Syllabus with
Curriculum and Regulations
2008

M.E.
INTERNAL COMBUSTION ENGINEERING
ACADEMIC REGULATIONS (M.E. / M.Tech / M.B.A. / M.C.A.)

1. Vision, Mission and Objectives

1.1 The Vision of the Institute is “To make everyone a success and no one a failure”.

In order to progress towards the vision, the Institute has identified itself with a mission to provide every individual with a conducive environment suitable to achieve his / her career goals, with a strong emphasis on personality development, and to offer quality education in all spheres of engineering, technology, applied sciences and management, without compromising on the quality and code of ethics.

1.2 Further, the institute always strives
  • To train our students with the latest and the best in the rapidly changing fields of Engineering, Technology, Management, Science & Humanities.
  • To develop the students with a global outlook possessing, state of the art skills, capable of taking up challenging responsibilities in the respective fields.
  • To mould our students as citizens with moral, ethical and social values so as to fulfill their obligations to the nation and the society.
  • To promote research in the field of science, Humanities, Engineering, Technology and allied branches.

1.3 Our aims and objectives are focused on
  • Providing world class education in engineering, technology, applied science and management.
  • Keeping pace with the ever changing technological scenario to help our students to gain proper direction to emerge as competent professionals fully aware of their commitment to the society and nation.
  • To inculcate a flair for research, development and entrepreneurship.

2. Admission

2.1. The admission policy and procedure shall be decided from time to time by the Board of Management (BOM) of the Institute, following guidelines issued by Ministry of Human Resource Development (MHRD), Government of India. The number of seats in each branch of the (M.E. / M.B.A. / M.C.A.) programme will be decided by BOM as per the directives from Ministry of Human Resource Development (MHRD), Government of India and taking into account the market demands. Some seats for Non Resident Indians and a few seats for Foreign nationals shall be made available.

2.2. The selected candidates will be admitted to the (M.E. / M.Tech / M.B.A. / M.C.A.) programme after he/she fulfills all the admission requirements set by the Institute and after payment of the prescribed fees.

2.3. Candidates for admission to the first semester of the Master’s Degree Programme shall be required to have passed in an appropriate Degree Examination recognized by Hindustan University

2.4. In all matters relating to admission to the (M.E. / M.Tech / M.B.A. / M.C.A.). programme, the decision of the Institute and its interpretation given by the Chancellor of the Institute shall be final.

2.5. If at any time after admission, it is found that a candidate has not fulfilled any of the requirements stipulated by the Institute, the Institute may revoke the admission of the candidate with information to the Academic Council.
3. Structure of the programme

3.1. The programme of instruction will have the following structure
   i) Core courses of Engineering / Technology / Management.
   ii) Elective courses for specialization in areas of student's choice.

3.2. The minimum durations of the programmes are as given below:

<table>
<thead>
<tr>
<th>Program</th>
<th>No. of Semesters</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.E. / M.Tech</td>
<td>4</td>
</tr>
<tr>
<td>M.B.A. (Full Time)</td>
<td>4</td>
</tr>
<tr>
<td>M.B.A. (Part Time)</td>
<td>6</td>
</tr>
<tr>
<td>M.C.A.</td>
<td>6</td>
</tr>
</tbody>
</table>

Every (M.E./ M.Tech / M.B.A. / M.C.A.) programme will have a curriculum and syllabi for the courses approved by the Academic Council.

3.3. Each course is normally assigned certain number of credits. The following norms will generally be followed in assigning credits for courses.
   - One credit for each lecture hour per week per semester;
   - One credit for each tutorial hour per week per semester;
   - One credit for each laboratory practical (drawing) of three (two) hours per week per semester.
   - One credit for 4 weeks of industrial training and
   - One credit for 4 hours of project per week per semester.

3.4. For the award of degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study. The curriculum of the different programs shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits specified below.

3.5. The medium of instruction, examination and the language of the project reports will be English.

4. Faculty Advisor

4.1. To help the students in planning their courses of study and for getting general advice on the academic programme, the concerned Department will assign a certain number of students to a Faculty member who will be called their Faculty Advisor.

5. Class Committee

5.1. A Class Committee consisting of the following will be constituted by the Head of the Department for each class:
   (i) A Chairman, who is not teaching the class.
   (ii) All subject teachers of the class.
   (iii) Two students nominated by the department in consultation with the class.

The Class Committee will meet as often as necessary, but not less than three times during a semester.

The functions of the Class Committee will include:
   (i) Addressing problems experienced by students in the classroom and the laboratories.
   (ii) Analyzing the performance of the students of the class after each test and finding ways and means of addressing problems, if any.
(iii) During the meetings, the student members shall express the opinions and suggestions of the class students to improve the teaching / learning process.

6. Grading

6.1 A grading system as below will be adhered to.

<table>
<thead>
<tr>
<th>Range of Marks</th>
<th>Letter Grade</th>
<th>Grade points</th>
</tr>
</thead>
<tbody>
<tr>
<td>95-100</td>
<td>S</td>
<td>10</td>
</tr>
<tr>
<td>85 - 94</td>
<td>A</td>
<td>09</td>
</tr>
<tr>
<td>75- 84</td>
<td>B</td>
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</tr>
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<td>65-74</td>
<td>C</td>
<td>07</td>
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<tr>
<td>55-64</td>
<td>D</td>
<td>06</td>
</tr>
<tr>
<td>50-54</td>
<td>E</td>
<td>05</td>
</tr>
<tr>
<td>&lt; 50</td>
<td>U</td>
<td>00</td>
</tr>
<tr>
<td>I (Incomplete)</td>
<td>--</td>
<td></td>
</tr>
</tbody>
</table>

6.2 GPA & CGPA

GPA is the ratio of the sum of the product of the number of credits $C_i$ of course “i” and the grade points $P_i$ earned for that course taken over all courses “i” registered by the student to the sum of $C_i$ for all “i”. That is,

$$GPA = \frac{\sum_{i} C_i P_i}{\sum_{i} C_i}$$

CGPA will be calculated in a similar manner, at any semester, considering all the courses enrolled from first semester onwards.

6.3. For the students with letter grades W / I in certain subjects, the same will not be included in the computation of GPA and CGPA until after those grades are converted to the regular grades S to U.

6.4 Raw marks will be moderated by a moderation board appointed by the Vice Chancellor of the University. The final marks will be graded using absolute grading system. The Constitution and composition of the moderation board will be dealt with separately.

7. Registration and Enrollment

7.1 Except for the first semester, registration and enrollment will be done in the beginning of the semester as per the schedule announced by the University.

7.2 A student will be eligible for enrollment only if he/she satisfies regulation 10 (maximum duration of the programme) and will be permitted to enroll if (i) he/she has cleared all dues in the Institute, Hostel & Library up to the end of the previous semester and (ii) he/she is not debarred from enrollment by a disciplinary action of the University.

7.3. Students are required to submit registration form duly filled in.

8. Registration requirement

8.1. A full time student shall not register for less than 16 credits or more than 24 credits in any 12 given semester.

8.2 If a student finds his/her load heavy in any semester, or for any other valid reason, he/she may withdraw from the courses within three weeks of the commencement of the semester with the written approval of his/her Faculty Advisor and HOD. However the student should ensure that the total number of credits registered for in any semester should enable him/her to earn the minimum number of credits per semester for the completed semesters.

9. Minimum requirement to continue the programme

9.1 For those students who have not earned the minimum required credit
prescribed for that particular semester examination, awarring letter to the concerned student and also to his parents regarding the shortage of this credit will be sent by the HOD after the announcement of the results of the university examinations.

10. Maximum duration of the programme
The minimum and maximum period for the completion of various programs are given below.

<table>
<thead>
<tr>
<th>Program</th>
<th>Min. No. of Semesters</th>
<th>Max. No. of Semesters</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.E . M,Tech</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>M.B.A. (Full Time)</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>M.B.A. (Part Time)</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>M.C.A.</td>
<td>6</td>
<td>12</td>
</tr>
</tbody>
</table>

11. Temporary discontinuation

11.1. A student may be permitted by the Dean to discontinue temporarily from the programme for a semester or a longer period for reasons of ill health or other valid reasons. Normally a student will be permitted to discontinue from the programme only for a maximum duration of two semesters.

12. Discipline

12.1. Every student is required to observe discipline and decorous behavior both in-side and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the University.

12.2. Any act of indiscipline of a student reported to the Dean (Academic) will be referred to a Discipline Committee so constituted. The Committee will enquire into the charges and decide on suitable punishment if the charges are substantiated. The committee will also authorize the Dean (Academic) to recommend to the Vice - Chancellor the implementation of the decision. The student concerned may appeal to the Vice Chancellor whose decision will be final. The Dean (Academic) will report the action taken at the next meeting of the Council.

12.3. Ragging and harassment of women are strictly prohibited in the University campus and hostels.

13. Attendance

13.1. A student whose attendance is less than 75% is not eligible to appear for the end semester examination for that course. The details of all students who have attendance less than 75% will be announced by the teacher in the class. These details will be sent to the concerned HODs and Dean.

13.2. Those who have 75% or more attendance for the period other than their medical leave will be considered for condonation of shortage of attendance provided the overall attendance in the course including the period of illness does not fall below 65%. Application for condonation recommended by the Faculty Advisor, concerned faculty member and the HOD is to be submitted to the Dean who, depending on the merit of the case, may permit the student to appear for the end semester examination. A student will be eligible for this concession at most in two semesters during the entire degree programme. Application for medical leave, supported by medical certificate with endorsement by a Registered Medical Officer, should reach the HOD within seven days after returning from leave or, on or before the last instructional day of the semester, whichever is earlier.

13.3. As an incentive to those students who are involved in extra curricular activities such as representing the University in Sports and Games,
Cultural Festivals, and Technical Festivals, NCC/ NSS events, a relaxation of up to 10% attendance will be given subject to the condition that these students take prior approval from the officer – in-charge. All such applications should be recommended by the concerned HOD and forwarded to Dean within seven instructional days after the programme/activity.

14. Assessment Procedure

14.1. The Academic Council will decide from time to time the system of tests and examinations in each subject in each semester.

14.2. For each theory course, the assessment will be done on a continuous basis as follows:

<table>
<thead>
<tr>
<th>Test / Exam</th>
<th>Weightage</th>
<th>Duration of Test / Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Periodical Test</td>
<td>15%</td>
<td>1 Period</td>
</tr>
<tr>
<td>Second Periodical Test</td>
<td>15%</td>
<td>1 Period</td>
</tr>
<tr>
<td>Third Periodical Test</td>
<td>20%</td>
<td>2 Periods</td>
</tr>
<tr>
<td>End – Semester Examination</td>
<td>50%</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>

14.3. For practical courses, the assessment will be done by the subject teachers as below:

(i) Weekly assignment/Observation note book / lab records – weightage 60%.
(ii) End semester examination of 3 hours duration including viva – weightage 40%.

15. Make up Examination/periodical Test

15.1. Students who miss the end-semester examinations / periodical test for valid reasons are eligible for make-up examination /periodical test. Those who miss the end-semester examination / periodical test should apply to the Head of the Department concerned within five days after he / she missed examination, giving reasons for absence.

15.2. Permission to appear for make-up examination/periodical test will be given under exceptional circumstances such as admission to a hospital due to illness. Students should produce a medical certificate issued by a Registered Medical Practitioner certifying that he/she was admitted to hospital during the period of examination / periodical test and the same should be duly endorsed by parent/guardian and also by a medical officer of the University within 5 days.

15.3. The student will be allowed to make up at the most two out of three periodical tests and end – semester examination.

16. Project evaluation

16.1. For Project work, the assessment will be done on a continuous basis as follows:

<table>
<thead>
<tr>
<th>Review / Exam</th>
<th>Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Review</td>
<td>10%</td>
</tr>
<tr>
<td>Second Review</td>
<td>20%</td>
</tr>
<tr>
<td>Third Review</td>
<td>20%</td>
</tr>
<tr>
<td>End semester Exam</td>
<td>50%</td>
</tr>
</tbody>
</table>

For end semester exam, the student will submit a Project Report in a format specified by the Dean. The first three reviews will be conducted by a Committee constituted by the Head of the Department. The end – semester exam will be conducted by a Committee constituted by the Controller of Examinations. This will include an external expert.

17. Declaration of results

17.1 A candidate who secures not less than 50% of total marks prescribed for a course with a minimum of 50% of the
marks prescribed for the end semester examination shall be declared to have passed the course and earned the specified credits for the course.

17.2 After the valuation of the answer scripts, the tabulated results are to be scrutinized by the Result Passing Boards of UG and PG programmes constituted by the Vice-Chancellor. The recommendations of the Result Passing Boards will be placed before the Standing Sub Committee of the Academic Council constituted by the Chancellor for scrutiny. The recommendations of the Result Passing Boards will be placed before the Standing Sub Committee along with the results are to be placed before the Vice-Chancellor for approval. After getting the approval of the Vice-Chancellor, the results will be published by the Controller of Examination/Registrar.

17.3 If a candidate fails to secure a pass in a course due to not satisfying the minimum requirement in the end semester examination, he/she shall register and reappear for the end semester examination during the following semester. However, the internal marks secured by the candidate will be retained for all such attempts.

17.4 If a candidate fails to secure a pass in a course due to insufficient internal marks though meeting the minimum requirements of the end semester examination, wishes to improve on his/her internal marks, he/she will have to register for the particular course and attend the course with permission of the HOD concerned and Dean with a copy marked to the Registrar. The sessional and external marks obtained by the candidate in this case will replace the earlier result.

17.5 A candidate can apply for the revaluation of his/her end semester examination answer paper in a theory course within 2 weeks from the declaration of the results, on payment of a prescribed fee through proper application to the Registrar/Controller of Examinations through the Head of the Department. The Registrar/Controller of Examination will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for project work.

18. Grade Card

18.1. After results are declared, grade sheet will be issued to each student, which will contain the following details:
(i) Program and branch for which the student has enrolled.
(ii) Semester of registration.
(iii) List of courses registered during the semester and the grade scored.
(iv) Semester Grade Point Average (GPA)
(v) Cumulative Grade Point Average (CGPA).

19. Class / Division
Classification is based on CGPA and is as follows:
CGPA ≥ 8.0: First Class with distinction
6.5 ≥ CGPA < 8.0: First Class
5.0 ≥ CGPA < 6.5: Second Class.

20. Transfer of credits

20.1. Within the broad framework of these regulations, the Academic Council, based on the recommendation of the transfer of credits committee so constituted by the Chancellor may permit students to earn part of the credit requirement in other approved institutions of repute and status in the country or abroad.

20.2. The Academic Council may also approve admission of lateral entry (who hold a diploma in Engineering/technology) candidates with advance
credit based on the recommendation of the transfer of credits committee on a case to case basis.

21. Eligibility for the award of (M.E. / M.Tech / M.B.A. / M.C.A.) Degree

21.1. A student will be declared to be eligible for the award of the (M.E. / M.Tech / M.B.A. / M.C.A.) Degree if he/she has
   i) registered and successfully credited all the core courses,
   ii) successfully acquired the credits in the different categories as specified in the curriculum corresponding to the discipline (branch) of his/her study within the stipulated time,
   iii) has no dues to all sections of the Institute including Hostels, and
   iv) has no disciplinary action pending against him/her.

The award of the degree must be recommended by the Academic Council and approved by the Board of Management of the University.

22. Power to modify

22.1. Notwithstanding all that has been stated above, the Academic Council has the right to modify any of the above regulations from time to time.
HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE
DEPARTMENT OF AUTOMOBILE ENGINEERING

M.E - INTERNAL COMBUSTION ENGINEERING
CURRICULUM
Semester - I

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
<th>TCH</th>
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<tr>
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<tr>
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* Common to Aero, CAD, ICE, R&AC and Thermal
** Common to ICE, R&AC and Thermal

Semester - II

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
<th>TCH</th>
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<td>2</td>
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<td>AT1608</td>
<td>Internal Combustion Engine Design</td>
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<td>AT1609</td>
<td>Instrumentation for Thermal Systems</td>
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Practical

<table>
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<th>Sl. No</th>
<th>Course Code</th>
<th>Course Title</th>
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<tr>
<td>7</td>
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<td><strong>Total</strong></td>
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Total: 24 + 30 = 54 credits
### Semester - III

<table>
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<th>Sl. No</th>
<th>Course Code</th>
<th>Course Title</th>
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<td>Elective – III</td>
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<td>AT1652</td>
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<td>AT1654</td>
<td>Project Work Phase - I</td>
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<td></td>
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<td><strong>Total</strong></td>
<td></td>
<td></td>
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**Total No. of Credit = 83**

### Semester - IV

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
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**Total No. of Credit = 83**
### LIST OF ELECTIVES

#### MASTER OF BUSINESS ADMINISTRATION (MBA)

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* Common to CAD, ICE, R&AC and Thermal

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**SEMESTER – I**

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M.E - Internal Combustion Engg
UNIT I    CALCUlUS OF VARIABLEs
Concept of variation and its properties- Euler’s Equation-Functional dependant on first and higher order derivatives - Functional dependant on functions of several independent variables- Isoperimetric problems – Direct methods-Ritz and Kantrovich methods

UNIT II    TRANSFORM METHODs
Laplace transform methods for one dimensional wave equation – Displacements in a long string – Longitudinal vibration of an elastic bar - Fourier Transform methods for one dimensional heat conduction problems in infinite and semi-infinite rod

UNIT III    ELLiptIC EQUATIONS
Laplace equation – Properties of Harmonic functions – Solutions of Laplace equation by means of Fourier transform in a half plane in an infinite strip and in a semi-infinite strip

UNIT IV    NUMERICAL SOLUTION OF PARTIAL DIFFERENTIALEQUATIONS
Solution of Laplace and Poisson equation on a rectangular region by Lieebmann’s method – Diffusion equation by the explicit and Crank Nicolson – Implicit methods – Solution of wave equations by explicit scheme Cubic spline interpolation

UNIT V    CONFORMAl MAPPING AND APPLICATIONS
The Schwarz – Christoffel transformation – Transformation of boundaries in parametric form – Physical applications - Application to fluid and heat flow

TOTAL: 60

REFERENCES
UNIT I   CONDUCTION AND RADIATION HEAT TRANSFER  12

One dimensional energy equations and boundary condition, three dimensional heat conduction equations, extended surface heat transfer, Conduction with moving boundaries, Porous-media heat transfer, Radiation in Gases and vapor.

UNIT II  TURBULENT FORCED CONVECTIVE HEAT TRANSFER  12


UNIT III  PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGER  12

Condensation with shear edge on bank of tubes, Boiling – pool and flow boiling, Heat exchanger, \( \varepsilon – \) NTU approach and design procedure, compact heat exchangers.

UNIT IV  NUMERICAL METHODS IN HEAT TRANSFER  12

Finite difference formulation of steady and transient heat condition problems – Discretization schemes – Explicit, Crank Nicolson and Fully implicit schemes, Control volume formulation, Steady one dimensional convection and Diffusion problems, Calculation of the flow field – Simpler Algorithm.

UNIT V  MASS TRANSFER AND ENGINE HEAT TRANSFER CORRELATION  12


TOTAL: 60

ME1631 - ADVANCED THERMODYNAMICS
(Common to ICE, R & AC and Thermal)

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UNIT I  AVAILABILITY ANALYSIS AND THERMODYNAMIC PROPERTY RELATIONS  12

UNIT II  REAL GAS BEHAVIOUR AND MULTI-COMPONENT SYSTEMS  12
Different Equations of State, Fugacity, Compressibility, Principle of Corresponding States, Use of generalized charts for enthalpy and entropy departure, fugacity coefficient, Lee-Kessler generalized three parameter tables, Fundamental property relations for systems of variable composition, partial molar properties, Real gas mixtures, Ideal solution of real gases and liquids, Activity, Equilibrium in multi phase systems, Gibbs phase rule for non-reactive components.

UNIT III  CHEMICAL THERMODYNAMICS AND EQUILIBRIUM  12
Thermo chemistry, First Law analysis of reacting systems, Adiabatic Flame temperature, Entropy change of reacting systems, Second Law analysis of reacting systems, Criterion for reaction equilibrium, Equilibrium constant for gaseous mixtures, evaluation of equilibrium composition,
Chemical availability, Availability of reacting systems.

UNIT IV  STATISTICAL THERMODYNAMICS  12

Microstates and Macrostates, Thermodynamic probability, Degeneracy of energy levels, Maxwell-Boltzman, Fermi-Dirac and Bose-Einstein Statistics, Microscopic Interpretation of heat and work, Evaluation of entropy, Partion function, Calculation of the Macroscopic properties from partition functions, Equilibrium constant statistical thermodynamics approach.

UNIT V  IRREVERSIBLE THERMODYNAMICS  12

Conjugate Fluxes and Forces, Entropy Production Onsager’s Reciprocity relations, Thermo-electric phenomena, formulations, Power Generation, Refrigeration.

TOTAL: 60

REFERENCES

UNIT I  FUELS  12

Availability and Suitability to Piston Engines, Concept of conventional fuels, potential alternative fuels – Ethanol, Methanol, DEE/DME – Hydrogen, LPG, Natural gas, Producer gas, Bio gas and Vegetable oils – Use in I.C.Engines – Merits and Demerits of various fuels.

UNIT II  ALCOHOL FUELS  12


UNIT III  GASEOUS FUELS  12


UNIT IV  VEGETABLE OILS  12

Types - Properties – Biodiesel Esterification – Performance in Engines

UNIT V  LUBRICATION FOR ALTERNATIVE FUELS  12

Concept of Lubrication and Conventional Lubricants – Properties - Effect of Lubricants for alternate fuels on Lubricants and its effects.

TOTAL: 60

TEXT BOOK


REFERENCES


UNIT I  COMBUSTION PRINCIPLES

Thermodynamics, concepts of combustion – Combustion equations, heat of combustion
Theoretical flame temperature, chemical equilibrium and dissociation.

UNIT II  CHEMICAL KINETICS

Theories of Combustion, Pre-flame reactions, Reaction rates, Laminar and Turbulent Flame
Propagation in Engines.

UNIT III  COMBUSTION IN S.I. ENGINES

Initiation of combustion, flame velocities, normal and abnormal combustion, knocking
combustion, pre-ignition, knock and engine variables, features and design consideration of
combustion chambers, stratified charge combustion, concepts of lean burn engines, heat release
correlations.

UNIT IV  COMBUSTION IN C.I. ENGINES

Various stages of combustion, vaporization of fuel droplets and spray formation, air motion,
swirl, squish, tumble flow, velocities, swirl measurement, delay period correlations, diesel knock
and engine variables, features and design considerations of combustion chambers, heat release
correlations.

UNIT V  COMBUSTION IN GAS TURBINE

Flame stability, re-circulation zone and requirements, Combustion chamber configuration,
materials.

TOTAL: 60

TEXT BOOKS

REFERENCES
2000.
3. Obert, E.F., Internal Combustion Engine and Air Pollution, International Text Book Publishers,
1983.


AT1605 - ADVANCED FLUID MECHANICS

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UNIT I INTRODUCTION

Ideal and non-ideal flows, general equations of fluid motion, Navier - stokes equations and their exact solutions. Boundary layer theory, wedge flows, laminar flow over plates and through cylinders.

UNIT II TWO DIMENSIONAL FLOW


UNIT III TURBULENT FLOW

Turbulence, models and flow equations: steady and unsteady turbulent boundary layers

UNIT IV COMPRESSIBLE FLOW THROUGH DUCTS

Introduction to compressible viscous flow, governing equations, flow with friction - flow with neat transfer flow though nozzle and diffuser.

UNIT V SHOCK WAVE


TOTAL: 60

REFERENCES

1. T. Radhakrishnan, Gas Dynamics Prentice Hall, New Delhi

SEMESTER – II
UNIT I  SENSORS  
Types – Air flow, Pressure, Temperature, Speed Oxygen, Detonation, Position – Principle of operation, Arrangement and material.

UNIT II  GASOLINE INJECTION SYSTEM  
Open loop and closed loop systems, Mono point, Multi point and direct injection systems – Principles and Features, Bosch injection systems.

UNIT III  DIESEL INJECTION SYSTEM  
Inline injection pump, Rotary pump and injector – Construction and principle of operation, Common rail and unit injector system – Construction and principle of operation.

UNIT IV  IGNITION SYSTEMS  
Ignition fundamentals, Types of solid state ignition systems, high energy ignition distributors, Electronic spark timing and control.

UNIT V  ENGINE MAPPING  
Combined ignition and fuel management systems. Digital control techniques – Dwell angle calculation, Ignition timing calculation and Injection duration calculation, Hybrid vehicles and fuel cells.

TOTAL: 60

TEXT BOOKS

REFERENCES
UNIT I  POLLUTANT FORMATION IN ENGINES AND TURBINES  12

Atmospheric pollution from piston engines and gas turbines, Global warming. Formation of oxides of nitrogen, carbon monoxide, hydrocarbon, aldehydes and Smoke, Particulate emission, effects of pollutions on environment.

UNIT II  POLLUTION MEASUREMENT  12

Non dispersive infrared gas analyzer, gas chromatography, chemiluminescent analyzer and flame ionization detector, smoke measurement, noise pollution, measurement and control

UNIT III  POLLUTION CONTROL - IN CYLINDER METHODS  12

Engine component, fuel modification, evaporative emission control, EGR, air injection, thermal reactors, Water Injection, catalytic converters, application of microprocessor in emission control.

UNIT IV  POLLUTION CONTROL AFTER TREATMENT  12

UNIT V  CYCLES AND EMISSION STANDARDS  12

Use of driving cycles for emission measurement, chassis dynamometer, CVS system, National and International emission standards

REFERENCES

UNIT I  GENERAL CONSIDERATIONS IN ENGINE DESIGN  12

   Principle of similitude, Choice of cycle, speed, fuel, bore and stroke, cylinder arrangement, choice of material, stress and fatigue considerations, design for manufacture, Factors for NHV and Control.

UNIT II  DESIGN OF MAJOR COMPONENTS  12

   Piston system, connecting rod assembly, crankshaft system, valve gearing, stress analyses

UNIT III  DESIGN OF OTHER COMPONENTS.  12

   Inlet and exhaust manifolds, cylinder block, cylinder liner, cylinder head, crankcase, engine foundations and mountings, gaskets, bearings, flywheel, Turbocharger, supercharger, computer controlled fuel injection system.

UNIT IV  DESIGN OF TWO-STROKE ENGINES  12

   Arrangement and sizing of ports, piston assembly, intake and exhaust system, scavenging, application to automotive gasoline and marine diesel engines.

UNIT V  CONCEPTS OF COMPUTER AIDED DESIGN  12

   Preparation of working drawings of designed components using CAD system.

TOTAL:  60

REFERENCES
8. Rodica Baranescu and Bernard Challen (Editors), Diesel Engine Reference Book, Second
AT1609 - INSTRUMENTATION FOR THERMAL SYSTEMS

UNIT I  MEASUREMENT CHARACTERISTICS  12

Instrument Classification, Characteristics of Instruments – Static and dynamic, experimental error analysis, Systematic and random errors, Statistical analysis, Uncertainty, Experimental planning and selection of measuring instruments, Reliability of instruments.

UNIT II  MICROPROCESSORS AND COMPUTERS IN MEASUREMENT  12

Data logging and acquisition, use of intelligent instruments for error reduction, elements of micro-computer interfacing, intelligent instruments in use.

UNIT III  MEASUREMENT OF PHYSICAL QUANTITIES  12

Measurement of thermo-physical properties, instruments for measuring temperature, pressure and flow, use of intelligent instruments for the physical variables.

UNIT IV  FLOW VISUALISATION  12

Techniques, shadow graph, Schlieren, interferometer, Laser Doppler anemometer, heat flux measurement, Telemetry in engines.

UNIT V  MEASUREMENT ANALYSIS  12

Chemical, thermal, magnetic and optical gas analyzers, measurement of smoke, dust and moisture, gas chromatography, spectrometry, measurement of pH, Review of basic measurement techniques.

REFERENCES

3. Prebrashensky, V., Measurements and Instrumentation in Heat Engineering, Vol.1 and 2,


AT1650 - ENGINE DESIGN LAB

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Students should design and develop model of Engine systems and validate the results.

AT1651 - I.C.ENGINES LAB

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PART – A     PERFORMANCE TESTS
1. Performance test on Spark Ignition engines using Alternate fuels such as ethanol and LPG.
2. Emission measurement in Spark Ignition and Compression Ignition Engines.
5. Performance test on variable compression ratio petrol and diesel engines.

PART – B     SIMULATION STUDIES
1. Simulation studies of Petrol and Diesel Engine Cycles.
2. Simulation of Gas Turbine Cycles
3. Simulation of Adiabatic flame temperature in constant volume heat addition process.
4. Simulation of Adiabatic flame temperature in constant pressure heat addition process.
5. CFD analysis for a fluid flow problem with heat transfer.

Note: The end semester examination shall be conducted in both Part – A and Part – B.

EQUIPMENTS REQUIRED:
1. Single cylinder / Multi cylinder petrol engine
2. Dynamometer suitable for the above
3. CO / HC / NOX Analyzers
4. Smoke meter
5. Pressure transducers (0 –250 bar)
6. Pressure transducer with spark plug adaptor
7. Charge amplifier
8. AD controller with PC or FFT analyzer or CRO (dual beam)
9. Variable Compression ratio petrol and diesel engines
10. Pentium 4 with 1 GB ram – 15 Nos
11. CFD Packages / STAR CD / Fluent / CFX for 15 users

SEMESTER – III
Students should undergo Industrial visit to reputed Industrial visit for a period of 4 weeks (minimum) during the vacation period at the end of 2nd semester. Examination will be conducted along with the 3rd semester as practical subjects. Students should prepare a Report and presentation seminar for the exam.

ELECTIVE COURSES

ME1624 - COMPUTATIONAL FLUID DYNAMICS
(Common to CAD, ICE, R & AC and Thermal)

UNIT I  GOVERNING EQUATIONS AND BOUNDARY CONDITIONS  12

Basics of CFD, Governing equations of Fluid Dynamics – Continuity momentum and Energy equations, Physical Boundary conditions, Mathematical behaviour of PDEs on CFD – Elliptic, Parabolic and Hyperbolic equations

UNIT II  DISCRETISATION TECHNIQUES AND SOLUTION METHODOLOGIES  12


UNIT III  CALCULATION OF FLOW – FIELD FOR N – S EQUATIONS  12


UNIT IV  TURBULENCE MODELING  12
Time – averaged equation for turbulent flow, Turbulence models – Zero equation model, one equation model, two equation K-I models, and advanced models.

UNIT V GRID GENERATION

Algebraic Methods – Methods – Differential Equation methods – Adaptive grids

TOTAL: 60

TEXT BOOKS


REFERENCES


AT1610 - AUTOMOTIVE ENGINE SYSTEMS
UNIT I  AUTOMOTIVE ENGINE TYPES  12


UNIT II  GASOLINE INJECTION  12


UNIT III  FUEL QUALITY  12

Fuel – Quality and Methods of Admission Fuel quality standards for Automotive Engines – Lead free gasoline, low and ultra – low sulphur diesels, LPG, CNG, Alcohols, Biodiesels, Gaseous Fuel Injections, Dual Fueling and Controls – CNG and Gasoline, Hydrogen and Diesel, Alcohols and Diesels etc.

UNIT IV  ENGINE ELECTRONIC  12

Engine electrical and electronic systems - Engine sensors, Distributorless ignition and Direct ignition systems, 12V, Dual voltage and 42V systems.

UNIT V  NEW ENGINE TECHNOLOGIES  12


TOTAL:  60

REFERENCES


AT 1611 - ENGINE AUXILLARY SYSTEMS
UNIT I  CARBURETION  12

Properties of air-petrol mixtures, Mixture requirements for steady state and transient operation, Mixture formation studies of volatile fuels, design of elementary carburetor, Chokes, Effects of altitude on carburetion, Carburetor for 2-stroke and 4-stroke engines, carburetor systems for emission control.

UNIT II  GASOLINE INJECTION AND IGNITION SYSTEMS  12


UNIT III  DIESEL FUEL INJECTION  12

Factors influencing fuel spray atomization, penetration and dispersion of diesel and heavy oils and their properties, rate and duration of injection, fuel line hydraulics, fuel pump, injectors.

UNIT IV  MANIFOLDS AND MIXTURE DISTRIBUTION  12

Intake system components, Discharge coefficient, Pressure drop, Air filter, Intake manifold, Connecting pipe, Exhaust system components, Exhaust manifold and exhaust pipe, Spark arresters, Waste heat recovery, Exhaust mufflers, Type of mufflers, exhaust manifold expansion.

UNIT V  LUBRICATION AND COOLING SYSTEMS  12

Lubricants, lubricating systems, Lubrication of piston rings, bearings, oil consumption, Oil cooling. Heat transfer coefficients, liquid and air cooled engines, coolants, additives and lubricity improvers, concept of adiabatic engines.

REFERENCES


Total: 60
UNIT I   INTRODUCTION  

Power plant cycles for stationary and aircraft applications, component behaviors, analysis of ramjet, turbojet and turbo-propeller, Inlets and nozzles.

UNIT II   COMPRESSORS  

Centrifugal and axial flow compressors momentum and energy transfer in rotors, velocity diagrams, stage performance, compressibility effects, cascade testing and characteristics.

UNIT III   AXIAL AND RADIAL FLOW TURBINE  

Stage velocity diagrams, reaction stages, losses and coefficients, blade design principles, materials, testing and performance characteristics.

UNIT IV   COMBUSTORS  

Different types and flow pattern, material requirement and cooling systems, air pollution and reduction.

UNIT V   MATCHING  

Matching procedure of power plant components, engine off-design performance.

TOTAL : 60

REFERENCES

5. Earl Logan, Jr., Hand book of Turbo machinery, Marcel Dekker, Inc., USA, 1992

AT 1613 - JET AND ROCKET PROPULSION
UNIT I THERMODYNAMICS OF AIRCRAFT JET ENGINES 12


UNIT II AERO-THERMODYNAMICS OF JET PROPULSION SUBSYSTEMS 12


UNIT III PERFORMANCE OF ROCKET VEHICLES 12


UNIT IV CHEMICAL ROCKET THRUST CHAMBERS 12


UNIT V CHEMICAL ROCKET PROPELLANT COMBUSTION & EXPANSION 12


TOTAL: 60

REFERENCES

5. S.M. Yahya., Gas Dynamics and Jet Propulsion.
UNIT I  CYLINDER BLOCK AND CYLINDER HEAD  12

Casting practice and special requirements, materials, machining, methods of testing, Cylinder liners – Mat, Types and Manufacture.

UNIT II  PISTON ASSEMBLY  12

Types, requirements, casting, forging, squeeze casting, materials, machining, testing, manufacture piston rings – material, types and manufacture – surface treatment, bimetallic pistons, articulated pistons.

UNIT III  DRIVE SYSTEMS  12

Requirements, materials, forging practice, machining, balancing of crankshaft, testing, CR, CS, CAS, VT.

UNIT IV  COMPUTER INTEGRATED MANUFACTURING  12

Integration of CAD, CAM and Business functions CIM- Networking, CNC programming for machining of I.C.Engines Components.

UNIT V  QUALITY AND TESTING  12

SPC - Introduction to ISO 9000, ISO 14000, TS 16949, its importance, BIS codes for testing various types of engines, equipments required, instrumentation, computer aided engine testing, metrology for manufacturing I.C.Engine Components, In site measurement – Telemetry and sensors.

TOTAL: 60

REFERENCES


AT 1615 - MARINE DIESEL ENGINES

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UNIT I  MARINE DIESEL ENGINE FUNDAMENTALS  12

Theory of Engine Operation, Engine Operating Cycles, Power Economy and basic performance factors; Supercharging and Scavenging Systems for 2 stroke and four-stroke cycle engines, Submarine Engine Systems.

UNIT II  MECHANICS OF MARINE ENGINES  12

Dynamics of crank gear, Engine Vibration, Design aspects of Marine Diesel Engine Systems, Speed governors and miscellaneous accessory equipment.

UNIT III  INSTRUMENTATION AND CONTROL OF ENGINES  12

Automatic instruments and remote control of marine engines, Testing of Marine Diesel Engines, Standard codes of test procedures, rating of engines.

UNIT IV  TYPICAL MODERN MARINE PROPULSION ENGINE SYSTEMS  12

M.A.N – B & W, Pielstick etc.

UNIT V  MARINE ENGINE AUXILIARY SYSTEMS  12

Starting and reversing gears of Marine Diesel Engines, Fuel system, cooling system, Lubrication system.

Total:  60

REFERENCES


4. Pounder’s Marine Diesel Engines, Doug Woodyard (Editor), Butterworth-Heinemann, UK (Seventh Edition), 1998


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**AT 1616 - SIMULATION OF I.C. ENGINE PROCESSES**

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**UNIT I**  
**INTRODUCTION**  
Simulation principles – Simulation exercises using computers, Validation of models.

**UNIT II**  
**COMBUSTION PROCESS – GENERAL**  
Heat of reaction – Adiabatic flame temperature – Temperature change due to fuel vaporization

**UNIT III**  
**COMBUSTION AND HEAT TRANSFER IN ENGINES**  

**UNIT IV**  
**C.I. AND S.I. ENGINE SIMULATION**  
Simulation of Otto cycles under full load and part load and supercharged conditions.

**UNIT V**  
**TWO STROKE ENGINE SIMULATION**  
Engine and porting geometry, gas flow, Scavenging.

**TOTAL : 60**

**REFERENCES**


AT 1617 - SPECIALITY ENGINES

UNIT I  INTRODUCTION  12
The design features of Automotive, Locomotive, Marine, Stationary and Generator-set engines.

UNIT II  S.I. ENGINE SYSTEMS  12

UNIT III  C.I. ENGINE SYSTEMS  12
Compression ignition engine system variants – Low, Medium and High speed system characteristics, High pressure fuel injection systems, Homogeneous Charge Compression Ignition systems, Dual and dedicated alternate fueled engine systems, coal and producer gas fueled engine systems, cogeneration system, Total engine systems.

UNIT IV  SPECIAL PURPOSE ENGINE SYSTEMS  12
Engines for special applications – Mining Defence, Off-highway – Tractor, Bulldozer etc. Submarines, Race car engine systems, Flexible fueled systems.

UNIT V  LIFE CYCLE ANALYSES OF ENGINE SYSTEMS  12
Life cycle cost.

TOTAL : 60
REFERENCES


AT 1618 - SUPERCHARGING AND SCAVENGING

UNIT I  SUPERCHARGING  12


UNIT II  SUPERCHARGERS  12


UNIT III  SCAVENGING OF TWO STROKE ENGINES  12


UNIT IV  PORTS AND MUFFLER DESIGN  12

UNIT V  

EXPERIMENTAL METHOD

Experimental techniques for evaluating scavenging – Firing engine tests – Non firing engine tests – Port flow characteristics – Kadenacy system – Orbital engine combustion system.

REFERENCES