**V-Semester 2020-21**

**Subject Code: MEEL05**

**Subject Name: I.C.Engines**

**Course Handout**

**Instructor: Dr.K. Bala Prasad**

**Offered In**: **B.Tech., Mechanical Engineering**

**Prerequisites: ME111 Mathematics-I,**

**ME121 Mathematics-II,**

**ME-214 Basic Thermodynamics,**

**ME225 Applied Thermodynamics**

**Course Objectives:**

* To familiarize with the terminology associated with IC engines and understand the Basics of IC Engines.
* To understand combustion and various parameters and variables affecting it in Various types of IC engines.
* The students acquires sufficient knowledge about Cooling Methods, Lubrication Methods, Ignition systems.
* The students acquires sufficient knowledge about emissions and its control and also Latest trends in IC engines.

**Course Description with syllabus:**

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| --- | --- | --- |
| **R.V.R. & J.C. COLLEGE OF ENGINEERING (AUTONOMOUS), GUNTUR-522019, A.P**. | | R-18 |
| MEEL05 | I C ENGINES | **L T P C Int Ext** |
| **Professional Elective -I** | **Semester v [Third Year]** | **3 1 3 40 60** |
| **UNIT- I** [CO:1] **(12)** | | |
| I.C.Engines: Introduction, Engine nomenclature, Classification of I.C.Engines, Working principles of S.I. and C.I. Engines (both 4 stroke and 2-stroke)-Valve Timing and Port timing diagrams Differences between S.I. &C. I. Engines and 2 Stroke & 4 stroke engines. Fuel Supply Systems: S.I. Engines- Chemically correct air-fuel ratio, Air fuel Mixture requirements, Carburetion, Simple float type carburetor, Fuel injection System for SI Engines, MPFI. C.I. Engines-Air fuel requirements, fuel injection systems, Electronic injection system, CRDI. | | |
| **UNIT- II [**CO:2] **(12)** | | |
| Combustion Processes: S.I. Engines-Normal combustion and flame front propagation, abnormal combustion, variables affecting detonation, Knock rating and Octane number, types of combustion chambers for petrol engines. C.I.Engines- Ignition delay, combustion knock in the C.I. Engines, variables affecting ignition delay, Knock rating and Cetane number, types of combustion chambers for diesel engines. Engine performance curves, Variables affecting engine performance for both S.I. & C.I. Engines. | | |
| **UNIT-III [CO:3] (12)** | | |
| Cooling Systems: Need for cooling system, Air and water cooling. Lubricating Systems: Objects of lubrication, Requirements of lubricants, various lubricating systems for I.C. Engines. Ignition System: Battery Ignition system, Ignition advance, ignition advance methods, Spark plugs, Magneto ignition system, Electronic Ignition system. | | |
| **UNIT-IV [CO:4] (12)** | | |
| Testing of I.C.Engines: Indicator diagram, evaluation of Indicated Power, Brake power, Fuel consumption, SFC, Mechanical & Thermal efficiencies, Mean Effective Pressure, air-fuel ratio, Heat balance sheet, Morse test. Engine emissions and control: S.I Engine emissions and methods to control, Diesel engine emissions, Diesel smoke and control. Options of prime movers: Electric Vehicle, Hybrid vehicle, Fuel cell vehicle. | | |

**Course Outcomes**

After completion of the course,

* The students are expected to understand the various components, principle of operation, working of different types of I.C engines.
* Able to know the variables affecting the performance of IC engines and methods to improve the performance.
* Able to understand the Cooling Methods, Lubrication Methods, Ignition systems
* The students are expected to understand the emissions and its control and also the Latest trends in IC engines.

**CO-PO – PSO Mapping**

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|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
| **CO1** | **3** |  |  | **2** | **1** | **1** |  |  |  |  | **2** | **3** | **3** | **3** |
| **CO2** | **3** |  |  | **3** | **1** | **1** |  |  |  |  | **2** | **3** | **3** | **3** |
| **CO3** | **3** |  |  | **2** | **1** | **1** |  |  |  |  | **2** | **3** | **3** | **3** |
| **CO4** | **3** |  |  | **3** | **1** | **3** |  |  |  |  | **3** | **3** | **3** | **3** |
| **CO5** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

**Learning Resources:**

**TEXT BOOK(s):**

* I.C. Engines - V.Ganesan - T.M.H., New Delhi, 3rd Edition
* Treatise on Heat Engineering-V.P.Vasandani and D.S.Kumar, Metropolitan Bookco, New Delhi, 4th Edition.
* A Course in I.C. Engines - M.L.Mathur &R.P.Sharma - Dhanpat Rai & Sons- New Delhi, 2010..
* Fundamentals of I.C.Engines - H.N. Gupta, PHI, New Delhi,

**REFERENCE BOOK(s):**

* 2009Thermal Science and Engineering- D.S.kumar, S.K.Kataria Publ, New Delhi 2010.
* Thermal Engineering -Rajput, Laxmi Publ, New Delhi, 2012.

**Additional Reading Resources**:

WEB RESOURCES:

* <http://autoclub.rso.siuc.edu/frange.html>
* <http://www.howstuffworks.com/engine1.htm>
* <http://inventors.about.com/library/inventors/blinternalcombustion.htm>
* <http://www.animatedengines.com/>
* SAE journals.

**Structure of Weekly Classes**:

(Lectures, videos, IOT techniques, highlighting concepts and applications)

Total 4 periods/ week,

Theory- 2 hours with Power Point Presentation through Moodle (ICT)

Problems – 2 Hours through Moodle.

**Lecture Hours** (as per timetable):

**01:15 -2:15 (Tuesday)**

**10:00 –11:00 (Wednesday)**

**01:15 -02:15 (Thursday)**

**10:00 –11:00 (Friday)**

**Lecture Plan:**

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| S. NO. | **TOPIC S TO BE COVERED** | **NO. PERIODS** |
| 1 | General discussion, Syllabus dictation, importance of I.C.Engine subject | 1 |
| ***UNIT 1 - I*** | | |
| **FUNDAMENTALS OF IC ENGINES** | | |
| 2 | Engine nomenclature, Classification of I.C. Engines | 1 |
| 3 | Working principles of S.I. and C.I. Engines (both 4 stroke and 2-stroke)- | 2 |
| 4 | Valve Timing and Port timing diagrams | 1 |
| 5 | Differences between S.I. &C. I. Engines and 2 Stroke & 4 stroke engines | 1 |
| 6 | Fuel Supply Systems: S.I. Engines- Chemically correct air-fuel ratio, Air fuel Mixture requirements, | 2 |
| 7 | Carburetion, Simple float type carburetor, Fuel injection System for SI engines, MPFI. | 2 |
| 8 | C.I.Engines-Air fuel requirements, fuel injection systems, Electronic injectionsystem, CRDI. | 2 |
|  |  | **12** |
| ***UNIT II*** | | |
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| **Combustion Processes** | | |
|  | **S.I.Engines** |  |
| 9 | Normal combustion and flame front propagation | 1 |
| 10 | abnormal combustion, variables affecting detonation. | 2 |
| 11 | Knock rating and Octane number, types of combustion chambers for petrol engines. | 2 |
|  | **C.I.Engines** |  |
| 12 | Ignition delay, combustion knock in the C.I. engines | 2 |
| 13 | variables affecting ignition delay, Knock rating and Cetane number, types of combustion chambers for diesel engines. | 3 |
| 14 | Engine performance curves, Variables affecting engine performance for both S.I. & C.I. Engines. | 2 |
|  |  | 24 |
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| ***UNIT III*** | | |
| * **Cooling Systems** | | |
| 15 | Need for cooling system, Air and water cooling. | 3 |
| * **Lubricating Systems** | | |
| 16 | Objects of lubrication, Requirements of lubricants, various lubricating systems for I.C. Engines. | 3 |
| **(c) Ignition System** | | |
| 17 | Battery Ignition system, Ignition advance, ignition advance methods, | 3 |
| 18 | Spark plugs, Magneto ignition system, Electronic Ignition system. | 3 |
|  |  | 36 |
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| ***UNIT IV*** | | |
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| **Testing of I.C.Engines** | | |
| 19 | Indicator diagram, evaluation of Indicated Power, Morse test | 1 |
| 20 | Brake power, | 1 |
| 21 | Fuel consumption, SFC, Mechanical & Thermal efficiencies. | 1 |
| 22 | Mean Effective Pressure, air-fuel ratio, Heat balance sheet | 1 |
| 23 | Problems | 3 |
| 24 | Emissions and control: S.I Engine emissions and methods to control, | 1 |
| 25 | Diesel engine emissions, Diesel smoke and control. | 2 |
| 26 | Options of prime movers: Electric Vehicle, Hybrid vehicle, Fuel cell vehicle. | 2 |
|  |  | 48 |

**Assessment Plan**

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| --- | --- | --- | --- | --- |
| **Assessment** | **Dates** | **Time** | **Total Marks** | **Remarks** |
| **Assignment Test I and Test II** | 4-10-2020 to 9-10-2020 &  07-12-2020 to 13-12-2020 | 45 min | 12 | Paper Based |
| **Home Assignments I & II / Quiz I & II** | 10-9-2020 & 10-11-2020/  24-9-2020 & 24-11-2020 | 4days/30min | 5 | Paper Based/ online quiz with MCQ’s |
| **Mid Examination**  **I & II** | 4-10-2020 to 9-10-2020 &  07-12-2020 to 13-10-2020 | 90 min | 18 | Paper Based |
| **End Examination** | 21-12-2020 | 180 min | 60 | Paper Based |
| **Total Marks** | | | **100** |  |

**Class Decorum**

* It is a mandatory to maintain silence when the class is going on (in session) to empower the learning of all the students.
* No use of mobile phone is allowed in the class. Use of mobile phone in the class will be dealt with in accordance with the Code of Student Conduct.
* It is advised to note down the contents when the instructor is teaching so that you can review them during the preparation.
* Students are advised to read the standard text books prescribed for the subject by the instructor.
* Whenever doubts arises you note down and ask them during the last 10 minutes session meant for that in the chat box by raising your hand.
* Whatever the home work/assignment given, try to do it independently by referring text books and resource materials.
* Try to learn the concepts thoroughly because this subject is useful for understanding next year automobile engineering subject as well as GATE and IES point of view.

**Note:** Refer to the document **Course Handout - Common Features** for the following sections of the course handout:

* Evaluation of Assessments & Feedback
* Make-Up Policy
* Grading System