



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
AUTOMOBILE ENGINEERING (R23-IInd Year COURSE STRUCTURE & SYLLABUS)

B. Tech – II Year I Semester

S.No	Category	Title	L	T	P	Credits
1	BS	Numerical Techniques and Statistical Methods	3	0	0	3
2	HSMC	Universal human values – understanding harmony and Ethical human conduct	2	1	0	3
3	Engineering Science	Thermodynamics & Thermal Engineering	3	0	0	3
4	Professional Core	Fluid Mechanics & Hydraulic Machines	3	0	0	3
5	Professional Core	Components of Automotive Chassis	3	0	0	3
6	Professional Core	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
7	Professional Core	Automotive Chassis Lab	0	0	3	1.5
8	Skill Enhancement Course	Computer Aided drafting and Automobile Assembly Drawing	0	1	2	2
9	Audit Course	Environmental Science	2	0	0	-
Total			16	2	8	20

B. Tech – II Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Management Course- I	Product Life Cycle Management	2	0	0	2
2	Engineering Science/Basic Science	Mechanics of Solids	3	0	0	3
3	Professional Core	Automobile Engines	3	0	0	3
4	Professional Core	Automobile Electrical and Electronics	3	0	0	3
5	Professional Core	Metallurgy and Material Science	3	0	0	3
6	Professional Core	Automobile Engines & Fuels Lab	0	0	3	1.5
7	Professional Core	Automobile Electrical and Electronics Lab	0	0	3	1.5
8	Skill Enhancement Course	Machine Tools and Metrology Lab	0	1	2	2
9	Engineering Science	Design Thinking & Innovation	1	0	2	2
Total			15	1	10	21
Mandatory Community Service Project Internship of 08 weeks duration during Summer Vacation						



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3	0	0	3

II Year - I Semester

NUMERICAL TECHNIQUES AND STATISTICAL METHODS

Course Objectives:

- To elucidate the different numerical methods to solve nonlinear algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration.
- To familiarize the students with the foundations of probability and statistical methods.
- To equip the students to solve application problems in their disciplines.

UNIT – I: Iterative Methods: (9 Hrs)

Introduction – Solutions of algebraic and transcendental equations: Bisection method – Secant method – Method of false position – Iteration method – Newton-Raphson method (One variable and simultaneous Equations)

Interpolation: Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula

UNIT – II: Numerical integration, Solution of ordinary differential equations with initial conditions: (9 Hrs)

Trapezoidal rule– Simpson's 1/3rd and 3/8th rule– Solution of initial value problems by Taylor's series– Picard's method of successive approximations– Euler's method –Runge-Kutta method (second and fourth order) – Milne's Predictor and Corrector Method.

UNIT – III: Probability and Distributions: (9 Hrs)

Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution functions – Probability mass function, Probability density function and Cumulative distribution functions – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.

UNIT – IV: Sampling Theory: (9 Hrs)

Introduction – Population and Samples – Sampling distribution of Means and Variance (definition only) –Point and Interval estimations – Maximum error of estimate – Central limit theorem (without proof) – Estimation using t , χ^2 and F-distributions.

UNIT – V: Tests of Hypothesis: (9 Hrs)

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance– One tail and two-tail tests – Test of significance for large samples and Small Samples: Single and difference means – Single and two proportions – Student's t- test, F-test, χ^2 -test.



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Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. Miller and Freund's, Probability and Statistics for Engineers, 7/e, Pearson, 2008.

Reference Books:

1. Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineering and Science, Tata Mc. Graw Hill Education.
2. M. K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
3. Lawrence Turyn, Advanced Engineering Mathematics, CRC Press.
4. S. C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
5. Shron L. Myers, Keying Ye, Ronald E Walpole, Probability and Statistics Engineers and the Scientists, 8th Edition, Pearson 2007.
6. Jay I. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Evaluate the approximate roots of polynomial and transcendental equations by different algorithms. Apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals	L3
CO2	Apply numerical integral techniques to different Engineering problems. Apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations	L3
CO3	Apply discrete and continuous probability distributions	L3
CO4	Design the components of a classical hypothesis test	L6
CO5	Infer the statistical inferential methods based on small and large sampling tests	L4



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II B. Tech I Semester

L	T	P	C
2	1	0	3

UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT

Course Objectives:

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes:

- Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
- Identify one's self, and one's surroundings (family, society nature) (L1, L2)
- Apply what they have learnt to their own self in different day-to-day settings in real life (L3)
- Relate human values with human relationship and human society. (L4)
- Justify the need for universal human values and harmonious existence (L5)
- Develop as socially and ecologically responsible engineers (L3, L6)

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT I Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about Oneself

Lecture 3: self-exploration as the Process for Value Education

Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations

Tutorial 2: Practice Session PS2 Exploring Human Consciousness

Lecture 5: Happiness and Prosperity – Current Scenario

Lecture 6: Method to Fulfill the Basic Human Aspirations

Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT II Harmony in the Human Being (6 lectures and 3 tutorials for practice session)



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Lecture 7: Understanding Human being as the Co-existence of the self and the body.

Lecture 8: Distinguishing between the Needs of the self and the body

Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.

Lecture 9: The body as an Instrument of the self

Lecture 10: Understanding Harmony in the self

Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self

Lecture 11: Harmony of the self with the body

Lecture 12: Programme to ensure self-regulation and Health

Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction

Lecture 14: 'Trust' – the Foundational Value in Relationship

Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust

Lecture 15: 'Respect' – as the Right Evaluation

Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect

Lecture 16: Other Feelings, Justice in Human-to-Human Relationship

Lecture 17: Understanding Harmony in the Society

Lecture 18: Vision for the Universal Human Order

Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)

Lecture 19: Understanding Harmony in the Nature

Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature

Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature

Lecture 21: Realizing Existence as Co-existence at All Levels

Lecture 22: The Holistic Perception of Harmony in Existence

Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

UNIT V Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)

Lecture 23: Natural Acceptance of Human Values

Lecture 24: Definitiveness of (Ethical) Human Conduct

Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct

Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order

Lecture 26: Competence in Professional Ethics

Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education

Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies

Lecture 28: Strategies for Transition towards Value-based Life and Profession

Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education
PS1 Sharing about Oneself



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PS2 Exploring Human Consciousness
PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being
PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self
PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society
PS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)
PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics
PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

READINGS:

Textbook and Teachers Manual

a. The Textbook

R R Gaur, R Asthana, G P Bagaria, *A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher's Manual

R R Gaur, R Asthana, G P Bagaria, *Teachers' Manual for A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. *Jeevan Vidya: Ek Parichaya*, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. *Human Values*, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. *The Story of Stuff* (Book).
4. *The Story of My Experiments with Truth* - by Mohandas Karamchand Gandhi
5. *Small is Beautiful* - E. F Schumacher.
6. *Slow is Beautiful* - Cecile Andrews
7. *Economy of Permanence* - J C Kumarappa
8. *Bharat Mein Angreji Raj* – Pandit Sunderlal
9. *Rediscovering India* - by Dharampal
10. *Hind Swaraj or Indian Home Rule* - by Mohandas K. Gandhi
11. *India Wins Freedom* - Maulana Abdul Kalam Azad
12. *Vivekananda* - Romain Rolland (English)
13. *Gandhi* - Romain Rolland (English)

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.



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Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than "extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

Online Resources:

1. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf>
2. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf>
3. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf>
4. <https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%202023.pdf>
5. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf>
6. <https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf>
7. <https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf>
8. <https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385>
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview



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L	T	P	C
3	0	0	3

II B. Tech I Semester

THERMODYNAMICS & THERMAL ENGINEERING

Course Objectives:

1. To impart knowledge of basic principles of thermodynamics via real world engineering examples.
2. To analyse and evaluate cardinal air standard cycles.
3. To analyse and evaluate cardinal Steam power cycles.
4. Summarize the governing concepts of Refrigeration and Air conditioning.
5. To introduce various modes of heat and mass transfer, related to real time scenarios of thermodynamics applied in engineering practice

UNIT – I: BASIC THERMODYNAMICS (10 Hrs)

Systems, closed, open and isolated. Property, state, path and process, quasi-static process, Zeroth law, First law. Steady flow energy equation. Engineering Applications of Steady flow energy equation Heat and work transfer in flow and non-flow processes. Second law, Kelvin-Planck statement – Clausius statement - Concept of Entropy, Clausius inequality, Entropy change in nonflow processes. Availability and Un Availability. Properties of gases and vapours

UNIT – II AIR STANDARD CYCLES AND COMPRESSORS (10 Hrs)

Cycle, Carnot cycle, Otto, Diesel, Dual combustion and Brayton cycles. Air standard efficiency. Mean effective pressure. Comparison of cycles, Efficiency versus compression ratio, For the same compression ratio and the same heat input. Compressors, Classifications of compressors, Single stage and multi stage, Effect of intercooler in multi stage compressor, Perfect and imperfect intercooler, work done by the compressor, Reciprocating, Rotary, Axial, Vane compressors.

UNIT – III: STEAM (8 Hrs)

Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface Properties of steam, Dryness fraction, Quality of steam by steam tables and Mollier chart – Rankine cycle, Work done, Steam rate – Steam Nozzles, Types of nozzles, Friction in nozzles.

UNIT – IV: REFRIGERATION AND AIR-CONDITIONING (8 Hrs)

Principles of refrigeration, Vapour compression – Types of VCR system with respect to condition of vapour, Problems, Vapour absorption types, comparison - Co-efficient of performance (COP), Properties of refrigerants – Basic Principle, Summer, winter and Year round Air conditioning.



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UNIT – V: HEAT AND MASS TRANSFER (10 Hrs)

Heat Transfer: Modes of heat transfer, Heat conduction in parallel, radial and composite wall – Heat conduction through hollow and composite cylinders, spheres. Basics of Convective heat transfer. Fundamentals of Radiative heat transfer – Flow through heat-exchangers, Logarithmic Mean Temperature Difference (LMTD) for parallel flow and counter flow heat exchangers.

Mass Transfer: Concepts of mass transfer, diffusion & convective mass transfer, Fick’s Law of diffusion, Significance of non-dimensional numbers.

Text Books:

1. Chattopadhyay. P Engineering Thermodynamics”, oxford University Press, New Delhi, 2010.
2. Nag.P.K., “Engineering Thermodynamics”, Tata McGraw-Hill, New Delhi, 2007.
3. Rathakrishnan E., “Fundamentals of Engineering Thermodynamics” Prentice-Hall India, 2005.

Reference Books:

1. Arora C.P, “Thermodynamics”, Tata McGraw-Hill, New Delhi, 2003.
2. Holman.J.P., “Thermodynamics”, 3rd Ed. McGraw-Hill, 2007.
3. Mathur& Sharma Steam Tables, Jain Publishers, New Delhi.
4. Merala C, Pother, Craig W, Somerton, “Thermodynamics for Engineers”, Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
5. Ramalingam K.K. “Thermodynamics”, Sci-Tech Publications, 2006.

Course Outcomes: At the end of the course students will be able to

CO’s	Statements	Bloom’s Level
CO1	demonstrate understanding of the nature of the thermodynamic processes for pure substances of ideal gases.	L2
CO2	interpret First Law of Thermodynamics and its application to systems and control volumes.	L2
CO3	solve any flow specific problem in an engineering approach based on basic concepts and logic sequences.	L5
CO4	compare and contrast between various types of refrigeration cycles	L2
CO5	Get exposed to the basics and modes of heat transfer	L1



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L	T	P	C
3	0	0	3

II B. Tech – I Semester

FLUID MECHANICS & HYDRAULIC MACHINES

Course Objectives: The students completing this course are expected to understand the properties of fluids, its kinematic and dynamic behavior through various laws of fluids like continuity, Euler's, Bernoulli's equations, energy and momentum equations. Further, the student shall be able to understand the theory of boundary layer, working and performance characteristics of various hydraulic machines like pumps and turbines.

UNIT – I: (10 Hrs)

Fluid statics: Dimensions and units: physical properties of fluids - specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure. Atmospheric, gauge and vacuum pressure, Measurement of pressure – Manometers - Piezometer, U-tube, inverted and differential manometers. Pascal's & hydrostatic laws.

Buoyancy and floatation: Meta center, stability of floating body. Submerged bodies. Calculation of metacenter height. Stability analysis and applications.

UNIT – II: (10 Hrs)

Fluid kinematics: Introduction, flow types. Equation of continuity for one dimensional flow, circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. Condition for irrotational flow, flow net, source and sink, doublet and vortex flow.

Fluid dynamics: surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, force on pipe bend.

Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line.

UNIT – III: (8 Hrs)

Boundary Layer Theory: Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles.

Dimensional Analysis: Dimensions and Units, Dimensional Homogeneity, Non dimensionalization of equations, Method of repeating variables and Buckingham Pi Theorem.

UNIT – IV: (8 Hrs)

Basics of turbo machinery: hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines: classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design – draft tube- theory- functions and efficiency.



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UNIT – V:

(10 Hrs)

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer. Hydraulic systems- hydraulic ram, hydraulic lift, hydraulic coupling. Fluidics – amplifiers, sensors and oscillators. Advantages, limitations and applications.

Centrifugal pumps: classification, working, work done – manometric head- losses and efficiencies- specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

Text Books:

1. Fluid Mechanics- Fundamentals and Applications by Y.A. Cengel, J.M.Cimbala, 6thEdn, McGrawHill
2. Fluid Mechanics - Dixon, 7th Edn, Elsevier

Reference Books:

1. Hydraulics, fluid mechanics and Hydraulic machinery- Modi and Seth
2. Fluid Mechanics and Hydraulic Machines - RK Bansal- Laxmi Publications (P)Ltd.
3. Fluid Mechanics and Hydraulic Machines -Rajput
4. Fluid Mechanics and Fluid Power Engineering - D.S. Kumar, Kotaria&Sons.
5. Fluid Mechanics and Machinery - D. Rama Durgaiyah, New Age International.

Course Outcomes: At the end of the course students will be able to

CO's	Statements	Bloom's Level
CO1	Understand the basic concepts of fluid properties.	L2
CO2	Demonstrate the concepts of mechanics of fluids in static and dynamic conditions.	L2
CO3	Illustrate the Boundary layer theory, flow separation and dimensional analysis.	L2
CO4	Calculate the hydrodynamic forces of jet on vanes in different positions.	L3
CO5	Understand the working Principles and performance evaluation of hydraulic pump and turbines.	L2



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II B. Tech – I Semester

COMPONENTS OF AUTOMOTIVE CHASSIS

COURSE OBJECTIVES:

- i. To understand the basic knowledge about various vehicle frames, front axles, steering systems and understand the conditions for true rolling motion of wheels during steering.
- ii. To recognize the construction and working principle of drive line, final drive and differential systems
- iii. To review the knowledge about the constructional feature of rear axle, wheels and tyres.
- iv. To evaluate the working principles of both conventional and independent suspension system.
- v. To demonstrate working principle of braking system used in automobile.

UNIT – I: INTRODUCTION, FRAME, CLUTCHES & GEAR BOX (10 Hrs)

Types of Chassis layout, with reference to Power Plant location and drive, various types of frames, Loads acting on vehicle frame, Constructional details and materials for frames, Testing of frames. Importance of Clutch, types and Applications. Requirement of Gear Box, Manual types of Gear Boxes including Synchromesh and its Applications

UNIT – II: PROPELLER SHAFT AND FINAL DRIVE (10 Hrs)

Effect of Driving Thrust, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints, Front Wheel drive, Final drive, different types, Double reduction and twin speed final drives, Multi-axled vehicles, Differential principle and types, Differential housings, limited speed differential, Differential locks.

UNIT – III: AXLES AND TYRES (8 Hrs)

Construction and Design of Drive Axles, Types of Loads acting on drive axles, Full – Floating, Three– Quarter Floating and Semi–Floating Axles, Axle Housings and Types – Lift axle, Dead axle, Types and Constructional Details of Different Types of Wheels and Rims, Different Types of Tyres and their constructional details.

UNIT – IV: STEERING & SUSPENSION SYSTEM (10 Hrs)

Steering System: Types of Front Axles and Stub Axles, Front Wheel Geometry, Condition for True Rolling Motion of Wheels during Steering, Ackerman’s and Davis Steering Mechanisms, Steering Error Curve, Steering Linkages, Different Types of Steering Gears, Slip Angle, Over–Steer and Under–Steer, Reversible and Irreversible Steering, EPAS.

Suspension System: Types of Suspension Springs, Constructional details and characteristics of Single Leaf, Multi–Leaf, Coil, Torsion bar, Rubber, Pneumatic and Hydro – elastic Suspension Spring Systems, Independent Suspension System, Shock Absorbers, Types and Constructional details.



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UNIT – V: BRAKING SYSTEM

(8 Hrs)

Theory of Automobile Braking, Stopping Distance Time and Braking Efficiency, Effect of Weight Transfer during Braking, Theory of Drum Brakes, Loading and Trailing Shoes, Braking Torque, Constructional Details of Drum Brake and its Activators, Disc Brake Theory, Types and Construction, Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power-Assisted Braking System, Anti-Lock Braking System, Constructional Details.

Text Books:

1. Kirpal Singh, Vol- I, Automobile Engineering, Standard Publisher, New Delhi ,2017
2. K.K.Ramalingam, “Automobile Engineering”, scitech publication (India),2011.
3. R.K. Rajput, A Text–Book of Automobile Engineering, Laxmi Publications Private Limited,2015

Reference Books:

1. Heinz Hazler, Modern Vehicle Technology, Butterworth, London,2005.
2. Heldt P.M., Automotive Chassis, Chilton Co., New York,1990
3. Newton Steeds and Garret, Motor Vehicles, 13th Edition, Butterworth, London, 2005.
4. N.K. Giri, Automotive Mechanics, Kanna Publishers,2007
5. William. H. Crows – Work shop Manuel –2005

Course Outcomes: At the end of the course students will be able to

CO's	Statements	Bloom's Level
CO1	Identify the different types of frame and chassis used in Automotive.	L2
CO2	Relate different types of drive lines and drives used in Automotive.	L2
CO3	Acquire knowledge about different types of front axle and rear axles used in motor vehicles.	L2
CO4	Examine the working principle of conventional and independent suspension systems.	L4
CO5	Apply knowledge on working principles of brake and its subsystems.	L3



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L	T	P	C
0	0	3	1.5

II B. Tech – I Semester

FLUID MECHANICS & HYDRAULIC MACHINES LAB

COURSE OBJECTIVES:

To impart practical exposure on the performance evaluation methods of various flow measuring equipment and hydraulic turbines and pumps.

LIST OF EXPERIMENTS:

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipeline.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Turbine flowmeter.

Course Outcomes: At the end of the course students will be able to

CO's	Statements	Bloom's Level
CO1	Understand calibration of flow measuring devices.	L2
CO2	Evaluate the losses in pipe flows.	L5
CO3	Apply the practical aspects of Bernoulli's principle	L3
CO4	Analyse the characteristics of different types of hydraulic turbines.	L4
CO5	Analyse the characteristics of different types of hydraulic pumps	L4



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II B. Tech – I Semester

L	T	P	C
0	0	3	1.5

AUTOMOTIVE CHASSIS LAB

COURSE OBJECTIVES:

- i. To assemble and disassemble the parts of an IC engine.
- ii. To identify the various component of an IC engine.
- iii. To identify the various components in transmission systems of an automobile.
- iv. To assemble and disassemble the various components of transmission system.
- v. To study all the functions of automobile components

LIST OF EXPERIMENTS:

1. To study constructional and working principle of clutch.
2. Assembly & Disassembly of Gear Box.
3. Assembly & Disassembly of Transfer case.
4. Assembly & Disassembly of Differential & rear axle.
5. Assembly & Disassembly of Stub Axle Assembly.
6. To assemble and disassemble Front axle.
7. To Study different chassis layouts
8. To Study braking system
9. To Study Steering system.
10. To Study Suspension system
11. To study Continuous Variable Transmission System
12. Study of different types of Wheels & Tyres

Course Outcomes: At the end of the course students will be able to

CO's	Statements	Bloom's Level
CO1	Understand working of braking, steering, clutch, transmission, Suspension systems.	L2
CO2	Differentiate various subsystems of two, three & Four wheeler vehicles	L2
CO3	Develop skills in Dismantling and assembling of chassis components.	L3



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II B. Tech I Semester

L	T	P	C
0	1	2	2

COMPUTER AIDED DRAFTING AND AUTOMOBILE ASSEMBLY DRAWING

COURSE OBJECTIVES:

- i. Introduce conventional representations of material and machine components.
- ii. Train to use software for 2D and 3D modeling.
- iii. Familiarize with thread profiles, riveted, welded and key joints.
- iv. Teach solid modeling of machine parts and their sections.
- v. Explain creation of 2D and 3D assembly drawings.
- vi. Familiarize with limits, fits and tolerances in mating components.

The following contents are to be done by any 2D software package

Conventional representation of materials and components:

Detachable joints: Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint with washer and locknut, stud joint, screw joint and foundation bolts.

Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.

Welded joints: Lap joint and T joint with fillet, butt joint with conventions.

Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.

Couplings: rigid – Muff, flange; flexible – bushed pin-type flange coupling, universal coupling, Oldhams' coupling.

The following contents to be done by any 3D software package Sectional views:

Creating solid models of complex machine parts and create sectional views.

Assembly drawings:(Any six of the following using solid model software)

Connecting Rod, Multi-plate Friction Clutch, Automobile Gear Box, Stub Axle, Tandem Master Cylinder, Fuel Injector, Piston, Radial Engine Sub Assembly.

Manufacturing drawing:

Representation of limits, fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.

Textbooks:

1. K.L.Narayana, P.Kannaiah and K.Venkat Reddy, Production Drawing, New Age International Publishers, 3/e, 2014
2. Software tools/packages- Auto CAD, Solid works or equivalent.

Reference Books:

1. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata Mcgraw-Hill, NY, 2000.
2. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
3. N.D.Bhatt, Machine Drawing, Charotar, 50/e, 2014



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Online Learning Resources:

<https://eedocs.wordpress.com/wp-content/uploads/2014/02/machinedrawing.pdf>

Course Outcomes: At the end of the course students will be able to

CO's	Statements	Bloom's Level
CO1	Interpret and analyse the national and international standards of various machine components.	L4
CO2	Apply and illustrate various machine elements through computer aided drawings.	L3
CO3	Apply limits and tolerances to assemblies and interpret the appropriate fits.	L3
CO4	Recognise the machining surface finish parameters through appropriate symbols.	L2



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II Year I Semester

L	T	P	C
2	0	0	-

ENVIRONMENTAL SCIENCE

Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
- To save earth from the inventions by the engineers.

UNIT – I

Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT – II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

- a. Forest ecosystem.
- b. Grassland ecosystem
- c. Desert ecosystem
- d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and Its Conservation : Introduction and Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III

Environmental Pollution: Definition, Cause, effects and control measures of:

- a. Air Pollution.



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- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT – V

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Textbooks:

1. Erach Bharucha, Text book of Environmental Studies for Undergraduate Courses, Universities Press (India) Private Limited, 2019.
2. Palaniswamy, Environmental Studies, 2/e, Pearson education, 2014.
3. S.Azeem Unnisa, Environmental Studies, Academic Publishing Company, 2021.
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, SciTech Publications (India), Pvt. Ltd, 2010.

Reference Books:

1. Deeksha Dave and E.Sai Baba Reddy, Textbook of Environmental Science, 2/e, Cengage Publications, 2012.
2. M.Anji Reddy, “Textbook of Environmental Sciences and Technology”, BS Publication, 2014.
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, 2006.



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4. J. Glynn Henry and Gary W. Heinke, Environmental Sciences and Engineering, Prentice Hall of India Private limited, 1988.
5. G.R. Chatwal, A Text Book of Environmental Studies, Himalaya Publishing House, 2018.
6. Gilbert M. Masters and Wendell P. Ela, Introduction to Environmental Engineering and Science, 1/e, Prentice Hall of India Private limited, 1991.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc23_hs155/preview
- https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-science-part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-d84c-4773-8388-1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science++Part+3%3A+Pollution+and+Resources&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science
- <http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science-1/Data%20Files/pdf/lec07.pdf>
- <https://www.youtube.com/watch?v=5QxxaVfgQ3k>

Course Outcomes:

COs	Statements	Blooms Level
CO1	Grasp multi disciplinary nature of environmental studies and various renewable and non-renewable resources.	L2
CO2	Understand flow and bio-geo- chemical cycles and ecological pyramids.	L2
CO3	Understand various causes of pollution and solid waste management and related preventive measures.	L2
CO4	Understand the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.	L2
CO5	Illustrate the causes of population explosion, value education and welfare programmes.	L3



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II B. Tech – II Semester

L	T	P	C
2	0	0	2

PRODUCT LIFE CYCLE MANAGEMENT

Course objectives: This course enables students to

1. Familiarize with various strategies of PLM
2. Understand the concept of product design and simulation.
3. Develop New product development ,product structure and supporting systems
4. Interpret the technology forecasting and product innovation and development in business processes.
5. Understand product building and Product Configuration.

UNIT-I: PLM AND PDM (5 Hrs)

Introduction to PLM, Need for PLM, opportunities and benefits of PLM, different views of PLM, components of PLM, phases of PLM, PLM feasibility study. PLM Strategies, strategy elements, its identification, selection and implementation. Product Data Management, implementation of PDM systems.

UNIT-II: PRODUCT DESIGN (5 Hrs)

Engineering design, organization and decomposition in product design, product design process, methodical evolution in product design, concurrent engineering, design for 'X' and design central development model. Strategies for recovery at end of life, recycling, human factors in product design. Modelling and simulation in product.

UNIT-III: PRODUCT DEVELOPMENT (5 Hrs)

New Product Development, Structuring new product development, building decision support system, Estimating market opportunities for new product, new product financial control, implementing new product development, market entry decision, launching and tracking new product program. Concept of redesign of product.

UNIT-IV: TECHNOLOGY FORECASTING (6 Hrs)

Technological change, methods of technology forecasting, relevance trees, morphological methods, flow diagram and combining forecast of technologies Integration of technological product innovation and product development in business processes within enterprises, methods and tools in the innovation process according to the situation, methods and tools in the innovation process according to the situation.

UNIT-V: PRODUCT BUILDING AND STRUCTURES (5 Hrs)

Virtual product development tools for components, machines, and manufacturing plants: 3D CAD systems, digital mock-up, model building, model analysis, production (process) planning, and product data technology, Product structures: Variant management, product configuration, material master data, product description data, Data models, Life cycles of individual items, status of items.



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Text Books:

1. Stark, John. Product Lifecycle Management: Paradigm for 21st Century Product Realisation, Springer-Verlag, 2004. ISBN 1852338105
2. Fabio Giudice, Guido La Rosa, Product Design for the environment-A life cycle approach, Taylor & Francis 2006

Reference Books:

1. Saaksvuori Antti / ImmonenAnselmie, product Life Cycle Management Springer, Dreamtech, 3-540-25731-4
2. Product Lifecycle Management, Michael Grieves, Tata McGraw Hill

Course Outcomes: At the end of the course students will be able to

CO's	Statements	Bloom's Level
CO1	Explain the various strategies of PLM and Product Data Management	L2
CO2	Describe decomposition of product design and model simulation	L2
CO3	Apply the concept of New Product Development and its structuring.	L3
CO4	Analyze the technological forecasting and the tools in the innovation.	L4
CO5	Apply the virtual product development and model analysis	L3



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II B. Tech – II Semester

L	T	P	C
3	0	0	3

MECHANICS OF SOLIDS

COURSE OBJECTIVE: The students completing this course are expected to understand the basic terms like stress, strain, poisson's ratio...etc and different stresses and deflections induced in beams, thin cylinders, thick cylinders, and columns. Further, the student shall be able to understand the shear stresses due to torsion in circular shafts.

UNIT-I **(10 Hrs)**

SIMPLE STRESSES & STRAINS: Elasticity and plasticity – Types of stresses & strains– Hooke's law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Bars of varying section – composite bars – Temperature stresses- Complex Stresses
Stresses on an inclined plane under different uniaxial and biaxial stress conditions - Principal planes and principal stresses - Mohr's circle - Relation between elastic constants, Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II **(10 Hrs)**

Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l, uniformly varying loads and combination of these loads. Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III **(8 Hrs)**

FLEXURAL STRESSES: Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT-IV **(10 Hrs)**

DEFLECTION OF BEAMS: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams, Statically indeterminate Beams and solution methods.

TORSION: Introduction-Derivation- Torsion of Circular shafts- Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel



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UNIT – V

(8 Hrs)

THIN AND THICK CYLINDERS: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells. Wire wound thin cylinders. Lamé’s equation – cylinders subjected to inside & outside pressures –compound cylinders.

COLUMNS:

Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler’s Formula, Rankine’s Formula,

TEXT BOOKS:

1. Strength of materials /GH Ryder/ Mc Millan publishers IndiaLtd.
2. Strength of materials by B.C. Punmia-lakshmi publications pvt.Ltd, New Delhi.

REFERENCE BOOKS:

1. Mechanics of Materials by Gere & Timoshenko
2. Strength of Materials -By Jindal, Umesh Publications.
3. Strength of Materials by S.Timoshenko- D. VAN NOSTRAND Company- PHIPublishers
4. Strength of Materials by Andrew Pytel and Ferdinand L. Singer Longman- Harpercollins College Division
5. Solid Mechanics, by Popov-
6. Mechanics of Materials/Gere and Timoshenko, CBS Publishers

Course Outcomes: On the completion of the course the student will be able to

CO's	Statements	Bloom's Level
CO1	Model & Analyze the behavior of basic structural members subjected to various loading and support conditions based on principles of equilibrium.	L4
CO2	Understand the apply the concept of stress and strain to analyze and design structural members and machine parts under axial, shear and bending loads, moment and torsional moment.	L3
CO3	Students will learn all the methods to analyze beams, columns, frames for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design of such structural components. Students are able to analyse beams and draw correct and complete shear and bending moment diagrams for beams.	L4
CO4	Students attain a deeper understanding of the loads, stresses, and strains acting on a structure and their relations in the elastic behavior	L2
CO5	Design and analysis of Industrial components like pressure vessels.	L6



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II B. Tech – II Semester

L	T	P	C
3	0	0	3

AUTOMOBILE ENGINES

COURSE OBJECTIVES:

1. To impart knowledge on basics of automotive SI and CI engines consisting of types, construction and working.
2. To Understand the actual engine working principle and its thermochemistry of fuel-air mixtures.
3. To learn the properties of gasoline and diesel fuel and combustion process involved in diesel engines.
4. To solve basic design problems of various operating parameters of the engines.
5. To analyze the performance and pollution characteristics of SAI and CI engine and learn modern developments in IC engine

UNIT-I:

(10 Hrs)

ACTUAL CYCLES AND ENGINE CONSTRUCTION:

Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blow down-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines; Constructional Details of Four Stroke SI and CI Engines, Working Principle, Actual Indicator Diagram, Two Stroke Engine Construction and Operation, Comparison of Four Stroke and Two Stroke Engine Operation, Firing Order and Its Significance. Basics of Lubrication and Cooling systems, Introduction to Supercharging and turbocharging.

UNIT-II:

(8 Hrs)

SI ENGINE FUELING & COMBUSTION

Fuel Systems: Multi point Injection system- Gasoline Direct Injection – GDI Pumps and Fuel Injectors - Pre-mixed charge combustion, Thermodynamic Analysis of Combustion, Cycle-to-Cycle Combustion variations and Knocking Combustion

UNIT-III:

(10 Hrs)

CI ENGINE FUELING & COMBUSTION

Fuel Injection and Spray Structure: Fuel Atomization and Droplet size distribution, Sauter Mean Diameter, Spray Penetration. Fuel Injection Pumps, Injector. Types of Combustion Chambers, Diesel Combustion Process Characterization: Ignition Delay, Effect of Engine and Operational Parameters on Delay, Pre-mixed Combustion, Mixing Controlled Combustion. Thermodynamic Analysis. Multi Pulse Injections, Dual fuel technologies - Introduction to Low Temperature Combustion - Homogeneous Charge Compression Ignition(HCCI), Fuel Stratified Charge combustion/ Reactivity Controlled Compression Ignition (RCCI) Technologies, Pre-mixed Charge Compression (PCCI).



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UNIT-IV: (10 Hrs)

FORMATION OF ENGINE EMISSIONS & CONTROL TECHNOLOGIES (SI & CI)

Emission Effects on Health & Environment: Sources of Engine emissions: Formation of CO, NO, UBHC, Soot and Particulate Matter. Diesel NO_x-Particulate Trade off: Effect of SI Design and operating variables: Effect of Diesel Engine Design and operating Variables. SI Engine Emission Control Technology: CI Engine Emission Control Technology: Exhaust Gas Recirculation, Diesel Particulate Filter, Selective Catalyst Reduction and Diesel Oxidation Converter, Lean NO_x Trap(LNT).

UNIT-V: (8 Hrs)

ENGINE TESTING & PERFORMANCE

Engine Performance Testing & Characteristics - Testing and measurement equipment-dynamometers, Air & Fuel, temperature, in-cylinder Pressure and Crank angle. Emission Measurement- CLA, FID, NDIR, Analysers and Smoke meters. Variables Affecting Engine Performance, Performance Maps.

TEXT BOOKS:

1. IC Engines, M.L. Mathur & R.P. Sharma, Dhanpat Rai & Sons
2. Engine Emissions, Pollutant Formation and Advances in Control Technology, B.P. Pundir, Narosa Publishing House

Reference Books:

1. IC Engines Fundamentals, John B. Heywood, Mc Graw Hill Publications
2. Engineering Fundamentals of I C Engines, Wiliard W. Pulkrabek, Prentice Hall Publications
3. Mixture Formation in Internal Combustion Engines, Carsten Baumgarten, Springer Pub
4. Thermal Engineering, PL Ballaney, Khanna Publishers, 25th Edition.

Course Outcomes: On the completion of the course the student will able to

CO's	Statements	Bloom's Level
CO1	Define engine glossaries, identify various components of SI and CI engines and its sub-systems	L1
CO2	Understand the actual engine working principle and its different induction and ignition systems.	L2
CO3	Exposed to gain knowledge on developments in cooling, lubrication, supercharging and turbocharging.	L2
CO4	Understand basic knowledge on SI and CI engine combustion and its related parameters	L2
CO5	Apply their knowledge in analyzing the engine performance and pollution characteristics.	L3



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II B. Tech – II Semester

L	T	P	C
3	0	0	3

AUTOMOBILE ELECTRICAL AND ELECTRONICS

Course Objectives:

1. To define the glossary related to vehicle electrical and electronic system.
2. To understand the need for starter batteries, starter motor and alternator in the vehicle.
3. To differentiate the conventional and modern vehicle architecture and the data transfer among the different electronic control unit using different communication protocols.
4. To list common types of sensor and actuators used in vehicles.
5. To understand networking in vehicles

UNIT-I: (10 Hrs)

Batteries and Accessories: Principle and Construction of Lead Acid Battery, Characteristics of battery, rating capacity and Efficiency of Batteries, Various Tests on Batteries, Maintenance and Charging. Lighting System: Insulated and Earth Return System, Details of Head Light and Side Light, LED Lighting System, Head Light Dazzling and Preventive Methods – Horn, Wiper System and Trafficator.

UNIT-II : (10 Hrs)

Starting System: Requirements of a Starting system, Behavior of Starter during Starting, Series Motor – Working Principle, construction and its Characteristics, Principle and Construction of Starter Motor, Working of Different Starter Drive Units, Care and Maintenance of Starter Motor, Starter Switches.

UNIT-III : (8 Hrs)

Charging System: Requirements of a Charging system – Alternators – Generation of electrical energy in vehicle- physical principles- Alternator and voltage regulations versions – power losses – characteristics curve- Alternator operation in the vehicle- Alternator circuitry.

UNIT-IV: (8 Hrs)

Fundamentals of Automotive Electronics:–Engine Management System – PFI, GDI, CRDI and UI systems. Electro Magnetic Interference Suppression, Electromagnetic Compatibility, Electronic Dashboard Instruments, Onboard Diagnostic System, Security and Warning System.

UNIT-V : (9 Hrs)

Sensors & Actuators:Engine Sensors: Speed, Throttle Position, Exhaust Oxygen, knock, Manifold Pressure, Crankshaft Position, Temperature, Air Mass Flow.

Automotive Sensors: Impact Sensor, Rain Sensor, GPS Sensor, Speed Sensor.

Actuators: Solenoids, Stepper Motors, Relay.



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Text Books

1. Young A.P. & Griffiths. L. “Automotive Electrical Equipment”, ELBS & NewPress-1999.
2. William B.Ribbens “Understanding Automotive Electronics”, 5th edition -Butter worth Heinemann Woburn,1998.

References

1. Bechtold “Understanding Automotive Electronics”, SAE,1998.
2. Crouse, W.H “Automobile Electrical Equipment”, McGraw-Hill Book Co., Inc., New York, 3rd edition, 1986.
3. Judge A.W “Modern Electrical Equipment of Automobiles”, Chapman & Hall, London,1992.
4. Kholi.P.L “Automotive Electrical Equipment”, Tata McGraw-Hill Co., Ltd., New Delhi,1975.
5. Robert Bosch “Automotive Hand Book”, SAE (5th Edition),2000.

Course Outcomes: On the completion of the course the student will able to

CO's	Statements	Bloom's Level
CO1	Define the glossary related to vehicle electrical and electronic system	L1
CO2	Understand the need for starter batteries, starter motor and alternator in the vehicle.	L2
CO3	Differentiate the conventional and modern vehicle architecture and the data transfer among the different electronic control unit using different communication protocols.	L2
CO4	List common types of sensor and actuators used in vehicles.	L1
CO5	Understand networking in vehicles.	L2



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II B. Tech – II Semester

L	T	P	C
3	0	0	3

METALLURGY & MATERIALS SCIENCE

COURSE OBJECTIVES: To understand the basic fundamentals of Material science and Physical metallurgy. The basic concepts to be taught will help for the improvement, proper selection and effective utilization of materials which is essential to satisfy the ever increasing demands of the society.

UNIT – I: (10 Hrs)

Structure of Metals and Constitution of alloys: Bonds in Solids, Metallic bond, crystallization of metals, Packing Factor-SC, BCC, FCC & HCP-line density, plane density. Grain and grain boundaries, effect of grain boundaries on the Properties of metal / alloys – determination of grain size. Imperfections– point, line, surface and volume-Slip and Twinning. Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

Equilibrium Diagrams: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of binary phase diagrams such as Cu-Ni and Fe-Fe₃C.

UNIT – II: (8 Hrs)

Ferrous metals and alloys: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Had field manganese steels, tool and die steels.

Non-ferrous Metals and Alloys: Structure and properties of Copper and its alloys, Aluminum and its alloys, Titanium and its alloys, Magnesium and its alloys, Super alloys.

UNIT – III: (8 Hrs)

Heat treatment of Alloys: Effect of alloying elements on Fe-Fe₃C system, Annealing, normalizing, hardening, TTT diagrams, tempering, harden ability, surface-hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

UNIT – IV: (10 Hrs)

Powder Metallurgy: Basic processes- Methods of producing metal powders- milling atomization-Granulation-Reduction-Electrolytic Deposition. Compacting methods – Sintering - Methods of manufacturing sintered parts. Sintering Secondary operations-Sizing, coining, machining –Factors determining the use of powder metallurgy-Application of this process.



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UNIT – V: **(9 Hrs)**

Ceramic and composite materials: Crystalline ceramics, glasses, cermets, abrasive materials, Classification of composites, various methods of component manufacture of composites, particle –reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and C-Ccomposites. Nanomaterials –definition, properties and applications.

Text Books:

1. Introduction to Physical Metallurgy-Sidney H. Avener-McGraw Hill
2. Essential of Materials science and engineering-Donald R.Askeland-Cengage.

Reference Books:

1. Material Science and Metallurgy–Dr. V.D.kodgire-Everest Publishing House
2. Materials Science and engineering-Callister & Baala subrahmanyam-Wiley Publications
3. Material Science for Engineering students –Fischer– Elsevier Publishers
4. Material science and Engineering-V.Rahghavan-PHI Publishers
5. Introduction to Material Science and Engineering–Yip-Wah Chung CRC Press
6. Material Science and Metallurgy–A V KSuryanarayana –BS Publications
7. Material Science and Metallurgy–U. C.Jindal –Pearson Publications

Course Outcomes: At the end of the course students will be able to

CO's	Statements	Bloom's Level
CO1	Understand the crystal line structure of different metals and study the stability of phases in different alloy systems.	L2
CO2	Study the behavior of ferrous and non ferrous metals and alloys and their application in different domains	L1
CO3	understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals	L2
CO4	Grasp the methods of making of metal powders and applications of powder metallurgy	L2
CO5	Comprehend the properties and applications of ceramic, composites and other advanced methods.	L3



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II B. Tech – II Semester

L	T	P	C
0	0	3	1.5

AUTOMOBILE ENGINES AND FUELS LAB

Course Objectives: To study the characteristics of the fuels and lubricants used in automobile and get practical knowledge in assembly & dismantling of engine components.

Note: Need to perform atleast Six Experiments from each of the Labs

PART-A: ENGINES LAB

LIST OF EXPERIMENTS

1. Draw the Valve and Port Timing Diagrams for 4S and 2S engines.
2. Evaluation of Performance and Emissions from 4S Petrol Engine
3. Evaluation of Performance and Emissions from 4S Diesel Engine
4. Evaluation of Frictional Power from the Morse Test on a 4-Stroke Multi Cylinder Engine
5. Determination of Frictional Power by the retardation and Motoring Test on IC Engine
6. Draw the Heat Balance Sheet for a 4-Stroke Petrol or Diesel Engine
7. Analysis of Combustion Characteristics like; P-θ, ~~Differential~~ Heat Release Rate, Cumulative Heat Release and Ignition Delay of diesel engine
8. Calculation of Stoichiometric Air- Fuel mixtures of Conventional fuels through oxidation Equation and compare with Spectrometric analysis
9. Calculation of Volumetric Efficiency of a conventional fuel and compare with Gas based Dual Fuel Operation, when secondary fuel is inducted through inlet manifold
10. Dismantling and Assembly of Agriculture single Cylinder and Multi- Cylinder Automotive Engines

PART-B: FUELS LAB

LIST OF EXPERIMENTS

1. To Perform the ASTM distillation test of liquidfuels.
2. Determining the different components available in a give fuel using Gas Chromatograph and quantify the same using Mass Spectrometry
3. Determining the Qualitative and Quantitative Analysis of given fuel by examining the IR spectrum peaks of the given fuel using FT-IR
4. To study the Structure and connectivity of Organic Molecules of given fuel using NMR C13/H1 analysis
5. To study the quantitative compositional data of hydrocarbon data using HPLC analysis using HPLC analyser
6. Determination of the Calorific value of liquid and gaseousfuel.
7. Determination of Flash and Fire points of petrol and diesel. (closed and opentype)
8. Determination of Temperature dependence of viscosity of lubricants & Fuels by RedwoodViscometer.
9. Determination of Viscosity index of lubricants & Fuels by SayboltViscometer.
10. Determination of Ash content and Carbon Residue Test.



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11. Determination of flow properties of oil using Cloud and Pour point Test.

Course Outcomes: Attending the laboratory the students shall be able to:

CO's	Statements	Bloom's Level
CO1	know the principles in assembly & dismantling of engine components	L1
CO2	learn characteristics of the fuels and lubricants used in automobile	L1



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II B. Tech – II Semester

L	T	P	C
0	0	3	1.5

AUTOMOBILE ELECTRICAL AND ELECTRONICS LAB

Course Objectives:

1. To understand the working principle of Electrical circuits in automobile.
2. To evaluate the working principle of Battery, and starter motor.
3. To understand the working principle of auxiliary systems used in automobiles.
4. To understand the use of sensors in an automobile.
5. To develop a programming knowledge on Microprocessor

Note : Any 6 Experiments from each stream and rest can be considered as extra experiments

Part-A: Automotive Electrical Lab:

List of Experiments:

1. Testing and study of different types of Batteries and constructions.
2. Testing, dismantling and assembling of starter motor used in automobile.
3. Testing, dismantling and assembling of alternator used in automobile.
4. Study of different colour code system used in automotive wiring system.
5. Demonstration and study of Battery Ignition System and their parts used in Automobile Vehicles.
6. Study of different Electrical Equipment's & Accessories (Speedometer, Warning lights, Electric Horn, Wind shield wipers system).
7. Study of different sensors used in modern automotive system.
8. Study of various electronics system (Electronic fuel injection system, Electronic ignition system, Air bag, ABS, Electronic fuel injector cleaner).
9. Demonstration and experiment on lighting system of ~~two-wheeler~~ and Four Wheelers.
10. Demonstration, experiment and diagnosis on ignition system.

Part-B: Automotive Electronics:

List of Experiments:

1. Visualization of Engine Sensor Signals and fault Diagnosis using OBD Kit
2. Interface of Seven segment display
3. Interfacing of ADC for a sensor and Interfacing of DAC for an actuator
4. Interface circuit like amplifier, filter, Multiplexer and De Multiplexer
5. Basic microprocessor programming like arithmetic and Logic operation, code conversion,
6. waveform generation, look up table etc.
7. Study of Aurdino Programming
8. EPROM Programming
9. Study of Virtual Instrumentation and Communication Protocols (CAN, LIN, MOST etc.)



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Course Outcomes: **Attending the laboratory the students shall be able to:**

CO's	Statements	Bloom's Level
CO1	Understand the working principle of Electrical circuits in automobile.	L2
CO2	Evaluate the working principle of Battery, and starter motor.	L5
CO3	Understand the working principle of auxiliary systems used in automobiles.	L2
CO4	Understand the use of sensors in an automobile.	L2



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II B. Tech – II Semester

L	T	P	C
0	1	2	2

MACHINE TOOLS AND METROLOGY LAB

Note: minimum of 6 experiments from each section

Course Objective: This practical course covers the topics related to precision measuring instruments and the working and operations of various machine tools.

Part-A: METROLOGY LAB

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear tooth vernier calipers and checking the chordal thickness of spur gear.
4. Machine tool alignment test on the lathe.
5. Machine tool alignment test on milling machine.
6. Angle and taper measurements by bevel protractor, Sine bars etc.
7. Use of spirit level in finding the straightness of a bed and flatness of a surface.
8. Thread measurement by two wire/ three wire method & tool makers microscope.
9. Surface roughness measurement by Talysurf.

Part-B: MACHINE TOOLS LAB

- Study of general purpose machines -lathe, drilling machine, milling machine, shaper, planing machine, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.
1. To perform Step turning and taper turning on lathe machine
 2. To perform Thread cutting and knurling on lathe machine.
 3. Development of models by Drilling and tapping.
 4. Development of models by Shaping and planing.
 5. Development of models by Slotting
 6. Development of models by Milling
 7. To Perform Cylindrical surface grinding
 8. To undergo Grinding of tool angles.

Course Outcome: After completing the course, the student will be able to operate various precision measuring instruments and working and operations of various machines tools. (L3)



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L	T	P	C
1	0	2	2

II B. Tech – II Semester

DESIGN THINKING & INNOVATION

Course Objectives: The objectives of the course are to

- Bring awareness on innovative design and new product development.
- Explain the basics of design thinking.
- Familiarize the role of reverse engineering in product development.
- Train how to identify the needs of society and convert into demand.
- Introduce product planning and product development process.

UNIT – I Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, customer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT - III Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT - IV Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

Activity: Importance of modeling, how to set specifications, Explaining their own product design.



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UNIT – V Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

Activity: How to market our own product, about maintenance, Reliability and plan for startup.

Textbooks:

1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3. William lidwell, Kritinaholden, & Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4. Chesbrough.H, The era of open innovation, 2003.

Online Learning Resources:

- <https://nptel.ac.in/courses/110/106/110106124/>
- <https://nptel.ac.in/courses/109/104/109104109/>
- https://swayam.gov.in/nd1_noc19_mg60/preview
- https://onlinecourses.nptel.ac.in/noc22_de16/preview

Course Outcomes:

COs	Statements	Blooms Level
CO1	Define the concepts related to design thinking.	L1
CO2	Explain the fundamentals of Design Thinking and innovation.	L2
CO3	Apply the design thinking techniques for solving problems in various sectors.	L3
CO4	Analyse to work in a multidisciplinary environment.	L4
CO5	Evaluate the value of creativity.	L5