# MIXTURE FORMATION IN INTERNAL COMBUSTION ENGINES

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| 1 | Course Title: | MIXTURE FORMATION IN INTERNAL COMBUSTION ENGINES | |
| 2 | Course Code: | OTO5129 | |
| 3 | Type of Course: | Optional | |
| 4 | Level of Course: | Second Cycle | |
| 5 | Year of Study: | 1 | |
| 6 | Semester: | 1 | |
| 7 | ECTS Credits Allocated: | 6.00 | |
| 8 | Theoretical (hour/week): | 3.00 | |
| 9 | Practice (hour/week): | 0.00 | |
| 10 | Laboratory (hour/week): | 0 | |
| 11 | Prerequisites: | | |
| 12 | Language: | Turkish | |
| 13 | Mode of Delivery: | Face to face | |
| 14 | Course Coordinator: | Prof. Dr. M.İHSAN KARAMANGİL | |
| 15 | Course Lecturers: | | |
| 16 | Contact information of the Course Coordinator: | 2941978 / ihsan@uludag.edu.tr | |
| 17 | Website: | | |
| 18 | Objective of the Course: | Objective of the course is to investigate the mixture formation techniques in engines in detail. | |
| 19 | Contribution of the Course to Professional Development: | | |
| 20 | Learning Outcomes: | | |
| | | **1** | Skill of comprehending mixture formation techniques in internal combustion engines |
| | | **2** | Skill of solving engineering problems related to mixture formation, evaporation phenomenon and combustion event |
| | | **3** | Skill of using information technologies effectively |
| | | **4** | Skill of gaining to conduct individual and team work |
| | | **5** | Skill of communicating oral and written communication in Turkish |
| | | **6** | Skill of gaining awareness of lifelong learning necessity |
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| 21 | Course Content: | | |

**Course Content:**

| Week | Theoretical | Practice |
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| 1 | Review of mixture formation methods in gasoline and diesel engines | |
| 2 | Definition of excess air-fuel ratio, values of the air/fuel ratio for basic engine running modes | |

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| **3** | Running modes of a gasoline engine (cold-start idling, acceleration, economic mode, deceleration and full load | |
| **4** | Introduction of the fuel injection systems in gasoline engines (SPI, MPI and GDI) | |
| **5** | Air motions in-cylinder in gasoline engines (Turbulence, swirl, squish, tumble) and combustion room types) | |
| **6** | Injection, ignition and combustion phases in gasoline engines, relation among injection parameters, fuel consumption and emissions | |
| **7** | Evaporation phenomenon in intake manifold in gasoline engines | |
| **8** | Mixture formation methods in diesel engines (classic diesel fuel injection systems and common rail systems) | |
| **9** | Midterm exam | |
| **10** | Breaking of fuel jet, spray formation and influential parameters | |
| **11** | Diameter distribution and measurement methods | |
| **12** | Droplet evaporation and parameters affecting | |
| **13** | Evaporation models | |
| **14** | Diesel combustion chamber types | |

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| **Textbooks, References and/or Other** | 1. Carsten Baumgarten "Mixture Formation in Internal Combustion Engines", Springer, 2006.<br>2. Heywood, J.B., "Internal Combustion Engine Fundamentals", McGraw-Hill, 1988.<br>3. Borat, O., Balcı, M., Sürmen, A., "İçten Yanmalı Motorlar", Birsen yayınevi, İstanbul, 2003, ISBN:975-511-<br>4. Öz, H.H., Borat, O., Sürmen, A., "Internal Combustion Engines". Birsen yayınevi, İstanbul, 2003, ISBN:975-511-<br>5. Gary L. Borman, Kenneth W. Ragland "Combustion Engineering", Mc-Graw Hill, 1998.<br>6. Diesel Engine Management, Compression Ignition Engines, SAE Publication.<br>7. Robert Bosch Gmbh "Gasoline Engine Management",<br>8. Robert Bosch Gmbh "Diesel Engine Management", Bosch yay, 2005. |

| Activites | Number | Duration (hour) | Total Work Load (hour) |
|---|---|---|---|
| Theoretical | | | |
| Practicals/Labs | | | |
| Self study and preperation | | | |
| Homeworks | | | |
| Projects | | | |
| Field Studies | | | |
| Midterm exams | | | |
| Others | | | |
| Final Exams | | | |
| Total Work Load | | | |
| Total work load/ 30 hr | | | |
| ECTS Credit of the Course | | | 6.00 |

| **TERM LEARNING ACTIVITIES** | **NUMBER** | **WEIGHT** |
|---|---|---|
| Midterm Exam | 1 | 35.00 |
| Quiz | 0 | 0.00 |
| Home work-project | 2 | 15.00 |
| Final Exam | | 50.00 |
| Total | 4 | 100.00 |
| Contribution of Term (Year) Learning Activities to Success Grade | | 50.00 |
| Contribution of Final Exam to Success Grade | | 50.00 |
| Total | | 100.00 |

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| Measurement and Evaluation Techniques Used in the Course | |

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| **24** | **ECTS / WORK LOAD TABLE** |

| **25** | **CONTRIBUTION OF LEARNING OUTCOMES TO PROGRAMME QUALIFICATIONS** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PQ1** | **PQ2** | **PQ3** | **PQ4** | **PQ5** | **PQ6** | **PQ7** | **PQ8** | **PQ9** | **PQ10** | **PQ11** | **PQ12** | **PQ13** | **PQ14** | **PQ15** | **PQ16** |
| **LO: Learning Objectives PQ: Program Qualifications** | | | | | | | | | | | | | | | | |
| **Contribution Level:** | **1 very low** | | **2 low** | | | **3 Medium** | | | **4 High** | | | | **5 Very High** | | | |