Course Information Sheet (CIS)

1. Academic Year	:2023 – 24 Even Semester
2. Name of Course Coordinator	: Mrs.K.Ramya
3. Department	: Agricultural Engineering
4. Programme	: B.Tech. – Agricultural Engineering
5. Class and semester	: II Year & IV th Semester
6. Course code and title	: 22AG4001 –Operation and maintenance of farm machinery lab
7. Regulations	: R2022
8. Course Category	: PC
9. Contact hours	: 30
10. Type of course	: Practical
11. Credit	: 2
12. Course Attainment level	: 60
13. Course pre-requisites	: Basic knowledge farm machinery and field capacity calculation

14. Course Learning Objectives (CLO) :

1. The students will be introduced to the practice of different farm machinery in the field on
2. Tillage, sowing, plant protection, harvesting and threshing
3. 2. Care and maintenance; lubrication
4. 3. Fits and tolerances and replacements
5. 4. Adjustments of farm machines
6. 5. Dismantling and reassembling of a disc harrow, seed-cum fertilizer drill, and sprayer and engine pumps.

15. Course Outcomes (COs) :

During this course, students have an ability

CO1: To identify farm equipment

CO2: To calculate and predict the actual field problem during the operation.

CO3: To trained to do adjustments of farm implements and Hitching of agricultural implements and trailers.

CO4: To give care and maintenance to the farm machinery implements.

CO5: To dismantle and assemble various machineries used in agriculture.

16. Course Syllabus:

LIST OF EXPERIMENTS

S.no	List of experiments	Instructional hours
1	Identification of major systems of a tractor and general guidelines on preliminary check measures.	2
2	Identification of components of power tiller and general guidelines on preliminary check measures	2
3	Hitching of agricultural implements and trailers	2
4	Operation of tractor drawn cultivator - adjustments- and determination of field capacity	2
5	Experiment on Calibration of seed drills	2
6	Field-testing of rocker arm sprayer, power sprayer and battery sprayer and their efficiency calculation	2
7	Operation and evaluation of dry land weeders and power operated weeder	2
8	Evaluation of land preparation implements and machinery	2
9	Study on wetland preparation implements and machinery	2
10	Visit to farm machinery industry and its research canter	2
11	Study of reaper um binder and flail mower	2
12	Determination of operational cost of farm implement	2

Total Instructional Hours **30**

References:

1. Jain, S.C. and C.R. Rai. Farm Tractor Maintenance and Repair. Standard publishers and Distributors, New Delhi, 1999.
2. Ojha, T. P. and Michael, A. M. 2011. Principles of Agricultural Engineering Vol. I. Jain Brothers, New Delhi

Sl. No.	Name of the Experiment	No. of Hrs.	Cumul. Hours
1.	Identification of major systems of a tractor and general guidelines on preliminary check measures.	2	2
2.	Identification of components of power tiller and general guidelines on preliminary check measures	2	4
3.	Hitching of agricultural implements and trailers	2	6
4.	Operation of tractor drawn cultivator - adjustments- and determination of field capacity	3	9
5.	Experiment on Calibration of seed drills	3	12
6.	Field-testing of rocker arm sprayer, power sprayer and battery sprayer and their efficiency calculation	2	14

7.	Operation and evaluation of dry land weeders and power operated weeder	3	17
8.	Evaluation of land preparation implements and machinery	3	20
9.	Study on wetland preparation implements and machinery	2	22
10	Visit to farm machinery industry and its research canter	2	24
11	Study of reaper um binder and flail mower	2	26
12	Determination of operational cost of farm implement	3	30

Total No. of Practical hours: 30

11. Weightage of unit contents:

Factors considered,

F1-Number of periods allotted for teaching the unit and weightage per hour is equal 1

F2 –Usefulness of the content matter of the unit in the student's learning point of view and its weightage equal to 1 if useful otherwise zero.

F3-Usefulness of the content matter of the unit in understanding other units of the same subject and its weightage equal to 1 if useful otherwise zero.

F4- Usefulness of the content matter of the unit in understanding other subjects prescribedfor the programme and its weightage equal to 1 if useful otherwise zero.

A1 – Total weightage and A2 – % of Weightage

Sl.No	Topics	F1	F2	F3	F4	A1	A2
1.	Identification of major systems of a tractor and general guidelines on preliminary check measures.	3	1	1	0	5	8
2.	Identification of components of power tiller and general guidelines on preliminary check measures	3	1	0	0	4	7
3.	Hitching of agricultural implements and trailers	3	1	1	1	6	10
4.	Operation of tractor drawn cultivator - adjustments- and determination of field capacity	3	1	1	1	6	10
5.	Experiment on Calibration of seed drills	3	1	0	1	5	7
6.	Field-testing of rocker arm sprayer, power sprayer and battery sprayer and their efficiency calculation	3	1	1	1	6	10
7.	Operation and evaluation of dry land weeders and power operated weeder	3	1	1	1	6	10
8.	Evaluation of land preparation implements and machinery	3	1	0	0	4	7
9.	Study on wetland preparation implements and machinery	3	1	0	0	4	7
10.	Visit to farm machinery industry and its research canter	3	1	1	1	6	10
11.	Study of reaper um binder and flail mower	3	0	0	1	4	7

12.	Determination of operational cost of farm implement	3	1	0	1	4	7
						60	100.00

12. Mapping syllabus with Bloom's Taxonomy LOT and HOT:

	Lower Order Thinking	
R	Remembering	Students are expected to Recall the information through Recognizing, listing, describing, retrieving, naming, finding
U	Understanding	Students are expected to Explain an ideas or concepts throughInterpreting, summarizing, paraphrasing, classifying, explaining
Ap	Applying	Students are expected to Use the information in another familiarsituation through Implementing, carrying out, using, executing
	Higher Order Thinking	
A	Analysing	Students are expected to Break the information into parts to explore understandings and relationships through Comparing, organizing, deconstructing, interrogating, finding
E	Evaluating	Students are expected to Evaluate the Justifying a decision or course of action through Checking, hypothesizing, experimenting, judging
C	Creating	Students are expected to Generate new ideas, products, or ways of viewing things through Designing, constructing, planning, producing, inventing.

Sl.No	Name of the Experiments	Process verb	Types of thinking
1.	Identification of major systems of a tractor and general guidelines on preliminary check measures.	Use, Outline	Remembering **CO1**
2.	Identification of components of power tiller and general guidelines on preliminary check measures	Demonstrate, Explain	Understanding **CO1**
3.	Hitching of agricultural implements and trailers	Analyze	Analyzing **CO2**
4.	Operation of tractor drawn cultivator - adjustments- and determination of field capacity	Analyze, Assess	Analyzing and Evaluating **CO2**
5.	Experiment on Calibration of seed drills	Analyze, Assess	Analyzing and Evaluating **CO3**
6.	Field-testing of rocker arm sprayer, power sprayer and battery sprayer and their efficiency calculation	Use, Develop	Applying **CO3**
7.	Operation and evaluation of dry land weeders and power operated weeder	Analyze, Assess	Analyzing and Evaluating **CO4**
8.	Evaluation of land preparation implements and machinery	Compare, Conclude	Analyzing **CO4**
9.	Study on wetland preparation implements and machinery	Compare, Conclude	Analyzing **CO5**

10.	Visit to farm machinery industry and its research canter	Analyze, Assess	Analyzing and Evaluating **CO5**
11.	Study of reaper um binder and flail mower	Compare, Conclude	Analyzing **CO4**
12.	Determination of operational cost of farm implement	Analyze, Assess	Analyzing and Evaluating **CO5**

	R	U	Ap	A	E	C	Total
Type of thinking in Nos	1	1	1	7	4	0	14
Weightage,%	**7**	**7**	**7**	**50**	**29**	**0**	**100**

Lower Order Thinking	**21%**
Higher Order Thinking	**79%**

13. Mapping Course Outcome(COs) with Bloom's Taxonomy LOT and HOT:

	R	U	Ap	A	E	C
CO1	□	□				
CO2	□□	□		□□	□	
CO3	□□	□	□	□	□	
CO4	□	□□		□□	□	
CO5	□	□		□□	□	

14. Mapping Course Outcome (CO) with Program Outcomes (PO) and Program Specific Outcomes (PSO):

	Graduate attributes	Descriptions
PO1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis	Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development ofsolutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations.
PO4	Conduct investigations ofcomplex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to Provide valid conclusions.

PO5	Modern tool usage	Create, select, and apply appropriate techniques, resources,and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO7	Environment and sustainability	Understand the impact of the professional engineeringsolutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable Development.
PO8	Ethics	Apply ethical principles and commit to professional ethicsand responsibilities and norms of the engineering practice.
PO9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11 →	Project management andfinance	Demonstrate knowledge and understanding of the engineering and management principles and apply these toone's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
PO12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	1	2	-	-	1	-	1	1	2	2	1	3
CO2	2	3	1	2	-	-	1	-	2	1	3	3	2	2
CO3	3	3	1	2	-	-	2	-	2	2	2	2	3	2
CO4	1	3	1	-	2	-	2	-	1	2	2	2	1	3
CO5	3	3	1	-	1	-	3	-	1	2	2	2	2	3
AVG	**2**	**3**	**1**	**2**	**2**	-	**2**	-	**2**	**2**	**3**	**2**	**2**	**3**

3	High	2	Moderate	1	Low

15. Mapping course with programme educational objectives (PEOs):

Programme Educational Objectives:

PEO1: To ensure that the graduates have been imbibed in their minds of the basics related to geotechnical engineering to solve the problems in the field of agriculture.

PEO2: The graduates would be capable of evaluating various soil physiochemical properties for crop production and agronomic practices.

PEO3: Graduates exhibit professionalism with ethics, communication and team work tosatisfy

	PEO1	PEO2	PEO3
CO1, CO2, CO3, CO4, CO5	**Strongly**	**Strongly**	**Moderate**

Strongly agreed | Moderately agreed

16. Course assessment: (Direct Assessment Method)

Record/ Observation Mark: 5 marks

Objective	To enhance students' understanding of a particular reading
Product	Hand written text/diagram in a record book
Frequency	After completing one experiment
Format	Each experiment has 5 mark
Evaluation	Based on rubrics

Experimental Set up/Execution/Result Mark: 15 marks

Objective	Based on the theoretical knowledge setting the experiments- Procedure- circuits – connection – reading – conclusion & Result
Product	Result
Frequency	After completing one experiment
Format	Each experiment has 15 mark
Evaluation	Based on rubrics

Model Lab: 25 Marks

Objective	To Identify What Students Have Learned and also to identify students strength and weakness and to know about experiment
Product	Answer scripts
Frequency	Once in a semester
Format	Total marks = 25 Duration : 2hour and 30 minutes
Evaluation	Based on answer given in the scripts / rubrics

Viva-Voce: 5 marks

Objective	To measure knowledge, abilities, and/or skills.
Product	Questions and answers
Frequency	After completing each experiment
Format	Objective type questions
Evaluation	Based on answer given by students

End semester exam: 50 marks

Objective	**To assess the each student's knowledge of the course**

Product	Result analysis
Frequency	Semester
Format	Aim and Procedure/Algorithm=20 marks
	Reading, calculation, Circuits, Connections, Coding & Execution=50 marks Result = 15 Marks Viva-Voice= 15 Marks Total marks =100 and this mark is converted to 50 marks Duration : 3hours
Evaluation	Based on answer given in the scripts
criteria	Minimum pass percentage: 50% If not, remedial action will be taken.

22. Course assessment: (Indirect Assessment Method)

Course Exit Survey: Course Exit Survey consists of few critical questions that evaluatethe level of students' satisfaction level with curriculum and course being taught.

Prepared by,

Course Coordinator
(K.RAMYA, AP/Agri)

Checked by,

Head of the Department

Approved by,

Dean (Academics)

PRINCIPAL

Hindusthan College of Engineering And Technology
Approved by AICTE, New Delhi, Accredited with 'A' Grade by NAAC
(An Autonomous Institution, Affiliated to Anna University, Chennai)
Coimbatore – 641 032

COURSE INFORMATION

1. **Academic Year** : 2023 - 2024
2. **Name of faculty** : Mr.J.Krishnaraj
3. **Department** : Automobile Engineering
4. **Programme** : B.E., Automobile Engineering
5. **Class and semester** : II year and Third semester
6. **Course code and title** : 22AU3001 and Automotive Components Laboratory
7. **Regulations** : R2019
8. **Core / Elective** : Core – Lab
9. **Contact hours** : 45
10. **Type of course** : Practical
11. **Number of credits** : 1.5
12. **Course pre-requisites**:

Nil

13. **Course learning objectives**:

1. Gain knowledge of the operational principles of petrol and diesel engines.
2. To acquire knowledge about fuel supply system and vehicles frames.
3. To examine and analyze the construction and operation of vehicle axles and differentials.
4. To comprehend the operation and purpose of the clutch and gearbox.
5. To comprehend the operation of the steering system as well as the cooling and lubrication system.

14. **Expected outcome of the course:**

At the end of this course students will be able to:

CO1 Acquire knowledge about the functioning principles of petrol and diesel engines.

CO2 Obtain a comprehensive understanding of the fuel supply system and vehicle frames.

CO3 Evaluate and analyze the design and functionality of vehicle axles and differentials

CO4 Gain knowledge about the working mechanisms and functions of the clutch and gearbox.

CO5 Gain an understanding of the purpose and operation of the steering system and the cooling and lubrication system.

15. Course Syllabus:

List of Experiments

1. Dismantle and assemble a multi-cylinder petrol engine to identify its nomenclature.
2. Disassemble, examine the nomenclature, and reassemble a multi-cylinder diesel engine.
3. Examine the fuel systems of petrol and diesel engines.
4. Analyze and measure the frames of light and heavy commercial vehicles.
5. Axle Dismantling and Assembly: Front and Rear Axles
6. Disassemble and assemble differentials and to identify the load distribution.
7. Dismantling and Assembly of a Clutch.
8. Analysis of Gearbox Functioning and Components to Compute Gear Ratios.
9. Investigate the functioning of steering systems.
10. Explore the cooling and lubrication systems.

TOTAL HOURS: 45

16. Course plan:

Name of the Experiment	No of Hrs	Cum Hours
Vision, Mission, Introduction about the subject, course objective and course outcome and how this subject help them to attain PEO, PO & PSO	1	1
Dismantle and assemble a multi-cylinder petrol engine to identify its nomenclature.	4	5
Disassemble, examine the nomenclature, and reassemble a multi-cylinder diesel engine.	4	9
Examine the fuel systems of petrol and diesel engines.	4	13
Analyze and measure the frames of light and heavy commercial vehicles.	4	17
Axle Dismantling and Assembly: Front and Rear Axles	4	21
Disassemble and assemble differentials and to identify the load distribution.	4	25
Dismantling and Assembly of a Clutch.	4	29
Analysis of Gearbox Functioning and Components to Compute Gear Ratios.	4	33
Investigate the functioning of steering systems.	4	37

Explore the cooling and lubrication systems.	4	41
Review of syllabus	4	45

Total No. of lecture hours: 45

17. Weightage of unit contents:

Factors considered

F1 Number of hours allotted for the units

F2 Usefulness of content with respect to student's work [0-5 scale: 0-not useful and 5-highly important]

F3 usefulness of content with respect to other units of same subject [0-5 scale: 0-not useful and 5-highly important]

F4 usefulness of content with respect to other subjects for the same programme [0-5 scale: 0-not useful and 5-highly important]

S.No	Topics	F1	F2	F3	F4	W [in Nos.]	W [in %]
1	Vision, Mission, Introduction about the subject, course objective and course outcome and how this subject help them to attain PEO, PO & PSO	1	5	3	3	12	15%
2	Dismantle and assemble a multi-cylinder petrol engine to identify its nomenclature.	4	5	5	5	19	9.5%
3	Disassemble, examine the nomenclature, and reassemble a multi-cylinder diesel engine.	4	5	5	5	19	9.5%
4	Examine the fuel systems of petrol and diesel engines.	4	5	3	5	17	10.64%
5	Analyze and measure the frames of light and heavy commercial vehicles.	4	5	1	2	12	15%
6	Axle Dismantling and Assembly: Front and Rear Axles	4	5	3	5	17	10.64%
7	Disassemble and assemble differentials and to identify the load distribution.	4	5	2	5	16	11.3%
8	Dismantling and Assembly of a Clutch.	4	5	2	5	16	11.3%
9	Analysis of Gearbox Functioning and Components to Compute Gear Ratios.	4	5	4	5	18	10%
10	Investigate the functioning of steering systems.	4	5	1	5	15	12%

11	Explore the cooling and lubrication systems.	4	5	1	1	11	16.45%
12	Assessment/ Evaluation/ Oral discussion	4	5			9	20.1%
						181	100%

18. Mapping syllabus with Bloom's Taxonomy LOT and HOT:

Lower Order Thinking		
R	Remembering	Students are expected to Recall the information through Recognizing, listing, describing, retrieving, naming, finding
U	Understanding	Students are expected to Explain an ideas or concepts through Interpreting, summarizing, paraphrasing, classifying, explaining
Ap	Applying	Students are expected to Use the information in another familiar situation through Implementing, carrying out, using, executing
Higher Order Thinking		
A	Analysing	Students are expected to Break the information into parts to explore understandings and relationships through Comparing, organizing, deconstructing, interrogating, finding
E	Evaluating	Students are expected to Evaluate the Justifying a decision or course of action through Checking, hypothesizing, experimenting, judging
C	Creating	Students are expected to Generate new ideas, products, or ways of viewing things through Designing, constructing, planning, producing, inventing.

ENGINE COMPONENTS DESIGN (Weightage- 100 %)			
Sl.No	**Name of the Experiments**	**Process verb**	**Types of thinking**
1.	Dismantle and assemble a multi-cylinder petrol engine to identify its nomenclature.	Illustrate Show	Understanding **CO1**
2.	Disassemble, examine the nomenclature, and reassemble a multi-cylinder diesel engine.	Model Build Construct	Applying **CO1**
3.	Examine the fuel systems of petrol and diesel engines.	Recall	Remembering **CO2**
4.	Analyze and measure the frames of light and heavy commercial vehicles.	Recall	Remembering **CO2**
5.	Axle Dismantling and Assembly: Front and Rear Axles	Model Build Construct	Applying **CO3**
6.	Disassemble and assemble differentials and to identify the load distribution.	Model Build Construct	Applying **CO3**
7.	Dismantling and Assembly of a Clutch.	Recall	Remembering **CO4**
8.	Analysis of Gearbox Functioning and Components to	Model	Applying

	Compute Gear Ratios.	Build Construct	**CO4**
9.	Investigate the functioning of steering systems.	Recall	Remembering **CO5**
10.	Explore the cooling and lubrication systems.	Model Build Construct	Applying **CO5**

	R	U	Ap	A	E	C	Total
Type of thinking in Nos	4	1	5	0	0	0	10
Weightage,%	**40**	**10**	**50**	**0**	**0**	**0**	**100%**

	R	U	AP	A	E	C	TOTAL
ENGINE DESIGN	**40**	**10**	**50**	**0**	**0**	**0**	**100%**
TOTAL	**40**	**10**	**50**	**0**	**0**	**0**	**100%**
Lower Order Thinking				**100 %**			
Higher Order Thinking				**0.00 %**			

Mapping course outcome with Bloom's Taxonomy LOT and HOT:

	R	U	Ap	A	E	C
CO1		√	√			
CO2	√√					
CO3			√√			
CO4	√		√			
CO5	√		√			

19. Mapping Programme outcome with graduate attributes:

	Graduate attributes	Descriptions
PO1	Engineering knowledge	Ability to apply knowledge of mathematics, basic science and engineering to analyze, design and evaluate automotive components and systems.
PO2	Problem analysis	An ability to identify, formulate and analyze the problems related to vehicle design, manufacturing, engine performance, flow resistance and maintenance engineering.
PO3	Design/development of solutions	An ability to design an automobile system and process to meet standard specifications with due consideration for safety and environment.
PO4	Conduct investigations of complex problems	An ability to design and conduct of experiments and apply knowledge to analyze and interpret the data for inferring valid conclusions.

PO5	Modern tool usage	An ability to implement the techniques, programming skills and latest computer aided engineering tools for modeling, simulation and analysis of complex automobile engineering problems.
PO6	The engineer and society	An ability to analyze the local and global impact of modern technologies on individual organizations, society and culture.
PO7	Environment and sustainability	Apply knowledge of contemporary issues to investigate and solve problems with a concern for sustainability and eco-friendly environment.
PO8	Ethics	Exhibit responsibility in professional, ethical, legal, security and social issues.
PO9	Individual and team work	An ability to comprehend and write effective reports, design documentation, develop effective presentations and give as well as receive clear instructions.
PO10	Communication	An ability to involve multidisciplinary activities effectively as an individual and as a member or a leader in diverse teams.
PO11	Project management and finance	An ability to engage in independent and life-long learning for personal and societal development.
PO12	Life-long learning	An ability to apply management principles and techniques individually/collaboratively in project planning, implementation and control.

	Descriptions
PSO1	Apply their technical knowledge and software proficiency with practical and social perspectives to succeed in the automotive sector.
PSO2	Solve technical challenges and produce realistic outcomes in engine management, transmission system, vehicle structure, hybrid and EV technology.

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1	3	3	3	2	3	2	2	1	2	1	2	2	3	3
CO2	3	3	3	2	2	2	1	1	2	1	2	2	2	2
CO3	3	2	3	2	2	1	1	1	1	1	1	1	2	2
CO4	3	2	3	3	3	2	1	1	2	1	3	3	3	3
CO5	3	3	3	3	3	2	2	1	2	1	3	3	3	3

3	High level	2	Moderate level	1	Low level

20. Mapping course with programme educational objectives:

Programme educational objectives:

The graduates will be able to:

PEO1: Apply analytical and computational techniques to address the challenges in automotive industry.

PEO2: Utilize their innovation, leadership skills and entrepreneurial skills to excel in their profession.

PEO3: Exhibit professionalism, team spirit and pursue lifelong learning with social concern to achieve career and organizational goals

	PEO1	PEO2	PEO3
AUTOMOTIVE COMPONENTS LABORATORY	3	3	2

3	High level	2	Moderate level	1	Low level

21. Course assessment methods:

Record/ Observation Mark: 5 marks

Objective	To enhance students' understanding of a particular reading
Product	Hand written in a record book
Frequency	After completing one experiment
Format	Each experiment has 5 mark
Evaluation	Based on aim, procedure and neatness
Criteria	Submit on or before the date of submission

Experimental Set up/Execution/Result Mark: 15 marks

Objective	Based on the theoretical knowledge setting the experiments- Procedure- finishing - & Result
Product	Result
Frequency	After completing one experiment
Format	Each experiment has 15 mark
Evaluation	Based on procedure and Finishing of the component
Criteria	Submit on or before the date of submission

Model Lab: 25 Marks

Objective	To Identify What Students have learned and also to identify students strength and weakness and to know about experiment
Product	Answer scripts
Frequency	Once in a semester
Format	Total marks = 25 Duration : 2hour and 30 minutes
Evaluation	Based on answer given in the scripts
criteria	If not, remedial action will be taken.

Viva-Voce: 5 marks

Objective	To measure knowledge, abilities, and/or skills.
-Product	Questions and answers
Frequency	After completing each experiment
Format	Objective type questions
Evaluation	Based on answer given by students
Criteria	-

End semester exam: 50 marks

Objective	**To assess the each student's knowledge of the course**
Product	Result analysis
Frequency	Semester
Format	Aim and Procedure = 20 marks Skill, tools usage and finishing of the component = 50 marks Result = 15 Marks Viva-Voce= 15 Marks Total marks = 100 and this mark is converted to 50 marks Duration : 3 hours
Evaluation	Based on answer given in the scripts
criteria	Minimum pass percentage: 50% If not, remedial action will be taken.

22. Course assessment: (Indirect Assessment Method)

Course Exit Survey: Course Exit Survey consists of few critical questions that evaluate the level of students' satisfaction level with curriculum and course being taught.

Prepared by,

Course Coordinator
(KRISHNARAJ J, AUTOMOBILE)

Checked by,

Head of the Department

Dean (Academics)

Approved by,

Principal

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Course Information Sheet (CIS)

1. **Academic Year** :2023–2024(ODD)
2. **Name of faculty** :J.YOGARAJA
3. **Department** :Automobile Engineering
4. **Programme** :B.E., Automobile Engineering
5. **Class and semester** :IV year and Seventh semester
6. **Course code and title** :21AU5001 and Engine Performance and Emission Testing Laboratory
7. **Regulations** :R2019
8. **Core/Elective** :Core–Lab
9. **Contact Periods** : 45
10. **Type of course** :Practical
11. **Number of credits** : 1.5
12. **Course pre-requisites**:
    (i) 19MA1101 & 19MA2102 Engineering Mathematics
    (ii) 19AU3203 Theory of Automotive Engines
13. **Course learning objectives**:
    - To acquire the basic knowledge of different dynamometers, valve and port timing diagram.
    - To Conduct the Performance and emission Test on the multi cylinder CI and SI engines.
    - To conduct retardation test on IC engine.
    - To conduct heat balance and Morse test on multi cylinder petrol and diesel engines.
    - To understand the P-Θ and P-V Diagrams.
14. **Expected outcome of the course:**

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

CO1 Understand the basic knowledge of different dynamometers, valve and port timing diagram.

CO2 Calculate the Performance and emission Test on the multi cylinder CI and SI engines

CO3 Calculate the retardation test on IC engines

CO4 Calculate the heat balance and Morse test on multi cylinder petrol and diesel engines

CO5 Calculate the P-Θ and P-V Diagrams

15. Course Syllabus:

LIST OF EXPERIMENTS

1. Study of hydraulic, electrical and eddy current dynamometers
2. Valve timing and port timing diagram
3. Performance and emission test on two wheeler SI engine
4. Performance and emission test on automotive multi-cylinder SI engine
5. Performance and emission test on automotive multi-cylinder CI engine
6. Retardation test on I.C. Engines.
7. Heat balance test on automotive multi-cylinder SI engine
8. Heat balance test on automotive multi-cylinder CI engine
9. Morse test on multi-cylinder SI engine
10. P-θ and P-V diagrams for IC engine with piezo-electric pick up, charge amplifier, angle encoder and PC.

TOTALHOURS:45

16. Course plan:

Name of the Experiment	No. of Hrs	Cum Hours
Introduction	2	2
Study of Hydraulic, Electrical and Eddy Current Dynamometers	4	6
Valve Timing and Port Timing Diagram	4	10
Performance and Emission Test on Two Wheeler SI Engine	4	14
Performance and Emission Test On Automotive Multi-Cylinder SI Engine	4	18
Performance and Emission Test On Automotive Multi-Cylinder CI Engine	4	22
Retardation Test on I.C. Engines.	4	26
Heat Balance Test on Automotive Multi-Cylinder SI Engine	4	30
Heat Balance Test on Automotive Multi-Cylinder CI Engine	4	34
Morse Test on Multi-Cylinder SI Engine	4	38
P-Θ and P-V Diagrams for IC Engine with Piezo-Electric Pick Up, Charge Amplifier, Angle Encoder and PC	4	42
Model Examination	3	45

Total No. of lecture Periods:45

17. Weightage of unit contents:

Factors considered

F1 Number of hours allotted for the units

F2 Usefulness of content with respect to student's work [0-5 scale: 0-not useful and 5-highlyimportant]

F3 usefulness of content with respect to other units of same subject [0-5 scale:0-not useful

F4 and 5-highly important]
usefulness of content with respect to other subjects for the same programme[0-5 scale: 0-notusefuland5-highly important]

Sl. No	Topics	F1	F2	F3	F4	W[in Nos.]	W[in %]
1.	Study of Hydraulic, Electrical and Eddy Current Dynamometers	6	3	5	3	17	11.64
2.	Valve Timing and Port Timing Diagram	3	5	3	2	13	8.9
3.	Performance and Emission Test on Two Wheeler SI Engine	3	5	5	2	15	10.27
4.	Performance and Emission Test On Automotive Multi-Cylinder SI Engine	3	5	5	2	15	10.27
5.	Performance and Emission Test On Automotive Multi-Cylinder CI Engine	3	5	5	2	15	10.27
6.	Retardation Test on I.C. Engines.	3	5	5	1	14	9.58
7.	Heat Balance Test on Automotive Multi-Cylinder SI Engine	3	5	5	2	15	10.27
8.	Heat Balance Test on Automotive Multi-Cylinder CI Engine	3	5	5	2	15	10.27
9.	Morse Test on Multi-Cylinder SI Engine	3	5	4	1	13	8.71
10.	P-Θ and P-V Diagrams for IC Engine with Piezo-Electric Pick Up, Charge Amplifier, Angle Encoder and PC	6	4	2	2	14	9.82

18. Mapping syllabus with Bloom's Taxonomy LOT and HOT:

Lower Order Thinking		
R	Remembering	Students are expected to Recall the information through Recognizing, listing, describing, retrieving, naming, finding
U	Understanding	Students are expected to Explain an ideas or concepts through Interpreting, summarizing, paraphrasing, classifying, explaining
Ap	Applying	Students are expected to Use the information in another familiar Situation through Implementing, carrying out, using, executing
Higher Order Thinking		
A	Analysing	Students are expected to Break the information into parts to explore Understandings and relationships through Comparing, organizing, deconstructing, interrogating, finding
E	Evaluating	Students are expected to Evaluate the Justify in a decision or course of action through Checking, hypothesizing, experimenting, judging
C	Creating	Students are expected to Generate new ideas, products, or ways of viewing things through Designing, constructing, planning, producing, inventing.

Dynamometers and Timing diagrams								
Sl. No	**Name of the Experiments**						**Process verb**	**Types of thinking**
1	Study of Hydraulic, Electrical and Eddy Current Dynamometers						Describe	Understand
2	Valve Timing and Port Timing Diagram						Describe	Understand
		R	**U**	**Ap**	**A**	**E**	**C**	**Total**
Type of thinking in Nos.		0	2	0	0	0	0	2
Weightage,%		**0**	**20.54**	**0**	**0**	**0**	**0**	**20.54%**
Performance of IC Engine								
3	Performance and Emission Test on Two Wheeler SI Engine						Calculate	Evaluating
4	Performance and Emission Test On Automotive Multi-Cylinder SI Engine						Calculate	Analyzing
5	Performance and Emission Test On Automotive Multi-Cylinder CI Engine						Calculate	Evaluating
		R	**U**	**Ap**	**A**	**E**	**C**	**Total**
Type of thinking in Nos.		0	0	2	1	0	0	3
Weightage,%		**0**	**0**	**20.54**	**10.27**	**0**	**0**	**30.81%**
Retardation Test on IC Engine								
6	Retardation Test on I.C. Engines.						Calculate	Evaluating
		R	**U**	**Ap**	**A**	**E**	**C**	**Total**
Type of thinking in Nos.		0	0	1	0	0	0	1
Weightage,%		**0**	**0**	**9.58**	**0**	**0**	**0**	**9.58%**
Heat Balance Test on IC Engine								
7	Heat Balance Test on Automotive Multi-Cylinder SI Engine						Calculate	Evaluating
8	Heat Balance Test on Automotive Multi-Cylinder CI Engine						Calculate	Evaluating
		R	**U**	**Ap**	**A**	**E**	**C**	**Total**
Type of thinking in Nos.		0	0	2	0	0	0	2
Weightage,%		**0**	**0**	**20.54**	**0**	**0**	**0**	**20.54%**
Testing of IC Engine								
Sl. No	**Name of the Experiments**						**Process verb**	**Types of thinking**
9	Morse Test on Multi-Cylinder SI Engine						Calculate	Evaluating

10	P-Θ and P-V Diagrams for IC Engine with Piezo-Electric Pick Up, Charge Amplifier, Angle Encoder and PC			Calculate		Evaluating	
	R	**U**	**Ap**	**A**	**E**	**C**	**Total**
Type of thinking in Nos	0	2	0	0	0	0	2
Weightage,%	**0**	**18.53**	**0**	**0**	**0**	**0**	**18.53%**

	R	U	AP	A	E	C	TOTAL
Dynamometers and Timing diagrams	0	20.54	0	0	0	0	20.54%
Performance of IC Engine	0	0	20.54	10.27	0	0	30.81%
Retardation Test on IC Engine	0	0	9.58	0	0	0	9.58%
Heat Balance Test on IC Engine	0	0	20.54	0	0	0	20.54%
Testing of IC Engine	0	18.53	0	0	0	0	18.53%
TOTAL	0	39.07	50.66	10.27	0	0	100
Lower Order Thinking							89.73%
Higher Order Thinking							10.27%
Total							100%

19. Mapping course outcome with Bloom's Taxonomy LOT and HOT:

	R	U	Ap	A	E	C
CO1		✓✓				
CO2			✓✓	✓		
CO3			✓			
CO4			✓✓			
CO5		✓✓				

20. Mapping Programme outcome with graduate attributes:

	Graduate attributes	**Descriptions**
PO1	Engineering knowledge	Ability to apply knowledge of mathematics, basic science and Engineering to analyze, design and evaluate automotive components and systems.
PO2	Problem analysis	An ability to identify, formulate and analyze the problems related to vehicle design, manufacturing, engine performance, flow resistance And maintenance engineering.

PO3	Design/development of solutions	An ability to design an automobile system and process to meet standard specifications with due consideration for safety and environment.
PO4	Conduct investigations of complex problems	An ability to design and conduct of experiments and apply knowledge to analyze and interpret the data for inferring valid conclusions.
PO5	Modern tool usage	An ability to implement the techniques, programming skills and latest computer aided engineering tools for modeling, simulation and analysis of complex automobile engineering problems.
PO6	The engineer and society	An ability to analyze the local and global impact of modern technologies on individual organizations, society and culture.
PO7	Environment and sustainability	Apply knowledge of contemporary issues to investigate and solve Problems with a concern for sustainability and eco-friendly environment.
PO8	Ethics	Exhibit responsibility in professional, ethical, legal, security and social issues.
PO9	Individual and teamwork	An ability to comprehend and write effective reports, design documentation, develop effective presentations and give as well as receive clear instructions.
PO10	Communication	An ability to involve multidisciplinary activities effectively as an Individual and as a member or a leader in diverse teams.
PO11	Project management and finance	An ability to apply management principles and techniques Individually / collaboratively in project planning, implementation and control.
PO12	Life-long learning	An ability to engage in independent and life-long learning for Personal and societal development.

	Descriptions
PSO1	Apply their technical knowledge and software proficiency with practical and social perspectives to succeed in the automotive sector.
PSO2	Solve technical challenges and produce realistic outcomes in engine management, transmission system, vehicle structure, hybrid and EV technology.

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1	3		2			2			2				1	1
CO2	3		2			1		2	2		1			
CO3	3		1	2		2	2	2	2		2	2	1	2
CO4	3		2	2		2			2				1	1
CO5	3		2			1			2					

3	High level	2	Moderate level	1	Low level

21. Mapping course with programme educational objectives:

Programme educational objectives:

PEO1	Apply analytical and computational techniques to address the challenges in automotive industry.
PEO2	Utilize their leadership skills and entrepreneurial skills to excel in their profession
PEO3	Exhibit professionalism, team spirit and pursue lifelong learning with social concern to achieve career and organizational goals

	PEO1	PEO2	PEO3
ENGINE PERFORMANCE AND EMISSION TESTING LAB	2	1	

3	High level	2	Moderate level	1	Low level

22. Course assessment methods:

Record/Observation Mark: 75marks

Objective	To enhance students' understanding of a particular reading
Product	Hand written in a record book
Frequency	After completing one experiment
Format	Each experiment has 5mark
Evaluation	Based on procedure, reading and calculation
Criteria	Submit on or before the date of submission

Model Lab: 25 Marks

Objective	To Identify What Students Have Learned and also to identify students strength and Weakness and to know about experiment
Product	Answer scripts
Frequency	Once in a semester
Format	Total marks =25 Duration: 2 hour and 30 minutes
Evaluation	Based on answer given in the scripts
criteria	If not, remedial action will be taken.

Internal Assessment (100 marks)

Evaluation of laboratory observation and record	**Model exam**
75	25
Internal assessment marks shall be converted into **60** marks	

End semester exam: 40 marks

Objective	**To assess the each student's knowledge of the course**
Product	Result analysis
Frequency	Semester
Format	Aim and Procedure/Algorithm=20marks Reading, calculation, Circuits, Connections Coding & Execution = 50 marks Result= 20 Marks Viva-Voice=10 Marks Total marks = 100 and this mark is converted to 50 marks Duration: 3hours
Evaluation criteria	Based on answer given in the scripts Minimum pass percentage:50% If not, remedial action will be taken.

23. Course assessment: (Indirect Assessment Method)

Course Exit Survey: Course Exit Survey consists of few critical questions that evaluate the level of students' satisfaction level with curriculum and course being taught.

Prepared by,

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Checked by,

Head of the Department

Approved by,

Dean (Academics)

PRINCIPAL