe how the maintenanceof machine tools were done.
2. Study the alignment test on machine tools such as Drilling and shaping.

Text and Reference Books:

1. Er.Sushil kumar Srivastava - Maintenance Engineering - Reprint2016 - S.Chand publication.
2. Georg Schlesinger, F. Koenigsberger , M. Burdekin - TESTING MACHINE TOOLS - 8th edition- Pergamon Press-1978.
3. K.J.Bag- Preventive Maintenance - ISTE Professional centre continuing education Programme- Distributed by ISTE Professional centre AnnaUniversity campus, Chennai.

Web-based/Online Resources:

- https://www.youtube.com/watch?v=f58SW0Hwcf0 –Principle of Maintenance –NPTEL-IIT Kharagpur

1020236242	MAINTENANCE OF MACHINE TOOLS	L	T	P	C
PRACTICUM		1	0	4	3

END SEMESTER EXAMINATION - 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

PART	DESCRIPTION	MARKS
A	Aim & Tools Required	10
B	Dismantling / Procedure	20
C	Troubleshooting procedure/ Geometrical test	20
D	Assembling & Inspection Report / Test Chart	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.

1020236242	MAINTENANCE OF MACHINE TOOLS	L	T	P	C
PRACTICUM		1	0	4	3

Equipment / Facilities required to conduct the Practical Course.

S.No	Name of the Equipment's	Quantity Required
1.	Lathe machine	1 No
2.	Surface grinding machine	1 No
3.	Milling machine	1 No
4.	Slotting Machine	1 No
5.	Surface roughness tester	1 No
6.	Lead screw and nut	1 No
7.	Three jaw chuck/ Four jaw chuck	1 No
8.	Drill chuck	1 No
9.	Dial gauge	5 Nos.
10.	Magnetic stand	5 Nos.
11.	Surface gauges	5 Nos.
12.	Spirit level	5 Nos.
13.	Spanners (DE/Ring/Box)	Sufficient quantity
14.	Screw drivers	Sufficient quantity
15.	Allen screw sets	Sufficient quantity
16.	Hammer	Sufficient quantity
17.	Test mandrels	Sufficient quantity
18.	Squares / Blocks	Sufficient quantity

1020236243	NON DESTRUCTIVE TESTING	L	T	P	C
PRACTICUM		1	0	4	3

Introduction:

Non-destructive testing (NDT)is a multidisciplinary profession that blends quality assurance and materials science. NDT is used to inspect and evaluate materials, components, or assemblies without destroying their serviceability. Through a set of test methods, skilled technicians identify cracks, voids, inclusions, and weld discontinuities, as well as identify misassembled subcomponents. This makes NDT crucial to help prevent catastrophic failures such as airplane and locomotive crashes, pipeline leaks and explosions, nuclear reactor failures, and ship disasters.

Course Objectives:

The objective of this course is to prepare the student,

- To learn about the various Non Destructive testing methods.
- To identify the types of equipment used for each Non-Destructive and Destructive Examination.
- To study about the process of Surface Testing Methods(LPT & MPT)
- To learn about the Sub Surface Testing methods(RT & UT)
- To study about the various applications of NDT Tests in Industries.

Course Outcomes

CO1: Explain NDT techniques which enable it to carry out various inspections in accordance with the established procedures.

CO2: Calibrate the instrument and inspect for in-service damage in the components.

CO3: Differentiate various defect types and select the appropriate NDT methods for better evaluation.

CO4: Communicate their conclusions clearly to specialist and non-specialist audiences.

CO5: Prepare the testing and evaluation of the results for further analysis.

Pre-requisites:

Knowledge of basic measuring instruments, material processing, and various types of materials defects.

1020236243	NON DESTRUCTIVE TESTING	L	T	P	C
PRACTICUM		1	0	4	3

CO/PO Mapping

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

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 curiosityto 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.
- Incorporate formative and summative assessments to gauge student progress and provide targeted feedback.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.

1020236243	**NON DESTRUCTIVE TESTING**	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
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.

1020236243	NON DESTRUCTIVE TESTING	L	T	P	C
PRACTICUM		1	0	4	3

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 experiment.

This documentation can be carried out in a separate notebook or a printed manual or a file with documents. The Procedure, Sketch and Result / Output should be written by the student manually in the documents.

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.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Procedure / Preparation	15
B	Observation / Sketch	20
C	Accuracy	15
TOTAL		50
D	Practical Documents (As per the portions)	10
		60

Cycle - I - Exercise 1, 2, 3 and 4.

Cycle - II - Exercise 5, 6, 7 and 8.

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.

1020236243	NON DESTRUCTIVE TESTING	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	Procedure/Preparation	15
B	Observation/Drawing	20
C	Accuracy	15
D	Result	10
E	Written Test	30
F	Viva Voce	10
TOTAL		100

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

1020236243	NON DESTRUCTIVE TESTING	L	T	P	C
PRACTICUM		1	0	4	3

Syllabus Contents

Theory Portion - Unit I	
Introduction: Non destructive testing (NDT) and its comparison with destructive testing, Defects/ flaws due to primary processing, secondary processing and inservice, Types of defects determined by NDT, Common non-destructive testing techniques, Advantages, limitations and applications of NDT. **Visual Inspection:** Principle of visual Inspection, Defects which can be detected by unaided visual Inspection, Optical aids used for visual inspection, Advantages and limitations of visual inspection. **Liquid Penetrant Test:** Advantages and limitations of Liquid Penetrant Test (LPT), Physical principles of LPT, Procedure employed for LPT, Penetrant methods, Materials used in LPT. **Magnetic Particle Test:** Advantages and limitations of Magnetic Particle Test (MPT), Procedure of MPT, Magnetizing Magnetic particles and suspending liquids, Detectable discontinuities, Non-relevant indications, Applications.	8
Practical Exercises	
Exercise 1: Detect the cracks in the specimen using Visual Inspection and ring test.	6
Exercise 2: Detect the Small surface flaws in the specimen using Microscopy Examination test.	6
Exercise 3: Detect the Subsurface flaws in the specimen using Radiography.	6
Exercise 4: Detecting Surface flaws in specimen using Die-penetration test.	6
Theory Portion - Unit II	
Eddy Current Test: Advantages and limitations of Eddy Current Test (ECT), Operation variables, Eddy current instrumentation, Reference standards, Applications. **Ultrasonic Test:** Advantages and limitations of Ultrasonic Test (UT), General characteristics of ultrasonic waves, Wave propagation and types of ultrasonic	7

1020236243	NON DESTRUCTIVE TESTING	L	T	P	C
PRACTICUM		1	0	4	3

waves, Major variables in UT, Angle beam techniques, Immersion testing, Applications. **Radiography Test:** Uses/ Applicability of radiography, Advantages and limitations of Radiography Test (RT), Interaction between penetrating radiation & matter (Attenuation), Image conversion media, Film radiography, Real time radiography. **Other Non-destructive Inspection Techniques:** Acoustic emission inspection, Microwave inspection, Thermal inspection, Electromagnetic techniques for residual stress measurements, Optical holography, etc.	
Practical Exercises	
Exercise 5: Detect of Surface flaws in specimen using Ultrasonic test.	6
Exercise 6: Detect the cracks in specimen using Magnetic particle test.	6
Exercise 7: Detect the Surface and near surface flaws in specimen using Eddy Current test.	6
Exercise 8: Case Study experiment - Can analyze entire structure of Any one used machine components using Acoustic emission test.	6
Assessment Test + Revision	12
Total	75

TEXT BOOKS

1. "Non Destructive Evaluation and Quality Control", Metals Handbook, Vol. 17, 9th Ed., ASM.1989
2. Srivastava, K.C., "Handbook of Magnetic Particle Testing", Oscar publications. 1998
3. Hull, B., "Non Destructive Testing", Springer. 2012
4. Dr.V.Jayakumar,Dr.K.Elangovan"Non-Destructive Testing of Materials"Lakshmi Publications,Chennai,2017
5. Baldev Raj, Jayakumar T, Thavasimuthu M, Practical Non- Destructive Testing, 3rd Ed., Narosa. 2019

1020236243	NON DESTRUCTIVE TESTING	L	T	P	C
PRACTICUM		1	0	4	3

Web-based/Online Resources:

- www.ndt-ed.org
- www.krautkramer.com.au
- https://onlinecourses.nptel.ac.in/noc23_mm05

END SEMESTER EXAMINATION - 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

PART	DESCRIPTION	MARKS
A	Procedure/Preparation	15
B	Observation/Drawing	20
C	Accuracy	15
D	Result	10
E	Written Test	30
F	Viva Voce	10
TOTAL		100

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

1025236244	PRODUCTION AND OPERATIONS MANAGEMENT	L	T	P	C
PRACTICUM		1	0	4	3

Introduction

Production and Operations Management (POM) offers a wealth of knowledge and practical skills that are highly valuable for students. Whether they are pursuing a career in manufacturing, services, or any field where efficient and effective operations are crucial, understanding POM concepts can significantly enhance their professional capabilities. It encompasses various aspects, from the initial design and planning stages to the execution and continuous improvement of production processes. The primary goal is to transform inputs (materials, labor, and energy) into outputs (goods and services) that meet customer needs while optimizing the use of resources.

Course Objectives

The objective of this course is to enable the student,

1. To implement the information systems in production and operations management.
2. To develop skills in designing facility layouts to optimize workflow and resource utilization.
3. To apply analytical tools and techniques to solve complex problems in production and operations management.
4. To develop Scheduling and Project Management Skills
5. To Develop skills in using quality control tools and techniques to improve product and service quality.

Course Outcomes

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

CO1: Apply forecasting techniques to predict future demand and plan capacity accordingly.

CO2: Develop and implement production schedules using appropriate techniques.

CO3: Design facility layouts that optimize workflow and resource utilization.

CO4: Use quality control tools and techniques to monitor and improve product and service quality.

CO5: Analyze and design efficient production and service processes.

1025236244	**PRODUCTION AND OPERATIONS MANAGEMENT**	L	T	P	C
PRACTICUM		1	0	4	3

Pre-requisites

Basic knowledge in Business or Management, Quantitative Skills

CO/PO Mapping

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

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

Instructional Strategy:

- Organize visits to manufacturing facilities or service operations to provide students with firsthand exposure to production processes.
- Present real-world scenarios to analyze and solve production and operations management challenges.
- Encourage student participation through discussions on POM topics, case studies, or current industry trends.
- Use simulation software or games to replicate production environments and allow students to make decisions and observe outcomes.

1025236244	PRODUCTION AND OPERATIONS MANAGEMENT	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 Units	All Exercises	All Exercises
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
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 exercise / 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.

1025236244	PRODUCTION AND OPERATIONS MANAGEMENT	L	T	P	C
PRACTICUM		1	0	4	3

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 a printed manual or a file with documents. The observations, readings, calculations and sketches should be written by the student manually in the document.

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.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim and Procedure	10
B	Problem Formulation	10
C	Manual solution / Excel Solution / Simulation	30
D	Practical Documents (As per the portions)	10
TOTAL MARKS		60

Cycle I: 1, 2, 3, 4, 5 and 6

Cycle II: 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

Description		Marks	
Part – A	30 MCQ from the complete theory portions.	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

1025236244	PRODUCTION AND OPERATIONS MANAGEMENT	L	T	P	C
PRACTICUM		1	0	4	3

- **CA4:** 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 and Procedure	10
B	Problem Formulation	10
C	Manual solution / Excel Solution / Simulation	30
D	Output / Result	10
E	Viva voce	10
F	Written test	30
TOTAL MARKS		**100**

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

1025236244	PRODUCTION AND OPERATIONS MANAGEMENT	L	T	P	C
PRACTICUM		1	0	4	3

SYLLABUS CONTENT

THEORY		
UNIT I	**INTRODUCTION, FORECASTING, SCHEDULING, AND STATISTICAL QUALITY CONTROL**	
Production Systems – Characteristics of modern production and operations function - Recent trends in production and operations management - Role of operations in strategic management. Forecasting: Need, Types, Objectives and Steps - Overview of Qualitative and Quantitative methods. Scheduling: Job sequencing (FCFS, SPT, EDD, LPT, CR) & Johnson's rule on two machines. SQC : Overview of Statistical Quality Control – Control Charts, Process Capability Analysis, Root Cause Analysis, Statistical Process Control (SPC), Quality control tools.		9
PRACTICAL EXERCISES: Solving Manually / Using Excel / Simulation Software		
EX.NO	**NAME OF THE EXPERIMENT**	**PERIOD**
1	Forecasting : Predicting future demand for products or services based on historical sales data, market trends, and other relevant factors.	4
2	Job sequencing : Solving job sequencing problem in order to minimize the total completion time or make span while considering machine capacities and job precedence constraints.	4
3	Pareto Analysis : Finding out the relative importance of different factors in a dataset.	4
4	Histogram : Finding out the frequency or count of data points falling within certain ranges.	4
5	Quality control charts : Ensuring a certain parameter of a component/service remains within the specified tolerance limits to meet quality standards and customer requirements.	4
6	Scatter Diagram : Analysing the data and determine whether there is a correlation between variables. And to identify any patterns or trends in the data	4

1025236244	PRODUCTION AND OPERATIONS MANAGEMENT	L	T	P	C
PRACTICUM		1	0	4	3

UNIT II	LINEAR PROGRAMMING, NETWORK PROBLEMS	
Definition and basic concepts of linear programming, Formulation of optimization problems as linear programs, simplex method, graphical method, Transportation problem, Assignment Problem, Travelling salesman problem, network flow problem.		6
PRACTICAL EXERCISES: Solving Manually / Using Excel / Simulation Software		
Ex.No	**Name of the Experiment**	**Period**
7	Simplex Problem : Finding the optimal mix of products to maximize revenue given limited resources and production capacities.	4
8	Transportation problem : Optimizing transportation routes to minimize shipping costs while meeting demand requirements.	4
9	Project Schedule : Determining the optimal project schedule to minimize project duration or total project costs.	4
10	Travelling salesman problem : Finding the shortest possible route that visits a set of given cities and returns to the original city.	4
	Student activity + Assessment Test + Revision	20
	TOTAL HOURS	75

List of Student Activity to be performed:

(NOT FOR BOARD EXAMINATION- REPORT TO BE SUBMITTED)

- Solving a real case study problem on POM.

Reference

1. Operations Research, P. Ramamurthy, New Age International (P) Limited, Publishers.
2. Production and Operations Management, K. Aswathappa, Himalaya Publishing House.
3. Production and Operations Management, R. Panneerselvam, PHI Learning Private Limited.
4. Operations Management, Heizer, J., & Render, B., Pearson Education.
5. Operations Management: Contemporary Concepts and Cases, Schroeder, R. G., Goldstein, S. M., & Rungtusanatham, M. J., McGraw-Hill Education.
6. Modern Production/Operations Management, Buffa, E. S., & Sarin, R. K., Wiley.

1025236244	PRODUCTION AND OPERATIONS MANAGEMENT	L	T	P	C
PRACTICUM		1	0	4	3

Web-based/Online Resources

- NPTEL (Website): The National Programme on Technology Enhanced Learning (NPTEL) offers free online courses on Operations management - https://onlinecourses.nptel.ac.in/noc20_me30/preview
- NPTEL (Website): The National Programme on Technology Enhanced Learning (NPTEL) offers free online courses on Production and Operations management - NPTEL Mechanical Engineering - https://onlinecourses.nptel.ac.in/noc20_mg06/preview

Additional Instructions

- For the record of work done for practical exercises, record notebook / printed manual may be used. In this, the student should draw a diagram, and mention the readings/observations, calculations and result manually. The same should be submitted for the examinations with Bonafide Certificate.
- All the exercises should be completed before the Board Practical Examinations. Students will be permitted to select any one exercise by lot, or the question paper provided by the DOTE.

END SEMESTER EXAMINATIONS – PRACTICAL EXAM

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim and Procedure	10
B	Problem Formulation	10
C	Manual solution / Excel Solution / Simulation	30
D	Output / Result	10
E	Viva voce	10
F	Written test	30
TOTAL MARKS		**100**

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

1020236245	PRODUCT DESIGN & DEVELOPMENT	L	T	P	C
PRACTICUM		1	0	4	3

Introduction:

A product is something sold by an enterprise to its customers. Product design deals with conversion of ideas into reality and, as in other forms of human activity, aims at fulfilling human needs. Product development is the set of activities beginning with the perception of a market opportunity and ending in the production, sale, and delivery of a product.

Course Objectives:

The objective of the course is

1. To excel in new product design and development through application of knowledge and practical skills.
2. To provide students with a solid foundation in mathematical modeling of engineering problems required for bringing new products fast into the market.
3. To provide students with required scientific and engineering knowledge so as to comprehend, analyze, design and create innovative products and solutions for real life problems.
4. To inculcate professional and ethical values in students and enable them to work in multidisciplinary teams.
5. To provide students an academic environment which can facilitate life-long learning needed for a successful career in new product development.

Course Outcomes:

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

CO1: Describe the characteristics used for product design and development.CO2: Assess the customer requirements in product design.

CO3: Apply structural approach to concept generation, selection and testing.

CO4: Identify various aspects of design such as industrial design, design for manufacture, assembly, service and quality and product architecture.

CO5: Explain various principles and technologies used for the preparation of prototype.

1020236245	**PRODUCT DESIGN & DEVELOPMENT**	L	T	P	C
PRACTICUM		1	0	4	3

Pre-requisites:

Knowledge of basic Science: Design of machine elements, CAD/CAM and Product Life Cycle Management.

CO/PO Mapping

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

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

Instructional Strategy:

1. Real time product design should be shown through video.
2. The subject can Lecture Cum Demonstration basics.
3. Practical demonstrations should be organized (industrial Visit).

1020236245	**PRODUCT DESIGN & DEVELOPMENT**	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.

1020236245	PRODUCT DESIGN & DEVELOPMENT	L	T	P	C
PRACTICUM		1	0	4	3

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 experiment.

This documentation can be carried out in a separate notebook or a printed manual or a file with documents. The Procedure, Sketch and Result / Output should be written by the student manually in the documents.

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.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Procedure / Preparation	10
B	Step / Report	20
C	Presentation	20
		50
D	Practical Documents (As per the portions)	10
	TOTAL	**60**

Cycle - I - Exercise 1, 2, 3,4 and 5.

Cycle - II - Exercise 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

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

1020236245	PRODUCT DESIGN & DEVELOPMENT	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 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	Procedure / Preparation	10
B	Step / Report	20
C	Presentation	20
D	Result / output	10
E	Written Test	30
F	Viva Voce	10
	TOTAL	100

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

Syllabus Contents

Unit I	**INTRODUCTION**
Theory: Product life cycle, Product policy of an organization, Selection of a profitable product, Product design process, New product strategy Idea generation, Screening Concept development, Testing Business analysis Product development testing and Analysis Commercialization Collaboration. Gantt chart product life cycle management.	3
Practical: 1. Case studies related to Characteristics of successful product development, Design and development of products. 2. Case studies related to different Development Processes and Organizations.	10

1020236245	PRODUCT DESIGN & DEVELOPMENT	L	T	P	C
PRACTICUM		1	0	4	3

Unit II	PRODUCT PLANNING	
Theory: The product planning process, identify opportunities. Evaluate andprioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process.		3
Practical: 3. Case studies related to the product planning process, identify opportunities. 4. Case studies related to Concept Generation, Concept Selection, Concept Testing.		10
Unit III	**IDENTIFYING CUSTOMER NEEDS**	
Theory: Gather raw data from customers, interpret raw data in terms of customer needs, organize the needs into a hierarchy, establish the relative importance of the needs and reflect on the results and the process. Product Specifications: What are specifications, when are specifications established, establishing target specifications, setting the final specifications.		3
Practical: 5. Case studies related to Identifying Customer Needs. 6. Case studies related to Customer Product Specification.		10
Unit IV	**CONCEPT GENERATION**	
Theory: Product implications of the architecture, establishing the architecture,variety and supply chain considerations. Industrial design: Assessing the need forindustrial design, the impact of industrial design, industrial design process,managing the industrial design process, assessing the quality of industrial design. Design for manufacturing: Definition, estimation of manufacturing cost, reducingthe cost of components, assembly, supporting production, impact of DFM on other factors, service and quality.		3
Practical: 7. Case studies related to Product Architecture.		10

1020236245	PRODUCT DESIGN & DEVELOPMENT	L	T	P	C
PRACTICUM		1	0	4	3

8. Case studies related to Design for Manufacturing.		
Unit V	**PROTOTYPING**	
Theory: Prototyping basics, principles of prototyping, technologies, planning for prototypes. Product development economics, Elements of economic analysis, base case financial mode, sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis.		3
Practical: 9. Case studies related to Prototyping, Product Development Economics. 10. Field Visit Report manufacturing or assembling industry.(Automobile Industry – Minimum – 4 Hrs) – Report should include: various steps involved in product manufacturing or product assemble ...(not included in Practical Exam)		10
Assessment + Revision		10
TOTAL		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. Online video demonstration.
2. Practical demonstration.
3. Automobile industry visit and prepare a report.

Involve students in trouble shooting activities either in group or individual.

Text and Reference Books:

1. Karl T Ulrich, Steven D Eppinger , " Product Design & Development." Tata McGrawhill New Delhi 2003
2. Hollins B & Pugh S "Successful Product Design." Butter worths London.
3. Bralla J G "Handbook of Product Design for Manufacture, McGrawhill NewYork.

1020236245	PRODUCT DESIGN & DEVELOPMENT	L	T	P	C
PRACTICUM		1	0	4	3

4. A K Chitale and R C Gupta, Product Design and Manufacturing, 6th Edition, PHI, New Delhi, 2003.

5. Boothroyd G, Dewhurst P and Knight W, Product Design for Manufacture and Assembly, 2nd Edition, Marcel Dekker, New York, 2002.

Web-based/Online Resources:

https://archive.nptel.ac.in/courses/112/107/112107217/

End Semester Examination - 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

PART	DESCRIPTION	MARKS
A	Procedure / Preparation	10
B	Step / Report	20
C	Presentation	20
D	Result / output	10
E	Written Test	30
F	Viva Voce	10
TOTAL		100

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

1020236246	ELECTRIC VEHICLE TECHNOLOGY	L	T	P	C
PRACTICUM		1	0	4	3

Introduction:

The world is transitioning to cleaner mobility options with the aim at improving air quality and reducing dependency on fossil fuels. Electric Vehicles (EVs) have emerged as a popular clean mobility choice to reduce emissions. EVs are powered fully or partially by batteries, they can help to reduce dependence on fossil fuels and also air quality.

Course Objectives:

The objective of this course is to enable the students to

- Learn and practice the charging systems of Electric Vehicles.
- Understand the concept of Electric Vehicle components.
- Study the configurations of Electric Vehicles and assemble.

Course Outcomes

On successful completion of this course, the student will be able toCO1:

Describe the electric vehicle and sub systems.

CO2: Demonstrate and test the EV battery and charging system.

CO3: Apply the procedures and testing of electric components and their accessories.CO4:

Test, diagnose and service the given electric two-wheeler.

CO5: Construct and test the electric Three-wheeler.

Pre-requisites:

Nil

1020236246	ELECTRIC VEHICLE TECHNOLOGY	L	T	P	C
PRACTICUM		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	-	-	-	1	-	-
CO2	2	1	-	2	-	-	1
CO3	1	1	1	2	-	-	1
CO4	1	1	1	2	-	-	1
CO5	1	1	1	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.
- 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 ina 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.
- The industry session shall be addressed by industry experts (in contact mode/online / recorded video mode) in the discipline only.

1020236246	**ELECTRIC VEHICLE TECHNOLOGY**	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.

1020236246	ELECTRIC VEHICLE TECHNOLOGY	L	T	P	C
PRACTICUM		1	0	4	3

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 experiment.

This documentation can be carried out in a separate notebook or a printed manual or a file with documents. The Procedure, Sketch and Result / Output should be written by the student manually in the documents.

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.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Procedure / Explanation	10
B	Observation/ Assembly/ Reading	20
C	Test Report	20
		50
D	Practical Documents (As per the portions)	10
	TOTAL	60

Cycle - I - Exercise 1, 2, 3,4 and 5.

Cycle - II - Exercise 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.

1020236246	ELECTRIC VEHICLE TECHNOLOGY	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 & Apparatus Required	10
B	Procedure / Explanation	10
C	Observation/ Assembly/ Reading	20
D	Test Report	20
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.

1020236246	ELECTRIC VEHICLE TECHNOLOGY	L	T	P	C
PRACTICUM		1	0	4	3

Syllabus Contents

Theory Portion - Electric Vehicle and accessories	
Environmental impact of conventional vehicle - Air pollution –History of Electric vehicles – Need for Electric Vehicle. Battery Electric Vehicle (BEV) –Block diagram of BEV - Major Components of Electric Vehicle – Working of BEV. Battery: Construction and working of Lead Acid and Lithium Based Batteries –Battery Management System. Battery Charging Techniques: Battery Charging techniques – Constant current and Constant voltage, Trickle charging – Battery Swapping Techniques. Types of EV motors - Permanent Magnetic Brushless DC Motor Drives (BLDC) – Principles, Construction and Working – Hub motor Drive system – Merits and Demerits of DC motor drive, BLDC motor drive. Power Converters: Role of Power Converters – Block diagram of Power Converters in EV – Types of Power Converters – DC to DC Converter, Inverter and Rectifier. Electronics Power Steering – Torque Sensor – EPS Motor – Regenerative Suspension System –Regenerative Braking system. Tamil Nadu EV Policy 2019 & 2023.	15
Practical Exercises	
Experiment 1: Battery Testing – Specific Gravity Test, Open volt testing, Cell voltage tester.	5
Experiment 2: Test the Lead acid Battery using voltage Load tester and test the battery pack supply to glow the Head lamp.	5
Experiment 3: Test the battery charging (Series and Parallel) and note the various charging parameters.	5
Experiment 4: Identify and test EV components. (Controller, Throttle, EV motor, Power ON Key, brake, indicator, horn and headlight)	5
Experiment 5: Construct and testing of BLDC Motor with throttle control.	5
Experiment 6: Test the Inverter circuit and buck converter circuit.	5

1020236246	ELECTRIC VEHICLE TECHNOLOGY	L	T	P	C
PRACTICUM		1	0	4	3

Experiment 7: Assemble and test E-bicycle with wiring harness.	5
Experiment 8: Assemble and test E-Bike with a central drive mechanism (Chain drive) with wiring harness.	5
Experiment 9: Assemble and test E-Auto rickshaw with differential and wiring harness.	5
Experiment 10: Plan maintenance and servicing schedule of electric two-wheeler.	5
Assessment Test and Revision	10
Total	75

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based on the course.

Text and Reference Books:

1. A.K Babu, Electric & Hybrid Vehicle, Khanna Publication, New Delhi – 2018 Edition
2. Iqbal Husian, Electric and Hybrid Vehicle Design Fundamentals, CRC Press, Boca Raton, Florida
3. Comparison of Electric and Conventional Vehicles in Indian Market: Total Cost of Ownership, Consumer Preference and Best Segment for Electric Vehicle (IJSR), Akshat Bansal, Akriti Agarwal
4. Tamil Nadu Electric Vehicles Policy 2019 & 2023 .
5. Design and analysis of aluminum/air battery system for electric vehicles, Shaohua Yang, Harold Knickle, Elsevier.
6. Propelling Electric Vehicles in India, Technical study of Electric Vehicles and Charging Infrastructure

1020236246	ELECTRIC VEHICLE TECHNOLOGY	L	T	P	C
PRACTICUM		1	0	4	3

Web-based/Online Resources:

1. NPTEL Fundamentals of Electric vehicles: Technology & Economics https://nptel.ac.in/courses/108106170
2. NPTEL Introduction to Hybrid and Electric Vehicles, IIT Guwahati https://nptel.ac.in/courses/108103009

END SEMESTER EXAMINATION - 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

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	10
B	Procedure / Explanation	10
C	Observation/ Assembly/ Reading	20
D	Report	20
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.

1020236246	ELECTRIC VEHICLE TECHNOLOGY	L	T	P	C
PRACTICUM		1	0	4	3

Equipment / Facilities required to conduct the Practical Course.

Sl. No.	Machines / Tools / Equipments	Quantity
1.	Lead acid battery / Lithium-ion battery	8 Nos.
2.	Battery Load tester	1 No.
3.	Specific gravity tester- Hydrometer	2 Nos.
4.	Cell voltage tester (High Discharge Tester)	1 No.
5.	Buck Converter	2 Nos.
6.	Battery Charger	1 No.
7.	Inverter Trainer Kit	1 No
8.	BLDC motor control Trainer kit or accessories	1 No
9.	Two-wheeler Wiring Harness board or kit	1 No
10.	E – Bicycle kit or Accessories 1. 24V DC Controller, 24 V DC motor 2. Throttle, Brake, Power ON key 3. Head lamp with Horn	1 No
11.	E – Bike kit or Accessories 1. 48 V BLDC Controller, 500W or 750 W, 48 VBLDC motor, Throttle, Brake, Power ON key, Display Board, Head lamp with Horn, Left & Right Indicator	1 No
12.	E-Auto Rickshaw 500 W or 750 W, 48 V BLDC motor with differential arrangement 1. Throttle 2. Brake 3. Power ON key 4. Display Board 5. Head lamp with Horn 6. Left & Right Indicator	1 No

13.	**Consumable: -** • Battery Cell - 1.5 V or 3.65 V • Soldering Iron • Flux • De-solder gun or Solder wick • Lead **Tools** • Continuity Tester • Line Tester • Multi-meter • Screw Drive set & Spanner set	As per requirement

1020236247	REVERSE ENGINEERING	L	T	P	C
PRACTICUM		1	0	4	3

Introduction:

Reverse Engineering (RE) has become an important Engineering task to obtain knowledge about engineering devices or systems. RE is an effective learning technique if other “solutions” are available on the market.

Course Objectives:

After the completion of the course, students should be able to:

- Understand basic engineering systems.
- Understand the terminologies related to re-engineering, forward engineering, and reverse engineering.
- Disassemble products and specify the interactions between its subsystems and their functionality
- Understand Reverse Engineering methodologies.
- Understand Reverse engineering of Systems, Mechanical RE.

Course Outcomes

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

CO1: Explain the fundamental concepts and principles of reverse engineering in product design and development.

CO2: Describe the principles of material characteristics, part durability and life limitation in reverse engineering

CO3: Apply the principles of material identification and process verification in product design and development.

CO4: Explain the principles of rapid prototyping

CO5: Analyze the various legal aspect and applications of reverse engineering in product design and development

1020236247	**REVERSE ENGINEERING**	L	T	P	C
PRACTICUM		1	0	4	3

Pre-requisites:

Material Science, Machine Design, Machine Drawing and Value Engineering.

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2		1			
CO2	3	2		1			
CO3	3	2		1			
CO4	3	2		1			
CO5	3	2		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 ina simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

1020236247	**REVERSE ENGINEERING**	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
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.

1020236247	REVERSE ENGINEERING	L	T	P	C
PRACTICUM		1	0	4	3

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 experiment.

This documentation can be carried out in a separate notebook or a printed manual or a file with documents. The Procedure, Sketch and Result / Output should be written by the student manually in the documents.

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.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	10
B	Procedure / Explanation	20
C	Presentation	20
		50
D	Practical Documents (As per the portions)	10
TOTAL		60

Cycle - I - Exercise 1, 2, 3,4 and 5.

Cycle - II - Exercise 6, 7, 8 and 9.

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.

1020236247	REVERSE ENGINEERING	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 & Apparatus Required	10
B	Procedure / Explanation	20
C	Presentation	20
D	Result	10
E	Written Test	30
F	Viva Voce	10
TOTAL		100

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

1020236247	REVERSE ENGINEERING	L	T	P	C
PRACTICUM		1	0	4	3

Syllabus Contents

Unit I	**Introduction**	
Theory: Definition – Uses – the Generic Process – Phases – Computer Aided Reverse Engineering - Surface and Solid Model Reconstruction – Dimensional Measurement – Prototyping.		3
Practical: 1. Prepare case study report – various type of rapid Prototype also write the technical difference.		6
UNIT II	**MATERIAL IDENTIFICATION AND PROCESS VERIFICATION**	
Theory: Material Specification, Composition Determination, Microstructure Analysis, Manufacturing Process Verification.		3
Practical: 2. Material Strength Testing: Compare the strength properties of different materials commonly used in automobile components, such as steel, aluminum, and composite materials. Perform tensile, compressive, and bending tests to determine their suitability for various vehicle types. 3. Impact Resistance Analysis: Test the impact resistance of different Automobile body materials by subjecting them to controlled impacts. Measure and compare the deformation and damage caused by impacts of varying intensity.		12
Unit III	**MATERIAL CHARACTERISTICS, PART DURABILITY AND LIFE LIMITATION**	
Theory: Alloy Structure Equivalency – Phase Formation and Identification – Mechanical Strength – Hardness –Part Failure Analysis – Fatigue – Creep and Stress Rupture – Environmentally Induced Failure		3

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PRACTICUM		1	0	4	3

Practical: 4. Structural Rigidity Testing: Conduct bending and torsion tests on Automobile body frames to determine their structural rigidity. Compare different frame designs and materials to identify the most robust and lightweight options.		5
Unit IV	**RAPID PROTOTYPING(RP)**	
Theory: Introduction, current RP techniques and materials, Stereo Lithography, Selective Laser Sintering, Fused Deposition Modeling, Three-dimensional Printing, Laminated Object Manufacturing, Multijet Modeling.		3
Practical: 5. Crash Testing Simulation: Utilize crash test dummies and acceleration sensors to simulate vehicle collisions. Study how different body designs and materials affect passenger safety and structural integrity during impact. 6. Prepare case study report - Rapid Prototyping – Any one mechanical Machine components (Impeller, Engine Block, Piston and Door Pad)		12
Unit V	**INDUSTRIAL APPLICATIONS**	
Theory: Reverse Engineering in the Automotive Industry; Aerospace Industry. Case studies and Solving Industrial projects in Reverse Engineering. Legality: Patent – Copyrights –Trade Secret – Third-Party Materials.		3
Practical: 7. Prepare case study report – Patent 8. Prepare case study report – Copy rights 9. Prepare case study report – Trademark		15
Assessment + Revision		**10**
TOTAL		**75**

Text and Reference Books:

1. Reverse Engineering: An Industrial Perspective by V. Raja and K. Fernandes, Springer-Verlag.Wego

1020236247	REVERSE ENGINEERING	L	T	P	C
PRACTICUM		1	0	4	3

2. Kevin Otto , “Product Design : Techniques in Reverse Engineering and New Product Development”, ISBN-13: 9788177588217, Dorling Kindersley

3. Robert Messler, “Reverse Engineering: Mechanisms, Structures, Systems & Materials”, McGraw Hill Education, ISBN: 9780071825160

4. Reverse Engineering by K. A. Ingle, McGraw-Hill.

5. Raja, Vinesh, Fernandes, Kiran J. , “Reverse Engineering An Industrial Perspective” ISBN 978-1-84628-856-2, Springer

END SEMESTER EXAMINATION - 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

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	10
B	Procedure / Explanation	20
C	Presentation	20
D	Result	10
E	Written Test	30
F	Viva Voce	10
TOTAL		100

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

1020236248	GREEN ENERGY & ENGINEERING	L	T	P	C
PRACTICUM		1	0	4	3

Introduction:

Traditional energy sources such as coal, oil, and natural gas contribute significantly to greenhouse gas emissions, air pollution, and environmental degradation. By transitioning to green energy sources such as solar, wind, hydroelectric, and biomass, engineers can mitigate these harmful effects while meeting the growing global demand for energy. The green energy projects often have lower life cycle carbon footprints compared to conventional energy sources, making them essential for achieving climate targets and promoting sustainable development. In essence, incorporating green energy into engineering practices is not only necessary for addressing environmental concerns but also essential for creating a resilient, equitable, and prosperous future for all.

Course Objectives:

The objective of this course is to prepare the student,

- To impart knowledge on solar energy collection and to demonstrate practical applications and benefits of solar panels and energy storage systems.
- To understand the principles of wind energy and biomass energy.
- To impart knowledge about geothermal heat pumps, ocean thermal energy conversion (OTEC), and their feasibility.
- To provide fundamental principles of energy-efficient appliances, building designs, and smart systems.
- To acquire knowledge regarding sustainable manufacturing process and to explore on eco-friendly production processes, materials, and waste reduction strategies.

Course Outcomes

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

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

CO1 - Acquire the knowledge of the principles of solar energy conversion and their benefits.CO2 - Enable for building a small range of wind energy conversion system.

CO3 - Gain knowledge on the various classification of energy sources and their environmental issues.

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PRACTICUM		1	0	4	3

CO4 - Analyze the limitless availability of green energy sources and understand the challengesin renewable hybrid system.

CO5 - learn hydrogen production method, storage methods and waste reduction strategies.

Pre-requisites:

Knowledge of basic energy sources.

CO/PO Mapping

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

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

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PRACTICUM		1	0	4	3

- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- 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	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 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 experiment.

This documentation can be carried out in a separate notebook or a printed manual or a file with documents. The Procedure, Sketch and Result / Output should be written by the student manually in the documents.

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.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim / Procedure	10
B	Block diagram / Explanation	20
C	Presentation / Report	20
TOTAL		50
D	Practical Documents (As per the portions)	10
		60

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PRACTICUM		1	0	4	3

Cycle - I - Exercise 1, 2, 3,4 and 5.

Cycle - II - Exercise 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

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.

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PRACTICUM		1	0	4	3

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Aim / Procedure	10
B	Block diagram / Explanation	20
C	Presentation / Report	20
D	Result / Output	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

UNIT I	**SOLAR ENERGY & WIND ENERGY**	
INTRODUCTION Overview of conventional & renewable energy sources, types of renewable energy systems, Future of Energy Use, Present Indian and international energy scenario of conventional and RE sources, Energy for sustainable development, Environmental Aspects of Energy, Limitations of RE sources. **SOLAR ENERGY & WIND ENERGY** Theory of solar cells - Concept of Solar PV systems - Flat plate and concentrating collectors, Solar PV Applications - solar heating/cooling technique, solar distillation and solar drying, solar cookers. Energy from Wind - Horizontal axis Wind Turbine -		7

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PRACTICUM		1	0	4	3

Vertical Axis Wind Turbine - Wind Energy Conversion Systems	
Familiarization with Different Solar Energy Gadgets	
Exercise 1: Study of Solar Distillation System	5
Exercise 2: Performance test on Solar Cooker	5
Exercise 3: Performance analysis of Solar Water Heater	5
Exercise 4: Performance test on Solar Dryer	5
Exercise 5: Performance Evaluation on Solar Lighting System	5

UNIT II	**GEOTHERMAL ENERGY, BIOMASS, HYDROGEN STORAGE, ENERGY EFFICIENT SYSTEMS & GREEN MANUFACTURING SYSTEMS**
OCEAN ENERGY, BIO-MASS ENERGY & HYDROGEN PRODUCTION OTEC, Principles of utilization, setting of OTEC plants - Tidal and wave energy. Principles of bio-conversion - types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects. Chemical Production of Hydrogen- Electrolytic Hydrogen- Thermolytic Hydrogen- Photolytic Hydrogen- Photobiologic Hydrogen Production **ENERGY EFFICIENT & GREEN MANUFACTURING SYSTEMS** Energy efficient motors, energy efficient lighting and control. Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, Environmentally friendly and Energy efficient compressors and pumps. Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, Sustainable green production systems - alternate casting and joining techniques, zero waste manufacturing.	8
Exercise 6: Study on the Production Process of Bio-Fuels	5
Exercise 7: Study on the Floating Drum & Fixed Drum Biogas Plants	5

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PRACTICUM		1	0	4	3

Exercise 8: Study on the various Bio-mass energy conservation technologies.	5
Exercise 9: Study on Production Process of Briquettes	5
Exercise 10: Performance test on BIO Diesel using blend analyzer	5
Revision + Assessment Test	10

Text and Reference Books:

1. D. S. Chauhan & S. K. Srivastava, Non-Conventional Energy Resources, New Age International Private Limited, 4 th Edition, 2021.
2. John Twidell & Tony Weir, Renewable Energy Resources, Routledge; 3 rd Edition, 2015.
3. D.P. Kothari, K.C. Singal & Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, PHI Learning; 3 rd Edition, 2022.
4. Ritu Dogra, Renewable Energy and Green Technology, Brillion Publishing, 1 st Edition, 2023.
5. Soli J. Arceivala, Green Technologies, McGraw Hill Education (India) Private Limited, 1 st Edition, 2017.
6. Chandan Deep Singh & Harleen Kaur, Sustainable Green Development and Manufacturing Performance through Modern Production Techniques, Taylor & Francis Ltd, 1 st Edition, 2021.

Web and Online Resources

- https://onlinecourses.nptel.ac.in/noc21_ch11/preview

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PRACTICUM		1	0	4	3

END SEMESTER EXAMINATION - 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

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	10
B	Procedure / Explanation	20
C	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.

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PRACTICUM		1	0	4	3

List of Equipment required.

S.No	Name of the Equipment	Quantity required
1	Solar PV Panel	1
2	Solar Current lamp	2
3	PV analyser	1
4	Solar Irradiation Meter	1
5	Solar Cooker	1
6	RTD - 2 mts	10 Qty
7	Solar Dryer	1
8	Pyranometer	2
9	Axial Fan	1
10	Biodiesel	2 lt
11	Biodiesel blends analyse	1
12	Solar Water Heater	1
Consumables and instruments		Sufficient quantity

1025236351	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 toreal-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.
- Facilitate the establishment of professional relationships with supervisor, administrators, and other professionals in the field.

1025236351	INTERNSHIP	540 Periods	C
PROJECT			12

- 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.

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.

1025236351	INTERNSHIP	540 Periods	C
PROJECT			12

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 workis 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 logbook and get the signatureof the concerned training supervisor.
- 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.

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PROJECT			12

- 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 ofinterns by internship provider, Student's Diary and Comprehensive Training Report.

Attendance Certification

Every month students have to get their attendance certified by the industrial supervisorin the prescribed form supplied to them. Students have also to put their signature on theform 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, 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

1025236351	INTERNSHIP	540 Periods	C
PROJECT			12

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.

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

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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 (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

1025236353	**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.

1025236353	**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, andinternships, 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 selecting 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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PROJECT			12

- 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.
- Assist fellows in developing technical and professional skills through hands-on projects, laboratory work, and practical applications of theoretical knowledge.

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PROJECT			12

- 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 encouragesgrowth, 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.
- 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.

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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.
- Uphold high ethical standards in all your academic and professional activities. Practice integrity, honesty, and responsibility. Adhere to the ethical guidelines and standards setby 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.
- **Recommendation Letters**: Letters from faculty mentor, employer, or professionals who can attest to your academic abilities, professional skills, and suitability for the fellowship.

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- **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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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 effectively.

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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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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

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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 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.

CO 5: Improve communication skills through the preparation and delivery of project reports, presentations, and documentation that effectively convey technical information to stakeholders.

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Important points to consider selecting 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.
- 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.

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- 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 appropriatein-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.
- Provide personal mentorship, fostering a supportive relationship that encouragesgrowth, 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.

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- 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.
- 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.

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- 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 setby 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.
3	Research Design and Methodology	Clear explanation of the research design. Appropriateness and justification of chosen research methods.

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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)*		
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.

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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.