DR.BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/ Sci & Tech./M.Voc/NEP/42/2024.

It is hereby inform to all concerned that, on the recommendation of Dean of Faculty of Science & Technology; **the Hon'ble Vice-Chancellor has accepted the following subject wise curriculum as per norms of university grants commission and National Education Policy-2020 ran at University Campus** Under the faculty of Science & Technology in his emergency powers under Section 12 [7] of the Maharashtra Public University Act, 2016 on behalf of the Academic Council

Sr.No	Subject Name	Semester
1.	**M.Voc in Industrial Automation (Industry Embedded) (New)**	**I & II**
2.	**M.Voc in Automobile Technology (Industry Embedded) (New)**	**I & II**

This is effective from the Academic Year 2024-25 onwards under the Faculty of Science & Technology.

All concerned are requested to note the contents of the circular and bring notice to the students, teachers and staff for their information and necessary action.

University campus,
Chhatrapati Sambhajinagar-431 004.
Ref. No.SU/M.voc./syllabus./2024-25/ 8570-78
Date: 10.10.2024

****

Deputy Registrar,
Academic Section.
(Syllabus)

Copy forwarded with compliments to :-

1] **The Director,Deen Dayal Upadhyay Kaushal Kendra, Dr. Babasaheb Ambedkar Marathwada University.**
2] **The Director,** University Network & Information Centre, UNIC, with **a request to upload the curriculum along with this Circular on University Website.**

Copy to :-

1] **The Director, Board of Examinations & Evaluation,** Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
2] The Section Officer, [B.Voc Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
3] The Programmer, [Computer Unit-1] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
4] The Programmer, [Computer Unit-2] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
5] The In-charge, [E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
6] The Public Relation Officer, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,

CHHATRAPATI SAMBHAJINAGAR-431004 (M.S.), INDIA

FACULTY OF SCIENCE AND TECHNOLOGY

Master of Vocation in Automobile Technology

(M. VOC. in Automobile Technology)

(2 Years Industry Embedded P.G. Program)

As Per

National Education Policy-2020

Course Structure and
Outcome based Curriculum

For University Department

Deen Dayal Upadhyay KAUSHAL Kendra

(Department with Academic Autonomy)

Effective from the Academic Year 2024-25

PREAMBLE

The National Education Policy (NEP) 2020 has introduced significant reforms aimed at transforming the education landscape in India. Here's how NEP 2020 intersects with skill education:

1. **Multidisciplinary Education**: NEP 2020 emphasizes multidisciplinary education, encouraging students to pursue a broad range of subjects and skills. This approach promotes flexibility and enables students to develop diverse skill sets tailored to their interests and career goals.
2. **Holistic Development**: The policy advocates for holistic development, which includes not only academic learning but also social, emotional, and vocational skills. This holistic approach ensures that students are well-rounded individuals equipped to navigate various aspects of life and work.
3. **Vocational Education and Internships**: NEP 2020 places a strong emphasis on vocational education, integrating it into mainstream curriculum from an early age. The policy encourages hands-on learning experiences, internships, and apprenticeships to provide practical skills and real-world exposure to students.
4. **Focus on Critical Thinking and Problem-Solving**: NEP 2020 prioritizes the development of critical thinking, creativity, and problem-solving skills. These skills are essential for innovation and adaptability in a rapidly changing world and are integrated across all levels of education.
5. **Flexible Learning Pathways**: The policy promotes flexible learning pathways, allowing students to choose their own educational trajectories based on their interests, aptitudes, and aspirations. This flexibility enables students to explore diverse skill areas and tailor their education to suit their individual needs.
6. **Teacher Training and Professional Development**: NEP 2020 recognizes the importance of teacher training and professional development in enhancing the quality of education. The policy emphasizes continuous learning for teachers, equipping them with the knowledge and skills necessary to effectively nurture students' talents and abilities.
7. **Digital Education and Technology Integration**: The policy advocates for the integration of digital technology in education to enhance access, equity, and quality. Digital platforms and tools are leveraged to facilitate interactive learning experiences, skill development, and personalized instruction.

By aligning with the principles and objectives of NEP 2020, skill education in India is poised to undergo a transformative shift, fostering innovation, equity, inclusivity, and excellence in education. These contexts have remained as mainframe while developing this curriculum.

The University has adapted Outcome-based education (OBE) since 2017. OBE is widely adopted in educational systems globally due to student centric advantages. OBE provides clear and measurable learning objectives that help students focus and stay motivated. It emphasizes real-world skills, bridging the gap between academia and the workforce. Customized learning paths are possible, accommodating different learning styles and promoting inclusivity. OBE focuses on mastery and competency rather than seat time, encouraging deeper learning and retention of knowledge. Continuous improvement is encouraged through ongoing assessment and feedback. OBE promotes accountability and transparency, allowing stakeholders to monitor progress and evaluate educational programs. It equips students with skills needed for the globalized economy, fostering critical thinking and collaboration. Lifelong learning skills like self-directed learning and adaptability are developed, creating a culture of continuous improvement. Overall, OBE offers a holistic approach to education, emphasizing relevant skills, competencies, and attitudes crucial for success in today's ever-changing world.

The authorities of Dr. Babasaheb Ambedkar Marathwada University, CHHATRAPATI SAMBHAJINAGAR (M.S.), remaining aligned to accreditation standards of National Assessment and Accreditation Council, decided to opt for National Education and Policy and Outcomes Based Education (OBE). As the part of the decision, different meetings, workshops and presentations were held at the campus of university. This document is the outcome such meetings and workshops held at university level and department level. The detailed document is designed and the existing curriculum of the department has been meticulously analysed from the standpoint of the immediate and long-time requirements of manufacturing and process industries, and transformed in to the framework of NEP with OBE. This is the first step towards the implementation of NEP with OBE in the university departments and affiliated colleges. The document will serve all stakeholders in the effective implementation of the curriculum. The OBE is continuous process for quality enhancement and it will go a long way in order to enhance the competencies and employability of the graduates/Post-graduates of the university departments and affiliated colleges.

Dr. Babasaheb Ambedkar Marathwada University proposes to offer a two years post graduate programme in Vocation (M. VOC.) in Automobile Technology. The curriculum design of this program is undertaken with following considerations –

The need for expert human resources in Automobile sector is critical for both manufacturing and Service sector due to several key factors:

1. **Technical Expertise**: Automobile sector involves complex systems such as CNC Machines, Supervisory Control and Data Acquisition (SCADA), Special purpose machine tools, and Industrial Internet of Things (IIoT). Expert human resources possess the technical knowledge and skills required to design, program, integrate, and troubleshoot these systems effectively.
2. **Process Optimization**: In manufacturing and service industries, optimization of production processes is essential for maximizing efficiency, reducing costs, and ensuring product quality. Expertise in Automobile Technology enables professionals to analyse processes, identify bottlenecks to streamline operations and improve overall performance.
3. **Safety and Compliance**: Automobile sector must adhere to strict safety standards and regulatory requirements to protect workers, equipment, and the environment. Expert human resources are needed to assess safety risks, implement safety measures, and ensure compliance with industry regulations to maintain a safe and secure working environment.
4. **Reliability and Maintenance**: Automobile machine tools require regular maintenance to ensure reliable operation and minimize downtime. Expert human resources are responsible for preventive maintenance activities, such as system inspections, software updates, and equipment calibration, to prevent unexpected failures and disruptions in production.
5. **Innovation and Continuous Improvement**: Expert human resources drive innovation and continuous improvement initiatives within manufacturing and service industries by exploring new automation technologies, evaluating their potential applications, and implementing innovative solutions to enhance productivity, quality, and competitiveness.

To summarize, expert human resources play a pivotal role in leveraging Automobile Sector to optimize processes, ensure safety and compliance, enhance reliability, and drive innovation in both manufacturing and Auto component industries.

Course Structure and Curriculum for
Master of Vocation (M. VOC.) in Automobile Technology
Illustrative Course and Credit Distribution Structure for
Two Years Post Graduate Programme with Multiple Entry Exit Options

Year / level	Sem.	Major subject		RM	OJT /FP	RP	Credits	Degree
		DSC Core Mandatory	DSE (Elective)					
First year 6.0	I	3(4) +2=14	4	4	--	--	22	PG Diploma (after 3 years degree)
	II	3(4) +2=14	4	--	4	--	22	
Cum. Cr. For PG Diploma		28	08	4	4	--	44	
Exit option with Post-graduate Diploma (44 credits) after first year or two semester with completion of courses equivalent to 44 credits								
Second Year 6.5	III	3(4)+2=14	4	---	---	4	22	PG Degree after 3 years UG or PG Degree after 4 years UG
	IV	3(4)=12	4	---		6	22	
Cum. Cr. For 1 year PG Degree		26	8			10	44	
Cum. Cr. For 2 years PG Degree		54	16	4	4	10	88	
2 Years -4 sem.PG Degree (88 credits) after three year UG Degree or 1 Year -2 sem. PG Degree (44 credits) after four year UG degree								

Note- DSC - is Discipline specific Core courses and are mandatory
Major – Comprising Mandatory – based on core subjects
DSE- Discipline Specific Elective based on specialization
OJT – On-the- Job Training
FP – Field Project (Corresponding to the Major (Specialization) Subject
RP – Research Project (Corresponding to the Major (Specialization) Subject
Internship/Apprenticeship - (Corresponding to the Major (Specialization) Subject

Course and Credit Distribution Structure for
Two Years Post Graduate Programme with Multiple Entry Exit Options
Class: M. VOC. First Year Semester: First Semester Subject: Automobile Technology

Course Type	Course Code	Course Name	Teaching Scheme (Hrs./Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Discipline Specific Core Course (DSC) Mandatory	MATT/MJ/500	Fuels and Combustion	2	--	2	--	14
	MATT/MJ/501	Measurement and Control	2	--	2	--	
	MATT/MJ/502	Automobile Air Conditioning	2	--	2	--	
	MATT/MJ/503	Project Management-I	2	--	2	--	
	MATP/MJ/504	Practical Based on MATT/MJ/500	--	4	--	2	
	MATP/MJ/505	Practical Based on MATT/MJ/501	--	4	--	2	
	MATP/MJ/506	Practical Based on MATT/MJ/502	--	4	--	2	
DSE (Choose any one from pool of Course)	MATT/DSE/507A	Automobile Engine Components Design	2	---	2	---	4
	MATP/DSE/507A	Practical Based on MATT/DSE/507A	---	4	---	2	
	OR						
	MATT/DSE/507B	Vehicle Dynamics	2	---	2	---	
	MATP/DSE/507B	Practical Based on MATT/DSE/507B	---	4	---	2	
RM	MATT/RM/508	Research Methodology	4	--	4	--	4
			14	16	14	8	22

Course and Credit Distribution Structure for
Two Years Post Graduate Programme with Multiple Entry Exit Options
Class: M. VOC. First Year Semester: Second Semester Subject: Automobile Technology

Course Type	Course Code	Course Name	Teaching Scheme (Hrs./Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Discipline Specific Core Course (DSC) Mandatory	MATT/MJ/550	Electrical Vehicles	2	--	2	--	14
	MATT/MJ/551	Advanced Hydraulics and Pneumatics	2	--	2	--	
	MATT/MJ/552	Transmission System Design	2	--	2	--	
	MATT/MJ/553	Project Management-II	2	--	2	--	
	MATP/MJ/554	Practical Based on MATT/MJ/550	--	4	--	2	
	MATP/MJ/555	Practical Based on MATT/MJ/551	--	4	--	2	
	MATP/MJ/556	Practical Based on MATT/MJ/552	--	4	--	2	
DSE (Choose any one from pool of Course)	MATT/DSE/557A	Automobile Body Engineering	2	--	2	--	4
	MATP/DSE/557A	Practical Based on MATT/DSE/557AT	--	4	--	2	
	OR						
	MATT/DSE/557B	Vehicle Aerodynamics and Design	2	---	2	---	
	MATP/DSE/557B	Practical/ Case Study Based on MATT/DSE/557BT	--	4	---	2	
OJT/FIELD PROJECT	MAT/OJT/FP/558 (Field Project)		--	8	--	4	4
			10	24	10	12	22

Course and Credit Distribution Structure for
Two Years Post Graduate Programme with Multiple Entry Exit Options
Class: M. VOC. Second Year Semester: Third Semester Subject: Automobile Technology

Course Type	Course Code	Course Name	Teaching Scheme (Hrs./Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Discipline Specific Core Course (DSC) Mandatory	MATT/MJ/600	Automotive Emissions and Control	2	--	2	--	14
	MATT/MJ/601	Automotive Ergonomics	2	--	2	--	
	MATT/MJ/602	Material Handling System	2	--	2	--	
	MATT/MJ/603	Automotive Tribology	2	--	2	--	
	MATP/MJ/604	Practical Based on MATT/MJ/600	--	4	--	2	
	MATP/MJ/605	Practical Based on MATT/MJ/601	--	4	--	2	
	MATP/MJ/606	Practical Based on MATT/MJ/602	--	4	--	2	
DSE (Choose any one from pool of Course)	MATT/DSE/607A MATP/DSE/607A	Product Design and Development Practical Based on MATT/DSE/607A	2	4	2	2	4
	OR						
	MATT/DSE/607B MATP/DSE/607B	Operations Management - I Practical/Case Study Based on MATT/DSE/607B	2	4	2	2	
RP - 1	MAT/RP-1/608	Research Project/Phase – I	--	8	--	4	4
			10	24	10	12	22
OR							
MAT/OJT/FP/609 - I			To be carried out in relevant Industry				22

Course and Credit Distribution Structure for
Two Years Post Graduate Programme with Multiple Entry Exit Options
Class: M. VOC. Second Year Semester: Fourth Semester Subject: Automobile Technology

Course Type	Course Code	Course Name	Teaching Scheme (Hrs./Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Discipline Specific Core Course (DSC) Mandatory	MATT/MJ/650	Production Planning & Control	2	--	2	--	14
	MATT/MJ/651	Design for Quality, Manufacturing and Assembly	2	--	2	--	
	MATT/MJ/652	Industrial Automation	2	--	2	--	
	MATP/MJ/654	Practical Based on MATT/MJ/650	--	4	--	2	
	MATP/MJ/655	Practical Based on MATT/MJ/651	--	4	--	2	
	MATP/MJ/656	Practical Based on MATT/MJ/652	--	4	--	2	
DSE (Choose any one from pool of Course)	MATT/DSE/657A MATP/DSE/657A	Intellectual Property Rights Practical/Case Study Based on MATT/DSE/657A	2	4	2	2	4
	OR						
	MATT/DSE/657B MATP/DSE/657B	Operations Management - II Practical/Case Study Based on MATT/DSE/608A	2	4	2	2	
RP - 2	MAT/RP-2/658	Research Project/Phase – II	--	8	--	4	4
			10	24	10	12	22
OR							
MAT/OJT/FP/659 -II			To be carried out in relevant Industry				22

Vision

To Foster an Academic Environment for providing affordable skill based education and training, in alignment to National Standards, under the fundamental aegis of Accessibility, Equity and Inclusion

Mission

- To continue with our responsive standpoint towards changing occupational demands by continuous augmentation of training expertise and infrastructure through industry-academia cooperative ecosystem
- To structure a concrete mechanism to reach closer to student fraternity to ensure inclusion of the truly needed part of society where affordable and quality skill-education defines the pivot for a socio-economic revolution
- To expand training domains to address challenges of multidisciplinary format of employment and entrepreneurial opportunities
- To come up with Open Distance Learning (ODL) models to improve accessibility of skill education and facilitate lifelong learning
- To continuously strive for a cohesive academic atmosphere that aids in gaining cognitive skills through enhanced experiential learning and to come up with strategic formative assessment to address outcome challenges at individual level

Program Educational Objectives:

The objectives of M.Voc (Automobile Technology) program are to produce graduates who -

1. Have a strong foundation in Automobile systems and Automobile Troubleshooting and Diagnostics with an ability to solve important problems in modern technological society as valuable, productive Supervisors and Managers.

2. Have a broad based background to practice Automobile Technology in the areas of Automobile Manufacturers, Service Industry, Autotronics, Auto Ancillary industry and Government sectors meeting the growing expectations of stakeholders.
3. Have an ability to pursue higher studies and succeed in academic and professional careers.
4. Have the ability to address professional demands individually and as a team member communicating effectively in technical environment using modern tools.
5. Recognize the need for and possess the ability to engage in lifelong learning.
6. Will be sensitive to consequences of their work both ethically and professionally for productive professional career.

Program Outcomes (PO):

Vocational Education is education that prepares the students for specific trades, crafts and career sat various levels and scopes. It trains the students from a trade/ craft, technician or professional position in R & D organizations. The Program Outcomes are the skills and knowledge which the students have at each exit level/at the time of graduation. These Outcomes are generic and are common to all exit levels mentioned in the program structure. Graduates of the M.Voc program are expected to -

PO1. Domain knowledge: Apply advanced knowledge of the specific skill based trade for the solution of target skill sector.

PO2. Problem Analysis: Identify industry domain related problems at varied complexity and analyze the same to formulate/ develop substantiated conclusion using first principles of domain sectors and technical literature.

PO3. Design Development of solutions: Design / develop solutions for specific critical problems in the target skill based trade to address changing challenges put forward by market demand/ stakeholder

PO4. Conduct Investigation of complex problems: Design and conduct technology enabled experiments, analyze the resulting data and interpret the same to provide valid conclusions

PO5. Modern tools: Use the techniques, skills and modern tools necessary skill-based trade to practice with clear understanding of limitations.

PO6. The citizenship and society: Apply sound understanding of ethical and professional skill-based trade practice in the context of global, economic, environmental and societal realities while encompassing relevant contemporary issues.

PO7. Environment and sustainability: Apply sound understanding of impact of skill-based trade in a global, economic, environmental and societal context.

PO8. Ethics: Apply ability to develop practical solutions for skill trade problems within positive professional and ethical boundaries.

PO9. Individual and team work: Function effectively as a leader and as well as team member in diverse/ multidisciplinary environments.

PO10. Communication: Communicate effectively in oral and written format addressing specific professional/ social demands.

PO11. Project management and finance: Demonstrate knowledge and understanding of the first principles of skill trade and apply these to one's own work as a member and leader in a team, to complete project in any environment.

PO12. Life-long learning: Recognize the need for and have the ability to address to the changing technological demands of the target skill trade.

Program Specific Outcomes (PSO):

Graduates of the M.Voc (Automobile Technology) program are expected to -

1. Apply knowledge of Automobile Technology to serve manufacturing, service & sales industries in solving complex problems in automotive field.
2. Design systems for motor vehicles, their manufacturing & servicing & repair sectors.
3. Diagnose faults in motor vehicles and its systems.
4. Use the techniques, skills and modern tools necessary for Automobile Technology practice with clear understanding of limitations.

Eligibility:

Those who have completed B.Voc. (Automobile)/ B.Sc with Automobile / B. E/ B. Tech (Automobile/ Mechanical/Production/Mechatronics) from any recognized Board/Institution are eligible for registration / admission.

Admission / Promotion Process:

in response to the advertisement for registration, interested students will have to register themselves. Admission should be done on the basis of performance of students at Common Entrance Test (CET). The CET will be conducted in the month of June every year. There is Full Carry on for M.Voc i.e. irrespective of individual performance in first year; a student should be promoted to Second Year. However, for obtaining M. Voc. Degree, a student will have to complete all semesters successfully within 04 years/ 08 semesters. It also offers multiple exit/entry. Students can exit after completion of one year and can enter into the system (second year) with 5 years from the date of first time registration.

Dropout students will be allowed to register for respective semester as and when the concerned courses are offered by the department, **HOWEVER HE / SHE SHOULD NOT EXCEED MORE THAN TWICE THE DURATION OF THE COURSE FROM THE DATE OF FIRST REGISTRATION AT PARENT DEPARTMENT / COLLEGE**. The admission of the concern student will be automatically cancelled if he / she fails to complete the M. VOC. degree within a period of maximum four years / eight semesters.

Choice Based Credit System (CBCS):

The choice based credit system is going to be adopted by the University. This provides flexibility to make the system more responsive to the changing needs of our students, the professionals and society. It gives greater freedom to students to determine their own pace of study. The credit based system also facilitates the transfer of credits. Students will have to earn 88 credits for the award of two years Master of Vocation (M.VOC) degree

Credit-to-contact hour Mapping:

(a) One Credit would mean equivalent of 15 periods of 60 minutes each for theory lecture.

(b) For lab course/ workshops/internship/field work/project, the credit weightage for equivalent hours shall be 50% that for lectures /workshop

(c) For self-learning, based on e-content or otherwise, the credit weightage for equivalent hours of study should be 50% or less of that for lectures/workshops.

Attendance:

Students must have 75 % of attendance in each course for appearing examination, otherwise he / she will be strictly not allowed for appearing the semester examination of each course. Frequent absence from regular lecture/practical course may lead to disqualification from continuous assessment test (CAT) process in respective subject.

Departmental Committee:

The Departmental Committee (DC) of the Department will monitor smooth functioning of the program.

Results Grievances / Redressal Committee

Grievances / redressal committee will be constituted in the department to resolve all grievances relating to the evaluation. The committee shall consist of Head of the department, the concerned teacher of a particular course and senior faculty member of Department of Committee. The decision of Grievances / redressal committee will have to be approved by Department committee.

Evaluation Methods:

Formative assessment is an efficient method to evaluate students' comprehension, learning needs, and academic progress. It offers immediate feedback, enhanced student engagement, personalized learning, improved learning outcomes, and encourages self-assessment. It reduces test anxiety, facilitates differentiation, enhances instructional practices, supports collaborative learning, fosters continuous improvement, encourages a growth mindset, and builds confidence. Formative assessment also reduces test anxiety by lowering the stakes, ensuring all students receive appropriate challenges and support. It also supports a culture of continuous improvement and fosters a growth mindset among students.

This program will adapt Formative assessment/ Continuous Internal Assessments for each 02 credit theory course in following format –

1. **Module-wise Tests – 10 Marks (*03 tests) = 30 marks**
2. **Assignment/Mini Project = 10 Marks**
3. **Seminar Presentation = 10 Marks**

1. **Module-wise Tests 10 Marks (*03 tests) = 30 marks**

Module-wise Tests will be conducted in each theory course immediately after completion of teaching with individual module. Such tests will be of 10 marks comprising of Part A and B.

- Part A will be consisting of 05 questions having 01 mark each (multiple choice questions / fill in the blanks/ answer in one sentence) as compulsory questions and it should cover entire module syllabus (05 Marks)
- Part B will contain 03 questions of 05 marks from module contents, from which students will have to attempt any one.

Every Module-wise Test will be followed by a remedial test. Any student, who has missed to appear for a test can appear for the remedial test. Or if any student wants to improve their performance of main test, will be allowed to appear for remedial test. For all students, who have appeared for main test as well as remedial test, the best performance will be considered for final marks memo preparation.

2. Assignment/Mini Project = 10 Marks

This will remain a group activity and concerned faculty will have to provide assignment/tasks that will lead to incubation of critical and creative thinking ability of students. Depending upon contents of a course, the faculty member may assign a mini project to a group of students as well. However assignment and project will not be given concurrently.

3. Seminar Presentation = 10 Marks

Individual student should deliver a seminar based on topics covered through course contents or topics related to course content. Evaluation of a seminar has to be carried out by course faculty member and an external faculty member.

A Semester End Examination (SEE) for a certain / all theory courses (of 02 credits) will be conducted only for students who will fall short in obtaining passing marks for respective course through the process of formative assessment. Following will be the pattern of SEE Question Paper –

The Question Paper will be of 50 marks consisting of Part A, Part B and Part C

- Part A will be consisting of 10 questions having 01 mark each (multiple choice questions / fill in the blanks/ answer in one sentence) as compulsory questions and it should cover entire module syllabus (10 Marks)
- Part B will contain 09 questions of 05 marks each from module contents, from which students will have to attempt any seven questions. Contents of each module should contribute towards framing of 03 questions. (35 Marks)

- Part C will contain 03 questions of 05 Marks each, from which students will have to attempt any one question. This question should critically look forward to evaluate critical applied thinking capability of a student. Contents of each module should contribute towards framing of 01 question. (05 Marks)

This program will adapt Formative assessment/ Continuous Internal Assessments for each 04 credit theory course in following format –

1. **Module-wise Tests – 20 Marks (*04 tests) = 80 marks**
2. **Assignment = 20 Marks**

4. **Module-wise Tests 20 Marks (*04 tests) = 80 marks**

Module-wise Tests will be conducted in each theory course immediately after completion of teaching with individual module. Such tests will be of 10 marks comprising of Part A and B.

- Part A will be consisting of 05 questions having 02 marks each (multiple choice questions / fill in the blanks/ answer in one sentence) as compulsory questions and it should cover entire module syllabus (05 Marks)
- Part B will contain 04 questions of 05 marks from module contents, from which students will have to attempt any two questions.

Every Module-wise Test will be followed by a remedial test. Any student, who has missed to appear for a test can appear for the remedial test. Or if any student wants to improve their performance of main test, will be allowed to appear for remedial test. For all students, who have appeared for main test as well as remedial test, the best performance will be considered for final marks memo preparation.

5. **Assignment = 20 Marks**

This will remain an individual activity and concerned faculty will have to provide assignment/tasks that will lead to incubation of critical and creative thinking ability of students.

A Semester End Examination (SEE) for a certain / all theory courses (of 04 credits) will be conducted only for students who will fall short in obtaining passing marks for respective course through the process of formative assessment. Following will be the pattern of SEE Question Paper –

The Question Paper will be of 100 marks consisting of Part A, Part B and Part C

- Part A will be consisting of 10 questions having 02 mark each (multiple choice questions / fill in the blanks/ answer in one sentence) as compulsory questions and it should cover entire module syllabus (20 Marks)
- Part B will contain 08 questions of 10 marks each from module contents, from which students will have to attempt any six questions. Contents of each module should contribute towards framing of 02 questions. (60 Marks)
- Part C will contain 04 compulsory short notes of 05 Marks each contents of each module should contribute towards framing of 01 question. (05 Marks)

Earning Credits:

At the end of every semester, a letter grade will be awarded in each course for which a student had registered. A student's performance will be measured by the number of credits that he/she earned by the weighted Grade Point Average (GPA). The SGPA (Semester Grade Point Average) will be awarded after completion of respective semester and the CGPA (Cumulative Grade Point Average) will be awarded at the final exit.

Grading System:

The grading reflects a student-own proficiency in the course. A ten point rating scale shall be used for the evaluation of the performance of the students to provide letter grade for each course and overall grade for the Master Programme. Grade points are based on the total number of marks obtained by him / her in all heads of the examination of the course. The grade points and their equivalent range of marks are shown in Table-I

Table – I: Ten point grade and grade description

Marks Obtained (%)	Grade Point (GPA/CGPA)	Letter Grade	Description
90-100	9.00- 10	O	Outstanding
80-89	8.00-8.99	A^+	Excellent
70-79	7.00-7.99	A	Very Good
60-69	6.00-6.99	B^+	Good
55-59	5.50-5.99	B	Above Average

50-54	5.00-5.49	C	Average
40-49	4.00-4.99	P	Pass
Below 40	Below 4.0	F	Fail
Absent	Absent	Ab	Absent

- Non-appearance in any examination / assessment shall be treated as the students have secured zero marks in that subject examination / assessment.
- Minimum P grade (4.00 grade points) shall be the limit to clear / pass the course / subject. A student with F grade will be considered as "failed" in the concerned course and he / she has to clear the course by appearing in the next successive semester examinations.
- Every student shall be awarded grade points out of maximum 10 points in each subject (based on 10 point scale). Based on the grade points obtained in each subject, Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) shall be computed. Results will be announced at the end of each semester and CGPA will be given at final exit.

Computation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average)

Grade in each subject / course will be calculated based on the summation of marks obtained in all five modules.

The computation of SGPA and CGPA will be as below

- Semester Grade Point Average (SGPA) is the weighted average points obtained by the students in a semester and will be computed as follows

$$SGPA = \frac{\text{Sum (Course Credits) X Number of Grade Points in concerned Course Gained by the Student}}{\text{Sum (Course Credits)}}$$

The SGPA will be mentioned on the grade card at the end of every semester.

- The Cumulative Grade Point Average (CGPA) will be used to describe the overall

performance of a student in all semester of the course and will be computed as under.

$$CGPA = \frac{\text{Sum (All four Semester SGPA)}}{\text{Total Number of Semester}}$$

The SGPA and CGPA shall be rounded off to the second place of decimal.

Grade Card

Results will be declared by the Centre and the grade card (containing the grades obtained by the student along with SGPA) will be issued by the university after completion of every semester. The grade card will be consisting of following details.

- Title of the courses along with code opted by the student.
- Credits associated with the course.
- Grades and grade points secured by the student.
- Total credits earned by the student in a particular semester.
- Total credits earned by the students till that semester.
- SGPA of the student.
- CGPA of the student (at final exit).

Cumulative Grade Card

The grade card showing detail grades secured by the student in each subject in all semesters along with overall CGPA will be issued by the University at final exit.

MATT/MJ/500:Fuels and Combustion

Total Credits :02 TotalContactHours:30Hrs Maximum
Marks : 50

LearningObjectivesof theCourse:

The course should enable students:

1. To gain knowledge about the characteristics of Conventional and Alternate fuels
2. Understand the performance characteristics of SI and CI engines.

CourseOutcomes(COs):

Aftercompletion ofthe course, students willbe able to-

CO1	Describe alternative fuels used in IC engines.
CO2	Evaluate performance of alternative fuels.
CO3	Prepare report of performance of alternative fuels.
CO4	Suggest alternative energy source for various applications of IC engines.
CO5	Explain combustion in CI and SI engines.
CO6	Compare performance of SI and CI engines.

CO-PO Attainment Matrix for Course
(L = Low, M = Medium, H = High)

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO10	PO12		PSO1	PSO2	PSO3
CO 1	H															
CO 2	H															
CO 3	H															
CO 4	H															
CO 5	H															
CO 6	H															

Module No.	Topics/ actual contentsof the syllabus	Contact Hours
I	**Types of Fuels** Introduction, Types of Fuels – Solid, Gaseous and Liquid fuels, Important qualities of SI and CI engine fuels, Rating of SI and CI engine fuels, Alternate fuels,	**10Hrs**
II	**Properties of Fuels** Cetane number, Octane number, Flash point, pour point, Fire point, proximate analysis, ultimate analysis, Combustion equations and calculation of Air-Fuel ratio, Analysis of Exhaust and Flue gas, Orsat Apparatus.	**10Hrs**
III	**Combustion in Engines** Introduction, Homogeneous mixture, Heterogeneous mixture, Stages of Combustion in SI & CI Engines, Pre-ignition, Ignition lag, Flame Front Propagation, Factors influencing flame speed, Rate of pressure rise, Abnormal combustion, Phenomenon of knock/detonation in SI & CI engines, Effects of engine variables on knock, Combustion chambers for SI & CI engines.	**10Hrs**

TextBooks:

1. Combustion Engineering – Gary L. Borman, Kenneth W. Ragland, McGraw Hill, 1998 ISBN 10: 0070065675/ ISBN 13: 9780070065673
2. Principles of Combustion – Kenneth K. Kuo, John Wiley & Sons, 2nd edition, (2005), ISBN-13: 978-0471046899, ISBN-10: 0471046892
3. Fundamentals and Technology of Combustion, Mahallawy-Habik, *Elsevier Science (2002). ISBN*10: 0080441068*ISBN*13: 9780080441061.
4. Fuels & Combustion – S. P. Sharma & Chander Mohan, Tata McGraw Hill, (1987) ISBN: 0070966273 9780070966277
5. Fuels & Combustion – Samir Sarkar, Universities Press, 3rd edition (2010), ISBN 1439825416, 9781439825419
6. A Course in Internal Combustion engine, Mathur-Sharma, Dhanpat Rai Publication (2010), ISBN-10: 8189928465, ISBN-13: 978-8189928469
7. Internal Combustion Engines, Ganesan.V, Tata McGraw Hill Publishing Co., New York, 4th Edition (2012), *ISBN*-0-07-049457-6.
8. Internal Combustion Engines, K.K. Ramalingam, SCITECH, 2nd edition (2011), *ISBN* 13: 9788183711029

MATP/MJ/504:Practical Based on Fuels and Combustion

Total Credits :02 TotalContactHours:30Hrs Maximum
Marks : 50

CourseOutcomes(COs):

Aftercompletion ofthe course, students willbe able to–

1. Accurately measure and analyze the flash and fire points of various fuels using the Pensky Martin apparatus.
2. Operate a digital bomb calorimeter to determine the calorific value of liquid fuels.
3. Conduct aniline point tests and analyze the results to determine the aromatic content of fuels.
4. Measure and interpret the vapor pressure of fuels using the Reid vapor pressure apparatus.
5. Utilize a 4-gas analyzer to perform exhaust gas analysis on engine exhausts.

CO-PO Attainment Matrix for Course
(L = Low, M = Medium, H = High)

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO10	PO12		PSO1	PSO2	PSO3
CO 1		H														
CO 2		H														
CO 3		H														
CO 4		H														
CO 5		H														

List of Practicals

1. Determination of flash point and fire point of fuels using Pensky Martin Apparatus.
2. Determination of Calorific Value of liquid Fuel using Digital Bomb Calorimeter
3. Determination of Aniline point of fuel using aniline point test apparatus.
4. Determination of vapor pressure of fuel using reid vapor pressure apparatus.
5. Perform exhaust gas analysis of an engine exhaust using 4-gas analyzer. Diagnose engine condition from exhaust gas analysis
6. Study of Orsat apparatus.
7. Viscosity Index of lubricating oil by Saybolt Viscometer.

MATT/MJ/501:Measurement and Control

Total Credits:02 TotalContactHours:30Hrs

Maximum Marks: 50

LearningObjectivesof theCourse:

The course should enable students:

1. To understand the Static and Dynamic Characteristics of instruments.
2. To understand procedure adopted for measuring pressure, temperature and flow.

CourseOutcomes(COs):

On completion of this course, students should be able to-

1. Classify Static and Dynamic characteristics of instruments.
2. Perform Pressure, Flow, and Temperature measurement.
3. Perform speed, force torque measurement with the help of various sensors

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1		H														
CO2		H														
CO3		H														

Module No.	Course Content	Contact Hours
I	**Static and Dynamic characteristics of Instruments:** Research – Definition, Characteristics, Function, Objective, Classification; Action Research; Problem – Reflective and Scientific Thinking, Identification of Problem, Sources, Criteria for selection of problem, Definition of Problem, Characteristics of Problem, Evaluation of Problem; Research Proposal Structure	**10Hrs**
II	**Temperature,Pressure and Flow Measurement** Thermometers, thermo-electric sensors common thermo- couples, reference junction considerations, metal resistance thermometers and thermistors; optical and radiation pyrometers, calibrationstandards, Bourdon tube, diaphragm and bellows, vacuum measurement – Mecleod gauge, thermal conductivity gauge and ionization gauge, Dead weight gauge tester. Electromagnetic flux meters, ultra-sonic flow meters and hot wire anemometer: Flow visualization technique.	**10Hrs**
III	**Speed, Force, Torque and Shaft Lower Measurement** Mechanical tachometers, vibration and tachometer and stroboscope; proving ring, hydraulic a pneumatic load cells, torque on rotating shafts, absorption, transmission and driving dynamometers. **Controls:** Control system-open and closed loop system; elements of a control system; servomechanism process control and regulators, transfer function; block diagram and overall transfer function of a multi loop control system, signal flow graph	**10Hrs**

TextBooks:

- Mechanical and Industrial Measurements by R.K. Jain, Khanna Publishers

- Mechanical Measurements by Shawney, McGraw Hill Publishers

Reference Books:

1. Experimental Method for Engineers by Holman J.P., McGraw Hill Publication Company.
2. Automatic Control System by Kuo B.C., Prentice Hall of India.
3. Measurement system: Application and Design by Doebelin E.O., McGraw Hill.
4. Mechanical Measurement and Control by Kumar D.S., Metropolitan Book Co. Pvt. Ltd., New Delhi.

Online Reference:

https://archive.nptel.ac.in/courses/112/107/112107242/
https://archive.nptel.ac.in/courses/112/103/112103261/

MATP/MJ/505:Practical Based on Measurement and Control

Total Credits :02 TotalContactHours:30HrsMaximum Marks : 50

CourseOutcomes(COs):

Aftercompletion ofthe course, students willbe able to–

1. Calibrate the temperature measuring device.
2. Measure the torque and power by using brake dynamometer.

CO-PO Attainment Matrix for Course
(L = Low, M = Medium, H = High)

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO 1		H														
CO 2		H														

List of Practical:

1. Study of various temperature measuring devices; thermocouple, RTD, gas thermometers.
2. Measuring velocity of fluid flow by Venturi meter/ orifice meter/ pitot-tube.
3. Measuring torque and power generated by a prime mover by using brake dynamometer.
4. Study of various pressure measuring devices like manometers, mercury in glass pressure gauge.
5. Calibration of temperature measuring device: Thermocouple.
6. Performance on linear and angular measurements and check different characteristics of measurements.

MATT/MJ/502:Automotive Air Conditioning

Total Credits :02 TotalContactHours:30Hrs Maximum
Marks : 50

LearningObjectivesof theCourse:

The course should enable students:

The course should enable students:

1. To identify various HVAC systems and sub systems.
2. To explain working & construction of HVAC Systems and sub systems.

CourseOutcomes(COs):

Aftercompletion ofthe course, students willbe able to-

CO1	Explain working and construction of HVAC systems and sub systems.
CO2	Carry out repair and maintenance of HVAC systems and sub systems.
CO3	Carry out retrofitting and alteration of HVAC systems.
CO4	Explain environmental aspects related to HVAC systems.

CO-PO Attainment Matrix for Course
(L = Low, M = Medium, H = High)

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO10	PO12		PSO1	PSO2	PSO3
CO 1		H														
CO 2		H														
CO 3		H														
CO 4		H														

Module No.	Topics/ actual contentsof the syllabus	Contact Hours
I	**Air Conditioning System** General layout of Automotive Air conditioning system,vapour compression cycle, Construction and working of refrigeration sub systems, evaporator, condenser, accumulator, Receiver, driers and accumulator. Reciprocating, scroll and rotary vane compressors, Refrigerants.	**10Hrs**
II	**System Control Devices** Switches - high- Side temperature switch, low-side temperature switch, high pressure switch, low- pressure switch, pressure regulator, ambient switch and superheat switch. Sensors- sun load sensor, outside temperature sensor and in car temperature sensors. Controls- Concept of Aspirator, blower clutch control, heater control, and time delay relay for heater control.Block diagram of climate control system and Electronic climate control system.	**10Hrs**

III	**Repairs and Maintenance of Air Conditioning System** Maintenance Of A.C. Systems -Visual and acoustic check, side glass, leak test, Temperature test,procedure of charging and discharging. Moisture removal procedure,Service equipments and tools- Vacuum pump, Manifold and gauge i.e. Low side and high side, gauge calibration recovery unit and recycling unit, Halide (Freon) and Fluorescent leak detector, nitrogen leak tester. Symptoms, Faults, causes and remedies, Hoses and connectors - construction of system hoses, charging hose with shut off valve and connectors, Comfort heating system - Function, Construction and working, Maintenance general faults and their remedies	**10Hrs**

TextBooks:

1. Automobile Air Conditioning, Boyce H. Dwiggins, Thomson Learning, 8th Edition, (2001) ISBN-13: 978-0-7668-0788-4, ISBN: 0-7668-0788-6
2. Automotive Heating and Air Conditioning, John H Haynes and Mike Stubblefield, Haynes Publishing Group, 2nd edition (January 1994), ISBN-10: 1563920719, ISBN-13: 978-1563920714
3. Automotive Mechanics, Crouse, Anglin, Tata McGraw - Hill Career Education ISBN 10: 0028009436 ISBN 13: 9780028009438
4. A text book of Refrigeration and Air Conditioning, R. S. Khurmi and J. K. Gupta, S. Chand, (2006), *ISBN* 10: 8121927811 - *ISBN* 13: 9788121927819
5. Refrigeration and Air Conditioning, P. N. Ananthanarayanan, Tata McGraw Hill, (2015), ISBN 10: 1259062708/ ISBN 13: 9781259062704
6. Principles of Refrigeration, Roy Dossat, Pearson Education, 4th Edition, *ISBN* 10: 8177588818 / *ISBN* 13: 9788177588811
7. Refrigeration and Air Conditioning, Domkunwar and Arora, Dhanpat Rai & Co.(p) Ltd-Delhi, 6th Edition, ISBN-10: 0000229660, ISBN-13: 9780000229663

MATP/MJ/504:Practical Based on Automotive Air Conditioning

Total Credits :02 TotalContactHours:30HrsMaximum Marks : 50

CourseOutcomes(COs):

Aftercompletion ofthe course, students willbe able to–

1. Sketch various types of duct systems used in automobile air conditioning, demonstrating a comprehensive understanding of their design and function.
2. Observe and document the procedure for evacuating and charging refrigerant from an automobile A.C. system.Perform tests on a vapor compression test rig and analyze the data to understand the principles of the vapor compression cycle.
3. Diagnose various running faults in car HVAC systems by observing symptoms and using diagnostic tools.
4. Identify the causes of common HVAC issues and propose effective remedies, enhancing problem-solving skills and technical expertise in automotive HVAC systems.

CO-PO Attainment Matrix for Course
(L = Low, M = Medium, H = High)

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO10	PO12		PSO1	PSO2	PSO3
CO 1		H														
CO 2		H														
CO 3		H														
CO 4		H														

List of Practicals

1. Observe and draw layout of Automobile Air Conditioning System and sub systems. Observe and Sketch of all types of Duct system.
2. Observe and write the procedure of evacuation and charging of refrigerant from A.C. system.
3. Test on vapor compression test rig.
4. Observe and write the procedure of leakage test of A.C. system.
5. Diagnosis of various running faults in car HVAC and write causes and remedies.
6. Perform trial on A.C. test rig and report the performance.

MATT/MJ/503:Project Management- I

Total Credits :02 TotalContactHours:30HrsMaximum Marks : 50

LearningObjectivesof theCourse:

To provide students with-

1. Basics knowledge of project management, types of organization
2. Understanding of project life cycle, market and demand analysis

CourseOutcomes(COs):

On completion of the course, students should be able to-

1. Recognize essential skill-set for careers in industry and entrepreneurial domain
2. Demonstrate basic traits of manage projects at every strata of profession
3. Undertake a project in the near future and seeking to learn and apply essential project management knowledge and skills.

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1						H	H	H	H	H	H	H				
CO2						H	H	H	H	H	H	H				
CO3						H	H	H	H	H	H	H				

Module No.	Course Content	Contact Hours
I	Introduction of Project Management, Project Success, Types of Structure Organizations, Project Management Office, Stakeholders Management	10Hrs
II	Types of Projects and Project Life Cycle, Project Life Cycle Phases & Project Appraisal, Methods of Project Selection, Market and Demand Analysis	10Hrs
III	Financial Analysis, Capital Budgeting Techniques, Risk Management, Stand Alone Risk Analysis, Hillier Model, Simulation Analysis, Product Mix and Plant Capacity Analysis	10Hrs

TextBooks:

- Fundamentals of Quality Control and Improvement by Mitra, Amitava; Wiley India Pvt Ltd, ISBN- 9781118491645

Reference Books:

- The certified six sigma Green Belt Handbook,by Roderick A. Munro and Govindarajan Ramu and Daniel J. Zrymiak,; ASQ Quality Press and Infotech Standards India Pvt. Ltd. , ISBN-978087389891:
- The Certified Six Sigma Black Belt Handbook by T. M. Kubiak and Donald W. Benbow; Pearson Publication, ISBN- 9788131728697

Online Reference:

https://nptel.ac.in/courses/110105167

MATT/DSE/507A: Automobile Engine Components Design

Total Credits:02 TotalContactHours:30Maximum Marks: 50

LearningObjectivesof theCourse:
To make the students understand the design concept and principles of various engine components
CourseOutcomes(COs):

Aftercompletion ofthe course, students willbe able to-

CO1	Differentiate between various types of stresses and failures of material.
CO2	Identify the failure of piston rings, valves and crankshaft bearings.
CO3	Select the material for engine cylinder, piston and crank shaft.
CO4	Design the cylinder head, piston and piston rings.

CO-PO Attainment Matrix for Course
(L = Low, M = Medium, H = High)

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO1 0	PO1 2		PSO 1	PS O 2	PS O 3
CO 1	H															
CO 2	H															
CO 3	H															
CO 4	H															

Module No.	Topics/ actual contentsof the syllabus	Contact Hours
I	**Introduction to Design** Stress, types of stresses, Engineering materials and their physical properties applied to design, selection of materials, Factor of safety, Theory of failures, Static load, dynamic load, failure modes, endurance limit, notch sensitivity, principles of design optimization.	**10Hrs**
II	**Design of Cylinder and Piston** Choice of material for cylinder and piston, load on cylinder, stress in cylinder, piston friction, piston slap, load on piston, stresses in piston, design of cylinder, piston, piston pin, piston rings, piston failures, lubrication of piston assembly, types of tolerances and fits, surface finish, and surface roughness.	**10Hrs**
III	**Design of Connecting rod, Crankshaft** Material for connecting rod, determining minimum length of connecting rod, small end and big end design, shank design, design of big end cap bolts, connecting rod failures, balancing of I.C. Engines, significance of firing order, material for crankshaft, design of crankshaft under bending and twisting.	**10Hrs**

TextBooks:

1. Design of Automotive Engines", A.Kolchin and V.Demidov, MIR Publishers, Moscow.
2. Design Techniques for Engine Manifolds, D.E. Winterborne and R.J.Pearson, SAE Int. Publisher.
3. The Internal Combustion Engine in Theory and Practice, C.F. Taylor, The M.I.T. Press, Cambridge, MA
4. Internal combustion engines fundamentals, J.B. Heywood McGraw-Hill, N.Y.
5. Diesel-Engine Management, H. Bauer, K.H. Dietsche, J. Crepin, F. Dinkler, Bosch-SAE Publishers.
6. Design of Machine Elements, V.B.Bhandari, Tata McGraw Hill publication, 3rd Edition, (2010), ISBN-10: 0070681791 ISBN-13: 9780070681798
7. Machine Design, P.Kannaiah, Scitech, (2010) ISBN 10: 8183711510/ ISBN 13: 9788183711517

MATP/MJ/507A:Practical Based on Automobile Engine Components Design

Total Credits:02 TotalContactHours:30Hrs Maximum Marks : 50

CourseOutcomes(COs):

Aftercompletion ofthe course, students willbe able to–

1. Analyze the stress profile in Automotive components
2. Design Automobile components using computer aided softwares.

CO-PO Attainment Matrix for Course
(L = Low, M = Medium, H = High)

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO 1		H														
CO 2		H														

List of Practical:

1. Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing naming layers, setting line types for different layers using various type of lines using Solidworks software.
2. To Draw Orthographic projection drawings (Front, Top and side) of machine part in CAD.
3. Make an Isometric dimensioned drawing of a connecting Rod using Isometric grid and snap.
4. Draw different types of bolts and nuts with internal and external threading in Acme and square threading standards. Save the bolts and nuts as blocks suitable for insertion.
5. Draw a 3D model of a machine component using 3D primitives and using commands like Union. Subtraction, Revolve, Slice, Rotate 3D etc.
6. Draw a spiral by extruding a circle

MATT/DSE/507B:Vehicle Dynamics

Total Credits:02 TotalContactHours:30Hrs

Maximum Marks: 50

LearningObjectivesof theCourse:

The course should enable students:

1. To understand the vehicle coordinate system.
2. To understand vehicle performance characteristics of road vehicle for steady state operation and transient operation.

CourseOutcomes(COs):

On completion of this course, students should be able to-

1. Differentiate between sprung mass and unsprung mass of vehicle.
2. Explain the gyroscopic effect, ride and handling in vehicle design.
3. Distinguished between vehicle coordinate system and earth fixed coordinate system

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	H															
CO2	H															
CO3	H															

Module No.	Course Content	Contact Hours
I	**Introduction of Vehicle Dynamics:** Vehicle coordinate system, earth fixed coordinate system, longitudinal, lateral and vertical vehicle dynamics, vehicle springing system - requirements, sprung mass and un-sprung mass, performance characteristics of road vehicles	**08Hrs**
II	**Steady State and Transient Operation** Various external forces acting on vehicle, Nature of the forces and factors affecting the forces, Tractive effort and Power available from the engine, equation of motion, maximum tractive effort, weight distribution, stability of vehicle on slope, road performance curves, acceleration, gradability and drawbar pull, Inertia effect, Equivalent mass, Equivalent moment of inertia, Equivalent ungeared system, Time to produce synchronizing during gear change, Effect of engine flywheel on acceleration, Dynamics of vehicles on Banked tracks, Gyroscopic Effects, Net driving power.	**12Hrs**
III	**Acceleration and Braking Characteristics** Acceleration - Power limited acceleration: Engines, Power Train, And Automatic Transmission. Traction Limited Acceleration: Transverse Weight Shift, Traction Limit, Numerical Treatment. Braking – Constant Deceleration, Braking Force, Brake Factor, Braking Efficiency And Stopping Distance, Reaction Time And Stopping Time, Braking Applied To Rear Wheels, Front Wheels And All Four Wheels, On Straight And Curved Path, Mass Transfer And Its Effect	**10Hrs**

TextBooks:

- Fundamentals of Vehicle Dynamics, Gillespie Thomas D, SAE USA ,1992, ISBN: 9781560911999

Reference Books:

1. Theory of Ground Vehicles - J. Y. Woung - John Willey & Sons, NY, ISBN: 9780471354611.
2. Steering, Suspension &Tyres – J. G. Giles, Illefe Books Ltd., London, ISBN-10: 0-592-00620-4.
3. Automotive Chassis – P. M. Heldt, Chilton Co. NK, ISBN-13: 9781114312395.
4. Mechanics of Road Vehicles – W. Steed, Illefe Books Ltd. London, ASIN: B0000CKKGV.

Online Reference:

https://nptel.ac.in/courses/107106080

MATP/DSE/507B: Practical Based on Vehicle Dynamics

Total Credits: 02 Total Contact Hours: 30 HrsMaximum Marks: 50

Course Outcomes (COs):

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

1. Analyzethe sprung and un-sprung mass system
2. Calculate the stiffness of tyre with variation of air pressure.

CO-PO Attainment Matrix for Course

(L = Low, M = Medium, H = High)

Course Outcome	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	PSO 3
CO 1		H														
CO 2		H														

List of Practical:

1. To simulate and understand behavior of sprung / un-sprung mass & lumped mass system.
2. Finding the stiffness of tyre with variation of air pressure.
3. To simulate and study the effect of different conditions on vehicle loading.
4. Study geometry of motorcycles as well as various types of forces faced by the motorcycle & its rider.
5. Study the location & height of Centre of gravity (C.G) of a motorcycle.
6. To study the effect of tyre pressure and temperature on the performance of the tyre.

MATT/RM/508:Research Methodology

Total Credits :04 TotalContactHours:60Hrs

Maximum Marks : 100

LearningObjectivesof theCourse:

The intent of the course is to make students aware of the details associated with formal researc and to help students overcome common misconceptions that may be present in their minds. By going through this course, students are likely to be able to take up research activities in a more systematic and formal manner right from the beginning.

CourseOutcomes(COs):

On completion of this course, students should be able to-

1. Define research and describe the research process and research methods
2. Relate basic aspects of the research process in order to plan and execute a research work
3. Demonstrate a good understanding of how to write a research / technical report

CO –PO – PSO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO
CO1		H														
CO2		H														
CO3					H											

Module No.	Course Content	Contact Hours
I	**Perception of Research and Problem Identification** Research – Definition, Characteristics, Function, Objective, Classification; Action Research; Problem – Reflective and Scientific Thinking, Identification of Problem, Sources, Criteria for selection of problem, Definition of Problem, Characteristics of Problem, Evaluation of Problem; Research Proposal Structure	**15Hrs**
II	**Literature Review and Hypothesis** Literature Review – Need, Objectives, Principles, Procedure, Sources, Functions; Standards of conducting research literature; Reporting; Hypothesis- Contrast of Assumption, Postulate and Hypothesis; Nature, Function, Classification; Characteristics of good hypothesis, Formulating and Testing of Hypothesis, Criteria for Hypothesis evaluation	**15Hrs**
III	**Research Design and Method** Characteristics of good research design, Concept of sampling; Types of Research Methods; Experimental method, Case Study method; DOE concepts, Tools for Research	**15Hrs**
IV	**Presentation of Research Outcome** Fundamentals of Data Collection and Analysis; Writing a Research Report; Writing a Research Paper; Ethical Issues; Case Studies	**15 Hrs**

TextBooks:

- C.R. Kothari, Gaurav Garg, "Research Methodology" Fourth Edition, New Age International, 2019
- Y. K. Singh,"Fundamental of Research Methodology and Statistics", Fourth Edition, New Age International, 2006

Reference Books:

- Phyllis G. Supino, Jeffrey S. Borer, "Principles of Research Methodology" Springer Verlag
- John W. Creswell, "Research Design Qualitative, Quantitative. and Mixed Methods Approaches", SAGE
- Angelika Hofmann, " Scientific Writing and Communication", Oxford University Press
- Joshua Schimel, "Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded", Oxford University Press
- A.YavuzOruc, "Handbook of Scientific Proposal Writing", CRC Press, Taylor & Francis group

Online Reference:

- https://archive.nptel.ac.in/courses/121/106/121106007/
- https://archive.nptel.ac.in/courses/127/106/127106227/