| **EMERGING TRENDS IN MECHANICAL ENGINEERING** | **Course Code : 315363** |
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|---|---|
| **Programme Name/s** | **: Automobile Engineering./ Mechanical Engineering/ Mechatronics/ Production Engineering/** |
| **Programme Code** | **: AE/ ME/ MK/ PG** |
| **Semester** | **: Fifth** |
| **Course Title** | **: EMERGING TRENDS IN MECHANICAL ENGINEERING** |
| **Course Code** | **: 315363** |

## I.  RATIONALE

As new technologies rapidly transform the manufacturing industry and related sectors, this course on Emerging Trends in Mechanical Engineering is designed to equip diploma pass outs with the latest knowledge essential for their professional growth. The course covers key areas such as green fuels, autonomous and sustainable maintenance practices, data analytics in manufacturing, and the integration of autonomous vehicles. It also explores the use of drones and autonomous technologies in agriculture. By focusing on these current trends, the course aims to enhance the skills of Mechanical, Automobile, Production, and Mechatronics diploma engineers, preparing them to excel in a rapidly evolving technological environment.

## II.  INDUSTRY / EMPLOYER EXPECTED OUTCOME

Adopt recent trends in mechanical engineering across various mechanical and allied industries.

## III.  COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Select appropriate green fuels for various applications for considering environmental sustainability.
- CO2 - Apply the principles of Autonomous and Sustainable maintenance practices in industry to improve equipment reliability and efficiency.
- CO3 - Identify the levels of autonomy in various mobility systems.
- CO4 - Use data analytics techniques to improve manufacturing processes and systems.
- CO5 - Utilize automated equipment and technologies for various agricultural applications.

## IV.  TEACHING-LEARNING & ASSESSMENT SCHEME

| Course Code | Course Title | Abbr | Course Category/s | Learning Scheme | | | | | Credits | Assessment Scheme | | | | | | | | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Actual Contact Hrs./Week | | | SLH | NLH | | Paper Duration | Theory | | | | Based on LL & TL | | | | Based on SL | | |
| | | | | | | | | | | | | | | | Practical | | | | | | |
| | | | | CL | TL | LL | | | | | FA-TH | SA-TH | Total | | FA-PR | | SA-PR | | SLA | | |
| | | | | | | | | | | | Max | Max | Max | Min | Max | Min | Max | Min | Max | Min | |
| 315363 | EMERGING TRENDS IN MECHANICAL ENGINEERING | ETM | DSC | 3 | - | - | - | 3 | 1 | 1.5 | 30 | 70*# | 100 | 40 | - | - | - | - | - | - | 100 |

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**Total IKS Hrs for Sem. :** 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

## V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

| Sr.No | Theory Learning Outcomes (TLO's)aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|---|---|---|---|
| 1 | TLO 1.1 Explain the concept of green fuels, including their benefits and advantages. TLO 1.2 Differentiate between the various classes of green fuels based on their sources and production methods. TLO 1.3 Describe different types of green fuels derived from plants. | **Unit - I Green Fuels** 1.1 Green Fuels: Introduction, Characteristics, Benefits and advantages. 1.2 Classes of Green Fuels: 1st Generation, 2nd Generation, 3rd Generation and 4th Generation Green Fuels 1.3 Types and Applications of Green Fuels: Biofuel, Hydrogen fuel, Synthetic fuel, Algae fuel, Bio diesel from plants, Applications of Green Fuels in Automobile, Power and Heat, Aerospace sectors. | Lecture Using Chalk-Board Presentations Video Demonstrations |
| 2 | TLO 2.1 Explain the concepts of data analytics, including its types and techniques. TLO 2.2 Describe the role of a data analyst in the manufacturing industry. TLO 2.3 Explain the characteristics of big data and its applications in manufacturing processes. | **Unit - II Recent trends in Manufacturing systems** 2.1 Big Data in Manufacturing: Introduction, Big Data Characteristics, Benefits 2.2 Data Analytics in manufacturing: Introduction, Steps in Data Analytics, Types of Data Analytics, Data Analytics techniques, Applications of Big Data analytics in Manufacturing – Preventive maintenance, Product Design, Production Management Automation, Customer Experience, Supply Chain Improvement, Benefits. 2.3 Data Analytics in Quality Control: Introduction, Applications, Benefits. | Lecture Using Chalk-Board Video Demonstrations Presentations |

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| Sr.No | Theory Learning Outcomes (TLO's)aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|---|---|---|---|
| 3 | TLO 3.1 Explain the levels of autonomy in mobility systems. TLO 3.2 Describe the systems used in autonomous vehicles such as Advanced Driver Assistance Systems (ADAS) and Full Self-Driving (FSD) technologies. TLO 3.3 State the application of Autonomous Vehicles for given mobility system. | **Unit - III Autonomous Vehicles** 3.1 Autonomy in Mobility Systems (Autonomous Vehicle): Levels, Components, Benefits and Challenges. 3.2 Systems used in Autonomous Vehicles: Advanced Driver Assistance Systems (ADAS) and Full Self-Driving (FSD) 3.3 Applications of Autonomy in other Mobility Systems: Autonomous Trains, Autonomous Ships, Autonomous Aircrafts (Unmanned Aircraft Systems (UAS) | Lecture Using Chalk-Board Presentations Video Demonstrations |
| 4 | TLO 4.1 Describe the concept of Autonomous and Sustainable Maintenance, including the pillars of Total Productive Maintenance (TPM). TLO 4.2 Explain the procedures of Autonomous and Sustainable Maintenance along with their benefits. TLO 4.3 Describe the role of data analytics in Predictive Maintenance. TLO 4.4 Explain the concept of Computerized Maintenance Management Systems (CMMS). | **Unit - IV Recent Trends in Maintenance** 4.1 Autonomous Maintenance: Concept, Pillars of TPM, Implementation steps, benefits. 4.2 Sustainable Maintenance: Concept, Importance, Implementation steps, benefits. 4.3 Data Analytics in Predictive Maintenance: Introduction, concept of Computerized Maintenance Management System (CMMS). | Lecture Using Chalk-Board Video Demonstrations Presentations |
| 5 | TLO 5.1 Explain the role of automation in agriculture field. TLO 5.2 Describe the benefits of automated farm equipment. TLO 5.3 Describe the features and advantages of autonomous tractors and their impact on enhancing agricultural practices. TLO 5.4 Describe the applications and advantages of using drones in agriculture sector. TLO 5.5 Explain significant features of government schemes supporting drone usage in agriculture field. | **Unit - V Recent Trends in Agriculture Engineering** 5.1 Automation in Agriculture: Introduction, Automated Farm Equipments - Agri-robots, Harvesting robots, Inspection and Monitoring Agriculture robots, Automatic Seeding and Planting Machine, AI Operated Irrigation Systems, Benefits 5.2 Autonomous Tractor: Self Driving Tractors, Features and Advantages 5.3 Agricultural Drones: Soil and Field Analysis, Crop Monitoring, Plantation, Crop Spraying, Advantages of Drones, Government Schemes for Drone Usage. | Lecture Using Chalk-Board Presentations Video Demonstrations |

**VI.  LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.**

**VII.  SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) : NOT APPLICABLE**

## VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

| Sr.No | Equipment Name with Broad Specifications | Relevant LLO Number |
|-------|------------------------------------------|---------------------|
| 1 | Not Applicable | All |

## IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

| Sr.No | Unit | Unit Title | Aligned COs | Learning Hours | R-Level | U-Level | A-Level | Total Marks |
|-------|------|------------|-------------|----------------|---------|---------|---------|-------------|
| 1 | I | Green Fuels | CO1 | 5 | 2 | 4 | 4 | 10 |
| 2 | II | Recent trends in Manufacturing systems | CO2 | 6 | 4 | 4 | 8 | 16 |
| 3 | III | Autonomous Vehicles | CO3 | 6 | 4 | 4 | 6 | 14 |
| 4 | IV | Recent Trends in Maintenance | CO4 | 6 | 2 | 4 | 8 | 14 |
| 5 | V | Recent Trends in Agriculture Engineering | CO5 | 7 | 4 | 4 | 8 | 16 |
| | | **Grand Total** | | **30** | **16** | **20** | **34** | **70** |

## X. ASSESSMENT METHODOLOGIES/TOOLS

**Formative assessment (Assessment for Learning)**

- Two Class test of 30 Marks and Average of two Class test

**Summative Assessment (Assessment of Learning)**

- Online MCQ based examination - 70 marks

## XI. SUGGESTED COS - POS MATRIX FORM

| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | | | Programme Specific Outcomes* (PSOs) | | |
|------|------|------|------|------|------|------|------|------|------|------|
| | PO-1 Basic and Discipline Specific Knowledge | PO-2 Problem Analysis | PO-3 Design/ Development of Solutions | PO-4 Engineering Tools | PO-5 Engineering Practices for Society, Sustainability and Environment | PO-6 Project Management | PO-7 Life Long Learning | PSO-1 | PSO-2 | PSO-3 |
| CO1 | 3 | - | - | - | 2 | - | 3 | | | |
| CO2 | 3 | - | - | - | 2 | - | 3 | | | |
| CO3 | 3 | - | - | - | 2 | - | 3 | | | |
| CO4 | 3 | - | - | - | 2 | - | 3 | | | |
| CO5 | 3 | - | - | - | 3 | - | 3 | | | |

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

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## XII. SUGGESTED LEARNING MATERIALS / BOOKS

| Sr.No | Author | Title | Publisher with ISBN Number |
|---|---|---|---|
| 1 | Carlos Ricardo Soccol, Satinder Kaur Brar, Craig Faulds, Luiz Pereira Ramos | Green Fuels Technology: Biofuels (Green Energy and Technology) | Springer International Publishing AG; 1st ed. 2016 edition (19 August 2016); 01149344934, ISBN-13: 978-3319302034 |
| 2 | Fumio Gotoh | Autonomous Maintenance in Seven Steps: Implementing TPM on the Shop Floor | 1st Edition, Productivity Press, ISBN-13: 978-0367199869 |
| 3 | Samuel Theodore, Daniel Lucky | Autonomous Maintenance | Maintenance Pro, 2023, ISBN-13 ?:979-886417453 |
| 4 | Matthias Hartwig | Self-driving cars | E-book, 2020, by BMW |
| 5 | George Dimitrakopoulos, Aggelos Tsakanikas, Elias Panagiotopoulos | Autonomous Vehicles Technologies, Regulations, and Societal Impacts | Elsevier,2021, ISBN-13: 978-0323901376 |
| 6 | Yan Li, Hualiang Shi | Advanced Driver Assistance Systems and Autonomous Vehicles | Springer, Singapore,2022, ISBN-13: 978-9811950520 |
| 7 | P Suresh, T. Poongodi, B Balamurugan, Meenakshi Sharma | Big Data Analytics in Smart Manufacturing: Principles and Practices | December 14, 2022 by Chapman & Hall, ISBN-13: 978-1032065519 |
| 8 | Rania I.M. AlmoselhyRania I.M. Almoselhy, Ravindran Chandran, Abisha Juliet Mary S J | Current Trends in Agriculture & Allied Sciences (Volume-1) | S. P. Publishing, Bhubaneshwar, Odisa,2023, ISBN-13: 978-9359061382 |
| 9 | Dr. Suman Lata, Mamta J. Patange, Dr. Anand K. Gore, Suchibrata Chamuah and Dr. Chandana Behera | Recent Trends in Agriculture (Volume-5) | Integrated Publications, New Delhi,2023, ISBN-13: 978-9395118644 |

## XIII. LEARNING WEBSITES & PORTALS

| Sr.No | Link / Portal | Description |
|---|---|---|
| 1 | https://www.engieimpact.com/insights/green-fuels | Green Fuels |
| 2 | https://www.youtube.com/watch?v=T_S7Q3Uede4 | Green Fuels |
| 3 | https://www.researchgate.net/publication/359732622_Green_fuels_concepts_benefits_and_studies_in_Nigeria/link/624c10bec7ab230e99cef13a/download?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6InB1YmxpY2F0aW9uIn19 | Green Fuels |
| 4 | https://nitsri.ac.in/Department/Chemical%20Engineering/BRTL12.pdf | Green Fuels |
| 5 | https://www.youtube.com/watch?v=4-R5Sh-xSiI&t=5s | Autonomous Maintenance (Total Productive Maintenance Series TPM) |
| 6 | https://www.youtube.com/watch?v=ZJ6tr1kkRDg | Sustainability in Manufacturing |
| 7 | https://www.youtube.com/watch?v=HgF7E5q9sU4&t=1s | An introduction to autonomous vehicles |
| 8 | https://www.youtube.com/watch?v=gEy91PGGLR0 | Autonomous car / self-driving car |
| 9 | https://www.youtube.com/watch?v=ACxTcsxSYvE | Data Analytics in Manufacturing |

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| Sr.No | Link / Portal | | Description |
|---|---|---|---|
| 10 | https://www.youtube.com/watch?v=31W0EzcfE74 | | Big data analytics for manufacturing |
| 11 | https://www.youtube.com/watch?v=P2YPG8PO9JU | | Agricultural Wonder Drone |
| 12 | https://www.youtube.com/watch?v=8-uPCmHX3U0 | | Agricultural Drones |
| 13 | https://www.youtube.com/watch?v=JeU_EYFH1Jk | | Artificial intelligence comes to farming in India |
| 14 | https://www.youtube.com/watch?v=tSdIgGin_rk | | Fully autonomous tractor |
| 15 | https://www.skillindiadigital.gov.in/courses/detail/32d86c56 -efc6-4c33-9c65-17901e296f8e | | Kisan Drone Operator |
| 16 | https://www.youtube.com/watch?v=q7tFDw5SAAU | | Farming with robots |
| 17 | https://www.youtube.com/watch?v=_Dmb1GN52no | | Spraying robots |

**Note :**

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

**MSBTE Approval Dt. 24/02/2025**    **Semester - 5, K Scheme**