SEMESTER-VII, MECHANICAL ENGG

102701	Internal Combustion Engines	3L:T:3P	4.5 Credits

Objectives:

1. To familiarize with the terminology associated with IC engines.
2. To understand the basics of IC engines.
3. To understand combustion, and various parameters and variables affecting it in various types of IC engines.
4. To learn about various systems used in IC engines and the type of IC engine required for various applications

Course Contents:

Module:1

Basics of IC Engines, Engine components and classification: Two strokes, four stroke (SI and CI) engines, engines parts, engines working principle and valve timing diagram. Ideal cycles and Fuel-air cycles. **(Lectures 6)**

Module: 2

Engine performance-test: purpose and types, measurement of power, Engine system & performance parameters evaluation. **(Lectures 4)**

Module: 3

Combustion in SI and CI engines: Stages of combustion in SI engines, abnormal combustion and knocking in SI engines, factors affecting knocking, effects of knocking, control of knocking, combustion chambers for SI engines, Stages of combustion in CI engines, detonation in C.I. engines, factors affecting detonation, controlling detonation, combustion chamber for SI and CI engine. **(Lectures 7)**

Module: 4

Fuel supply systems in SI and CI engines, carburetors, Port fuel injection, Direct injection and Common rail injection. **(Lectures 6)**

Module: 5

Ignition system: Battery and magneto ignition system, spark plug, firing order, quality, quantity & hit and miss governing.

Lubrication system and Cooling system: Lubrication of engine components, Lubrication system – wet sump and dry sump, crankcase ventilation, Types of cooling systems – liquid and air cooled, comparison of liquid and air cooled systems. **(Lectures 7)**

Module: 6

Measurement and Testing of IC engines: Measurement of indicated power, brake power, fuel consumption and emission, Measurement of friction power by Willan's Line Method and Morse Test, calculation of brake thermal efficiency, brake power and brake specific fuel consumption of IC Engines, variable compression ratio engines, heat balance sheet of IC Engines.

Engine Emission and their control: Air pollution due to IC engines, constituent and types of emission HC, CO and NOx emission, catalytic convertor**.** Advanced IC Engine concepts.

(Lectures 8)

Module: 7

Super charging, engine lubrication and cooling. **(Lectures 4)**

Text Books:

1. Obert E. F, "Internal Combustion Engines and Air Pollution", Harper and Row Publication Inc. NY, 1973.
2. Heisler H, "Advanced Engine Technology", Edward Arnold, 1995.
3. Heywood J. B, "Internal Combustion Engine Fundamentals", McGraw Hill Book Co. NY, 1989
4. Heldt P. M, "High Speed Combustion Engines", Oxford & IBH publishing Co. India, 1985.
5. Stockel M W, Stockel T S and Johanson C, "Auto Fundamentals", The Goodheart, Wilcox Co.
6. Inc., Illinois, 1996.

Course Outcomes:

Students who have done this course will have a good idea of the basics of IC engines and how different parameters influence the operational characteristics of IC Engines

Laboratory:

1. To study the cross-sectional view of I.C. engine.
2. Determination of the calorific value of a given fuel and its flash & fire points.
3. To study the actual valve timing diagram of 4-stroke engine.
4. To prepare the heat balance sheet by conducting performance test on a single cylinder 4-stroke diesel engine.
5. To prepare the heat balance sheet by conducting performance test on a single cylinder 4-stroke petrol engine.
6. Performance evaluation of multi cylinder Diesel Engine.
7. Conduct the Morse test on a multi cylinder petrol engine and find out the friction power.

102706	Operations Research	3L:0T:0P	3 credits

Pre-requisite: NIL

Objective: To enable students to understand and apply operations research techniques in industrial operations for obtaining optimized solutions.

Outcome: Determination of optimal or near optimal solution to complex decision making problems.

Module: 1

Introduction: Features of Operations Research (OR), Methodology of OR, Scopes and Objectives of OR, models in OR. (**Lectures 4)**

Module: 2

Inventory classification, Different cost associated to Inventory, Economic order quantity, Inventory models with deterministic demands, ABC analysis

Introduction and assumptions of LPP, Mathematical formulation of LPP, Graphical Method, Simplex Method. (**Lectures 9)**

Module: 3

Transportation Problems: Introduction, North – West Corner Method, Least Cost Method, Vogel's Approximation Method, Test for Optimality. Assignment Problems: Introduction, Hungarian Assignment Method, Unbalanced Assignment Problems. (**Lectures 8)**

Module: 4

Sequencing: Introduction, Formulation of Sequencing Problem, Johnson's Rule. Network Analysis: Introduction, PERT and CPM, Time – Cost Trade-off (Project Crashing), Resource Leveling. (**Lectures 7)**

Module: 5

Dynamic Programming: Introduction, Deterministic Dynamic Programming, Probabilistic Dynamic Programming. Simulation: Introduction, Monte Carlo Simulation, Simulation of Inventory and Queuing System. (**Lectures 7)**

Module: 6

Queuing Theory: Introduction, General Structure of Queuing System, Operating Characteristics of Queuing System, Queuing Models. Replacement Theory: Introduction, Replacement Policies: Gradually Deteriorating Equipments, Items that Fail Suddenly.

(**Lectures 7)**

Text/Reference Books:

1. Operations research – An Introduction, Hamdy A Taha, 8th Edition, Pearson Education.
2. Introduction to Operations Research, Hillier and Lieberman, 8th Edition, TMH.
3. Operations Research, R Panneerselvan, 2nd Edition, PHI.
4. Quantitative Techniques in Management, N D Vohra, 4th Edition, McGraw Hill.

Mechanical Engineering

102702	Refrigeration and Air Conditioning	3L:0T:3P	4.5 credits

Objectives:

1. To familiarize with the terminology associated with refrigeration systems and air conditioning
2. To understand basic refrigeration processes
3. To understand the basics of psychometric and practice of applied psychometrics
4. To acquire the skills required to model, analyses and design different refrigeration as well asair conditioning processes and components.

Course Content:

Module: 1

Air refrigeration system: Refrigeration machine, heat pump, coefficient of performance, ideal refrigeration cycle, Bell – Coleman, refrigeration cycle, open and closed systems, application of air-refrigeration in air-crafts. **(Lectures 6)**

Module:2

Various compression systems: Simple vapour compression refrigeration cycle, merits and Refrigerants demerits of this system over air refrigeration system, factors affecting the performance of a vapour compression refrigeration system, sub cooling and superheating of vapour, wet and dry compression, multistage vapour compression system, intercooler, flash chamber, accumulator and heat exchanger. **(Lectures 8)**

Module:3

Vapour absorption system: Simple and modified vapour absorption refrigeration system, Electrolux refrigerator, COP of heat operated refrigeration system. **(Lectures 5)**

Module:4

Special refrigeration system, absorption, cascade, vortex, thermoelectric and steam jet refrigeration system. **(Lectures 4)**

Module: 5

Refrigerants: classification and nomenclature of refrigerants, primary and secondary refrigerants, properties of some common refrigerants, physical, chemical and thermodynamics properties, selection of refrigerants, leakage of refrigerants and methods of detection.

(Lectures 3)

Module:6

Psychometry: Properties of air vapour mixture, wet bulb, dew point & dry bulb temperatures, humidity, specific humidity, humidity ratio, degree of saturation, relative humidity, total heat psychometric relation, psychometric charts and its uses, psychometric processes evaporative cooling.

(Lectures 5)

102705	Automobile Engineering	3L:0T:3P	4.5 credits

Objectives:

To understand the construction and working principle of various parts of an automobile

Contents:

Module: 1

Types of automobiles, vehicle construction and layouts, Car body Style, chassis, frame and body, vehicle aerodynamics, IC engines-components, function and materials, variable valve timing (VVT), Front engine front wheel drive, Front engine Rear wheel drive, foure wheel drive.

(Lectures 6)

Module: 2

Engine auxiliary systems, electronic injection for SI and CI engines, unit injector system, rotary distributor type and common rail direct injection system, transistor based coil ignition & capacitive discharge ignition systems, turbo chargers (WGT, VGT), engine emission control by 3-way catalytic converter system, Emission norms (Euro & BS). **(Lectures 6)**

Module: 3

Transmission systems, clutch types, cone clutch, Single plate, multi plate, diaphragm spring & centrifugal clutch, electromagnetic clutch & construction, gear boxes- manual and automatic gear shift mechanisms, over drive principles, transfer box, Transaxles, flywheel, torque converter, propeller shaft, slip joints, universal joints, differential and rear axle, Hotchkiss drive and Torque tube drive**.** **(Lectures 8)**

Module:4

Steering geometry and types of steering gear box, power steering, types of front axle, types of suspension systems, constructional details & characteristics of Leaf spring, pneumatic and hydraulic braking systems, antilock braking system (ABS), electronic brake force distribution (EBD) and traction control. **(Lectures 8)**

Module: 5

Caster, Camber, King pin inclination Toe in Toe out, Full Floating, three quarter floating &semi Floating rear axles. **(Lectures 5)**

Module: 6

Alternative energy sources, natural gas, LPG, biodiesel, bio-ethanol, gasohol and hydrogen fuels in automobiles, modifications needed, performance, combustion & emission characteristics of alternative fuels in SI and CI engines, Electric and Hybrid vehicles, application of Fuel Cells.

(Lectures 7)

Course Outcomes:

Upon completion of this course, students will understand the function of each automobile component and also have a clear idea about the overall vehicle performance.

Text books:

1. Kirpal Singh, Automobile Engineering, 7th ed., Standard Publishers, New Delhi, 1997.
2. Jain K.K. and Asthana R.B., Automobile Engineering, Tata McGraw Hill, New Delhi, 2002.
3. Heitner J., Automotive Mechanics, 2nd ed., East-West Press, 1999.
4. Heisler H., Advanced Engine Technology, SAE International Publ., USA, 1998.

Practical:

1. To study and prepare report on the constructional details, working principles and operation of the Automotive Clutches.
2. To study and prepare report on the constructional details, working principles and operation of the Automotive Transmission systems.
3. To study and prepare report on the constructional details, working principles and operation of the Automotive Drive Lines & Differentials.
4. To study and prepare report on the constructional details, working principles and operation of the Multi-cylinder: Diesel and Petrol Engines.
5. To study and prepare report on the constructional details, working principles and operation of the Fuels supply systems.
6. To study and prepare report on the constructional details, working principles and operation of the Engine cooling & lubricating Systems.
7. To study and prepare report on the constructional details, working principles and operation of the Automotive Suspension Systems.
8. To study and prepare report on the constructional details, working principles and operation of the Automotive Steering Systems.
9. To study and prepare report on the constructional details, working principles and operation of the Automotive Brake systems.