

Syllabus for B.Tech(Automobile Engineering) up to Fourth Year

Revised Syllabus of B.Tech in AUE for the students who were admitted in Academic Session 2010-2011)



Second Year – Third Semester

A. THEORY							
Sl.No.	Paper Code	Subjects	Contact Hours / Week				Cr.Points
			L	T	P	Total	
1.	HU-301	Values & Ethics in Profession	3	0	0	3	3
2.	PH-301	Physics-2	3	1	0	4	4
3.	CH301	Basic Environmental Engineering & Elementary Biology	3	0	0	3	3
4.	ME 301	Applied Thermodynamics	4	0	0	4	4
5.	ME 302	Strength of Materials	3	0	0	3	3
6.	ME 303	Engineering Materials	3	0	0	3	3
Total Theory			19	1	0	20	20
B. PRACTICAL							
Sl.No.	Field	Subjects	Contact Hours / Week				Cr.Points
			L	T	P	Total	
7.	HU-381	Technical Report Writing & Language Lab Practice	0	0	3	3	2
	PH391	Physics Lab-2	0	0	3	3	2
8.	ME 391	Machine Drawing –I	0	0	3	3	2
9.	ME 392	Workshop Practice-II	0	0	3	3	2
10.	ME 393	Applied Mechanics Lab	0	0	3	3	2
Total Practical			0	0	15	15	10
Total Semester			19	1	15	35	30

Second Year – Fourth Semester

A. THEORY							
Sl.No.	Field	Subjects	Contact Hours / Week				Cr.Points
			L	T	P	Total	
1.	M(CS)401	Numerical Methods	2	1	0	3	2
2.	M-402	Mathematics-3	3	1	0	4	4
3.	ME 401	Fluid Mechanics & Hydraulic Machines	4	0	0	4	4
4.	ME 402	Mechanisms	3	0	0	3	3
5.	ME 403	Primary Manufacturing Processes	4	0	0	4	4
Total Theory			16	2	0	18	17
B. PRACTICAL							
Sl.No.	Field	Subjects	Contact Hours / Week				Cr.Points
			L	T	P	Total	
6.	M(CS)491	Numerical Methods Lab	0	0	2	2	1
7.	ME491	Fluid Mechanics & Hydraulics Lab	0	0	3	3	2
8.	ME 492	Manufacturing Technology Lab	0	0	3	3	2
9.	ME493	Material Testing Lab	0	0	3	3	2
10.	ME 494	Machine Drawing-II	0	0	3	3	2
Total Practical			0	0	14	14	9
Total Semester			16	2	12	32	26

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Fifth Semester

A. Theory							
Sl. No.	Field	Subjects	Contact Hours /Week				Cr.Points
			L	T	P	Total	
1	AUE501	Dynamics of Machine.	3	0	0	3	3
2	AUE502	Heat Transfer.	3	0	0	3	4
3	AUE503	Design of Machine Element.	4	0	0	4	4
4	AUE504	Professional Elective I	3	0	0	3	3
5	AUE505	M/c Tools & Machining Technology.	3	0	0	3	3
Total Theory			16	0	0	16	17
B. Practical							
Sl. No.	Field	Subjects	Contact Hours /Week				Cr.Points
			L	T	P	Total	
6	AUE 591	Seminar I (Trg.)	0	0	3	3	2
7	AUE592	Engine Component Lab.	0	0	3	3	2
8	AUE 593	Design Practice	0	0	3	3	2
9	AUE 594	Professional Elective Lab I	0	0	3	3	2
Total Theory			0	0	12	12	8
Total Semester			16	0	12	28	25

List of Professional Elective I

AUE504 (A) Automotive Chassis.

AUE504 (B) Fluid Power Control.(To be taken from ME604C)

Sixth Semester

A. Theory							
Sl. No.	Field	Subjects	Contact Hours /Week				Cr. Points
			L	T	P	Total	
1	AUE601	Automotive Petrol & Diesel Engine	3	0	0	3	3
2	AUE602	Power Unit & Transmission	3	0	0	3	3
3	AUE603	Metrology & Measurement.	3	0	0	3	3
4	AUE604	Professional Elective II	3	0	0	3	3
5.	AUE 605	Professional Elective III	3	0	0	3	3
6	AUE 606(HU)	Production Management & Operation Research	3	1	0	4	4
Total Theory			18	1	0	19	19
B. Practical							
Sl. No.	Field	Subjects	Contact Hours /Week				Cr. Points
			L	T	P	Total	
7	AUE 691	Metrology & Measurement Lab.	0	0	3	3	2
8	AUE692	Applied Thermodynamics & Heat Transfer Lab.	0	0	3	3	2
9	AUE 693	CAD Applications in Automotive Engineering	0	0	3	3	2
10	AUE 695	Professional Elective II Lab	0	0	3	3	2
Total Theory			0	0	12	12	8
Total Semester			18	1	12	31	27

List of Professional Elective II

AUE 604 (A) Vehicle Body Engineering.

AUE 604 (B) Mechatronics.(To be taken from ME604B)

List of Professional Elective III

AUE 605 (A) Design of Automotive Systems.

AUE 605 (B) Material Handling(To be taken from ME605A)

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Seventh Semester

A. Theory							
Sl. No.	Field	Subjects	Contact Hours /Week				Cr. Points
			L	T	P	Total	
1.	AUE701	Vehicle Dynamics	3	0	0	3	3
2	AUE702	Automotive Electrical & Electronics System.	3	0	0	3	3
3	AUE703	Professional Elective IV	3	0	0	3	3
4	AUE704	Professional Elective V	3	0	0	3	3
5	AUE705	Free Elective I	3	0	0	3	3
Total Theory			15	0	0	15	15
B. Practical							
Sl. No.	Field	Subjects	Contact Hours /Week				Cr. Points
			L	T	P	Total	
6	AUE791	ETPM Lab.	0	0	3	3	2
7	AUE792	Project Part I	0	0	6	6	2
8	AUE793	Seminar II (Trg.)	0	0	2	2	2
9	AUE783	Group Discussion	0	0	2	2	2
Total Theory			0	0	13	13	8
Total Semester			15	0	13	26	23

List of Professional Elective IV

- AUE 703 (A) Combustion & Pollution Control in Automobile.
AUE 703 (B) Robotics and Robot application.

List of Professional Elective V.

- AUE 704 (A) Transport Management.
AUE 704 (B) Modern Vehicle Technology

List Of Free Elective I

- AUE 705 (A) Non-Destructive Testing Methods.
AUE 705 (B) Maintenance Engineering.

Eighth Semester

A. Theory							
Sl. No.	Field	Subjects	Contact Hours /Week				Cr.Points
			L	T	P	Total	
1	AUE801(HU)	Engineering Economy & Financial Management.	2	0	0	2	2
2	AUE802	Professional Elective VI	3	0	0	3	3
3	AUE803	Free Elective II	3	0	0	3	3
Total Theory			8	0	0	8	8
B. Practical							
Sl. No.	Field	Subjects	Contact Hours /Week				Cr.Points
			L	T	P	Total	
4	AUE 891	Automotive Elect. & Electronics Lab	0	0	3	3	2
5	AUE892	Auto Scanning Lab.	0	0	3	3	2
6	AUE 893(Project)	Project Part II	0	0	12	12	6
7	AUE 894	Comprehensive Viva Voce	0	0	0	0	2
	AUE 881	Deign Lab	0	0	6	6	4
Total Theory			0	0	24	24	16
Total Semester			8		24	32	24

List of Professional Elective VI

- AUE 802 (A) Off Road Vehicle.
AUE 802 (B) **Automotive Air Conditioning.**
AUE 802 (C) CAD/CAM and modern manufacturing methods(To be taken from ME802A)

List Of Free Elective II

- AUE 803 (A) **Alternate Fuels and Energy Systems.** AUE 803 (B) **Quality Control and Reliability Engineering.**(To be taken from ME802D). AUE 803 (C) **Finite Element Methods and its Application** (To be taken from ME605B)

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SEMESTER - III Theory

VALUES & ETHICS IN PROFESSION

HU-301

Contracts:3L

Credits- 3

Science, Technology and Engineering as knowledge and as Social and Professional Activities

Effects of Technological Growth:

Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development

Energy Crisis: Renewable Energy Resources

Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics

Appropriate Technology Movement of Schumacher; later developments

Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis.

Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.

Ethics of Profession:

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Profession and Human Values:

Values Crisis in contemporary society

Nature of values: Value Spectrum of a good life

Psychological values: Integrated personality; mental health

Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution.

Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity

Moral and ethical values: Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.

Books:

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

Ph 301 : :Physics2

Contacts : 3L + 1T

Credits : 4

Module 1:

Vector Calculus:

1.1 Physical significances of grad, div, curl. Line integral, surface integral, volume integral- physical examples in the context of electricity and magnetism and statements of Stokes theorem and Gauss theorem [No Proof]. Expression of grad, div, curl and Laplacian in Spherical and Cylindrical co-ordinates. 2L

Module 2 :

Electricity

2.1 Coulombs law in vector form. Electrostatic field and its curl. Gauss's law in integral form and conversion to differential form . Electrostatic potential and field, Poisson's Eqn. Laplace's eqn (Application to Cartesian, Spherically and Cylindrically

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symmetric systems – effective 1D problems) Electric current, drift velocity, current density, continuity equation, steady current. 5L

2.2 Dielectrics-concept of polarization, the relation $D=\epsilon_0E+P$, Polarizability. Electronic polarization and polarization in monoatomic and polyatomic gases. 3L

Module 3:

Magnetostatics & Time Varying Field:

3. Lorentz force, force on a small current element placed in a magnetic field. Biot-Savart law and its applications, divergence of magnetic field, vector potential, Ampere's law in integral form and conversion to differential form. Faraday's law of electro-magnetic induction in integral form and conversion to differential form. 3L

Module 4:

Electromagnetic Theory:

4.1 Concept of displacement current Maxwell's field equations, Maxwell's wave equation and its solution for free space. E.M. wave in a charge free conducting media, Skin depth, physical significance of Skin Depth, E.M. energy flow, & Poynting Vector.

6L

Module 5:

Quantum Mechanics:

5.1 Generalised coordinates, Lagrange's Equation of motion and Lagrangian, generalised force potential, momenta and energy. Hamilton's Equation of motion and Hamiltonian. Properties of Hamilton and Hamilton's equation of motion.

4L

Course should be discussed along with physical problems of 1-D motion

5.2 Concept of probability and probability density, operators, commutator. Formulation of quantum mechanics and Basic postulates, Operator correspondence, Time dependent Schrödinger's equation, formulation of time independent Schrödinger's equation by method of separation of variables, Physical interpretation of wave function ψ (normalization and probability interpretation), Expectation values, Application of Schrödinger equation – Particle in an infinite square well potential (1-D and 3-D potential well), Discussion on degenerate levels. 9L

Module 6:

Statistical Mechanics:

3.1 Concept of energy levels and energy states. Microstates, macrostates and thermodynamic probability, equilibrium macrostate. MB, FD, BE statistics (No deduction necessary), fermions, bosons (definitions in terms of spin, examples), physical significance and application, classical limits of quantum statistics Fermi distribution at zero & non-zero temperature, Calculation of Fermi level in metals, also total energy at absolute zero of temperature and total number of particles, Bose-Einstein statistics – Planck's law of blackbody radiation..

7L

Basic Environmental Engineering and Elementary Biology

CH-301

L-T-P = 3-0-0

At least 30 Hrs/Sem

General

Basic ideas of environment, basic concepts, man, society & environment, their interrelationship.

1L

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Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. 2L

Materials balance: Steady state conservation system, steady state system with non conservative pollutants, step function. 1L

Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering. 2L

Ecology

Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. 1L

Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web. 2L

Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. 1L

Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity. 2L

Air pollution and control

Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. 1L

Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems. 1L

Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget. 1L

Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion). 2L

Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model. 2L

Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant.

Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. 2L

Smog, Photochemical smog and London smog.

Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification. 1L

Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). 1L

Water Pollution and Control

Hydrosphere, Hydrological cycle and Natural water.

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Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. 2L

River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river[deoxygenation, reaeration], COD, Oil, Greases, pH.

2L

Lake: Eutrophication [Definition, source and effect]. 1L

Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) 1L

Standard and control: Waste water standard [BOD, COD, Oil, Grease],

Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening]

Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition.

2L

Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic

1L

Land Pollution

Lithosphere; Internal structure of earth, rock and soil 1L

Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling.

Solid waste management and control (hazardous and biomedical waste). 2L

Noise Pollution

Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise]

1L

Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level,

L_{10} (18 hr Index), Ld_n .

Noise pollution control. 1L

Environmental Management:

Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. 2L

References/Books

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.

De, A. K., "Environmental Chemistry", New Age International.

ME301 : Applied Thermodynamics

Contacts : 4L

Credits : 3

Module No.	Syllabus	Contact Hrs
1	<ol style="list-style-type: none"> 1. Review of fundamentals; Heat and work, First law for unsteady flow system. 2. Pure Substance, Properties of pure substance; Phases of pure substances- Phase rule; Phase Change Processes of Pure Substances – triple pt., critical pt.; Property diagrams of Phase change Processes; P-V-T surface for phase change; Property tables of real substances - compressed liquid, saturated, wet & superheated vapour. 	03
		04

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2	<p>3. The 2nd Law of Thermodynamics; the corollaries & their proofs; the property of entropy; entropy change of a pure substance; Tds equations and calculation of entropy change; concept and uses of entropy; the entropy generation principle. The second law of thermodynamics for an open system.</p> <p>4. Exergy analysis, Reversible work and irreversibility, Exergy change of a system, 2nd Law efficiency.</p>	07 04
3	5. Maxwell relations; Clapeyron Equation, Joule Thompson co-efficient	04
4	<p>6. I.C.Engine, Air Standard cycles; Otto, Diesel, Dual Combustion.</p> <p>7. Reciprocating air compressors; the compressor cycle with and without clearance, efficiencies; volumetric efficiency & its effect on performance; multistaging.</p>	03 03
5	8. Vapour power cycles & its modifications, Reheat & Regenerative cycle for steam, Binary cycle and cogeneration.	04
6	<p>9. Refrigeration cycles, reversed carnot cycle; components and analysis of simple vapour compression Refrigeration cycle, Actual Refrigeration cycles, Vapour Absorption Refrigeration cycle.</p> <p>10. Use of psychometric charts & processes for air conditioning</p>	05 03

Total=40L

Books recommended:

1. Engineering Thermodynamics - P.K Chattopadhyay, OUP
2. Fundamentals of Thermodynamics - 6e by Sonntag, Borgnakke & Van Wylen, John Wiley.
3. Engineering Thermodynamics-4e by P.K .Nag, TMH
4. Thermodynamics- an Engineering approach - 6e, Cengel & Boles, TMH
5. Engineering Thermodynamics- M. Achyuthan, PHI
6. Basic Engineering Thermodynamics- R. Joel, 5th ed, Pearson
7. Engineering Thermodynamics (Indian edition) – Russel & Adeliyi, OUP
8. Thermodynamics (Schaum's) – 2nd ed, Potter & Somerton, TMH

ME : Strength of Materials

Contact Week / Semester= 12 minimum

Contact per week: 3L

Credit: 3

Module	Syllabus	Contact Hrs.
1A.	Concept of mechanics of deformable solids; concept of stress developed against external force/pressure; brief review of normal and shearing stress and strain;	1L
B.	Deformation of axially loaded members, statically determinate and indeterminate problems.	4L
C.	Strain energy in tension and compression	1L
2.	Analysis of Biaxial stresses-Mohr's circle for biaxial stress; concept of normal stress, principal stress and pure shear. Shear strain and shear strain energy. Stresses in thin walled pressure vessels- tangential and Hoop stress. Relation between shear modulus and Young's modulus.	6L
3.	Stresses in beams; shear force (SF), axial force and bending moment (BM); differential relations for BM, SF and load; SF and BM diagrams; bending stresses in straight beams – symmetric loading; stresses in beams of various cross sections; stresses in built-up beams and beams of different materials.	7L
4.	Torsion of a circular shaft, shear energy in torsion. Concept of closed and open coiled helical springs, Stresses and deflection of helical springs under axial pull.	4L
5.	Deflection of statically determinate and indeterminate beams due to bending moment, differential equation of elastic line, Area-moment method, Strain energy method- Castigliano's theorem, superposition method.	7L
6.	Theory of columns; eccentric loading of short strut; column buckling: Euler load for columns with pinned ends and other end restraints; Euler's curve; empirical column formulae – (i) straight line, (ii) parabolic and (iii) Rankine Gordon.	6L

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Note for Teachers:

1. Stress should be given to clarify different concepts of the subject.
2. Deduction of all relevant equations should be worked out and explained.
3. Sufficient number of problems from each topic should be worked out during class and as home assignment.

Books Recommended

1. *Elements of Strength of Materials* by Timoshenko & Young, 5th Ed.- East west press.
2. *Introduction to Solid Mechanics* by Shames & Pitarresi, 3rd Ed., Prentice Hall India.
3. *Mechanics of Materials* by Beer & Johnston, TMH
4. *Engineering Mechanics of Solids* by E.P. Popov; 2nd Ed., Prentice Hall India
5. *Fundamentals of Strength of Materials* by Nag & Chanda, Wiley India
6. *Strength of Materials* by R.Subramanian, 2nd Ed., Oxford Univ. Press
7. *Strength of Materials* by Ryder, Mcmillan press

ME303 : Engineering materials

Contacts : 3L

Contact week/ semester = 12 minimum

Credits : 3

Sl.No.	Syllabus	Contact Hrs.
1.	Introduction: Material Science—its importance in engineering; Classification of Materials—metals, polymers, ceramics, composites; Advanced materials—semiconductors, smart materials, nano-materials; Review atomic structure, Atomic bonding in solids—bonding forces and energies; ionic/covalent/metallic bonding.	2
2.	Crystal Structure: Fundamental concepts; Unit cells; seven crystal systems; single crystal, polycrystalline and non-crystalline materials; Metallic crystal structures—FCC, atomic packing factor, BCC & HCP structures.	2
3.	Imperfections in Metals: Point defects due to vacancy & impurities, alloys, solid solutions; Dislocations—linear defects, interfacial defects, grain boundaries.	2
4.	Phase Diagrams: Definition and basic concepts; solubility limit; Phase equilibria, one-component phase diagram, binary phase diagram, interpretation of phase diagrams.	3
5.	Iron-carbon System: allotropy of iron, iron-iron carbide phase diagram, properties and uses of plain carbon steel	2
6.	Classification of Metals and Alloys- compositions, general properties and uses: 6.1 Ferrous alloys: Classification –low carbon steels, medium carbon steels, high carbon steels, stainless steels, alloy steels, tool and die steel, cast irons. 6.2 Non-ferrous alloys: Copper & Copper alloys; Aluminum alloys; Zinc alloys; Nickel alloys; Lead & Tin alloys;	6
7.	Mechanical Properties of Materials: Elastic properties of materials—tensile and compressive stress and strain, stress-strain behaviour, modulus of elasticity (Young’s modulus), yield strength, tensile strength, plastic deformation, true stress and strain; Ductility; Resilience; Toughness, impact tests; Hardness- Brinell, Rockwell and Vickers hardness and their testing procedures, correlation between hardness and tensile strength; Fatigue strength; Effect of temperature on tensile strength & impact properties, creep failure.	6
8.	Heat Treatment: Definition and purposes; Heat treatment processes for steels—Hardening, structural change during heating and cooling, factors affecting hardening; Tempering; Austempering; Normalizing; Annealing—full annealing, spheroidising annealing, stress-relieving, recrystallisation annealing; Precipitation or Age Hardening of non-ferrous alloys.	4
9.	Polymers & Elastomers: Definition; How polymers are made- polymerization; Polymer molecular structures; Thermoplastics & Thermosets; Special characteristics like low sp. gravity, optical, electrical & thermal property, decorative color, easy formability, low corrosion etc; Uses of polymers and elastomers.	2
10.	Ceramic Materials: What is ceramics; common ceramic materials and their characteristics; How ceramics are made—sintering and vitrification process; Ceramic structures; Properties and applications.	2

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Sl.N o.	Syllabus	Contact Hrs.
11.	Composite materials: What is composites; Polymers matrix and their applications; Metal matrix and ceramic matrix composites and their applications; How composites are made.	2
12.	Corrosion and Degradation of Engineering Materials: Definition; Types of corrosion—uniform, pitting, crevice, galvanic, stress corrosion cracking and erosion; Corrosion control — material selection, environment control, proper design.	2
13.	Materials Selection Methodology: Selection of material based on required properties, availability and cost of material, environmental issues.	1

Note for Teachers:

1. Stress should be given to clarify different concepts.
2. Industrial examples must be cited regarding use of various materials and the specific properties involved for selection of these materials.

Books Recommended

1. Materials Science and Engineering by W.D. Callister and adapted by R. Balasubramaniam, Willey India, 2010 Ed.
2. Engineering Materials: properties and selection by Budinski & Budinski, 9th Ed., Prentice Hall India
3. Engineering Materials and Metallurgy by R.Srinivasan, 2nd Ed., Tata McGraw Hill.
4. Materials & Processes in Manufacturing by E.P.Degarmo and adapted by Black & Koshner, 10th Ed., Wiley India.
5. Materials Science and Engineering by V.Raghavan, 5th Ed., Prentice Hall India.

Practical

Technical Report Writing & Language Lab Practice

Code: HU-381

Cr-2

Guidelines for Course Execution:

Objectives of this Course: This course has been designed:

1. To inculcate a sense of confidence in the students.
2. To help them become good communicators both socially and professionally.
3. To assist them to enhance their power of Technical Communication.

Detailed Course Outlines:

A. **Technical Report Writing** : 2L+6P

1. Report Types (Organizational / Commercial / Business / Project)
2. Report Format & Organization of Writing Materials
3. Report Writing (Practice Sessions & Workshops)

B. **Language Laboratory Practice**

1. Introductory Lecture to help the students get a clear idea of Technical Communication & the need of Language Laboratory

Practice Sessions 2L

2. Conversation Practice Sessions: (To be done as real life interactions)

2L+4P

a) Training the students by using Language Lab Device/Recommended Texts/cassettes /cd's to get their Listening Skill & Speaking Skill honed

b) Introducing Role Play & honing over all Communicative Competence

3. Group Discussion Sessions: 2L+6P

a) Teaching Strategies of Group Discussion

b) Introducing Different Models & Topics of Group Discussion

c) Exploring Live /Recorded GD Sessions for mending students' attitude/approach & for taking remedial measure
Interview Sessions; 2L+6P

a) Training students to face Job Interviews confidently and successfully

b) Arranging Mock Interviews and Practice Sessions for integrating Listening Skill with Speaking Skill in a formal situation for effective communication

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4. Presentation:

2L+6P

- Teaching Presentation as a skill
- Strategies and Standard Practices of Individual /Group Presentation
- Media & Means of Presentation: OHP/POWER POINT/ Other Audio-Visual Aids

5. Competitive Examination:

2L+2P

- Making the students aware of Provincial /National/International Competitive Examinations
- Strategies/Tactics for success in Competitive Examinations
- SWOT Analysis and its Application in fixing Target

Books – Recommended:

Nira Konar: English Language Laboratory: A Comprehensive Manual

PHI Learning, 2011

D. Sudharani: Advanced Manual for Communication Laboratories & Technical Report Writing
Pearson Education (W.B. edition), 2011

References:

Adrian Duff et. al. (ed.): Cambridge Skills for Fluency
A) *Speaking (Levels 1-4 Audio Cassettes/Handbooks)*
B) *Listening (Levels 1-4 Audio Cassettes/Handbooks)*
Cambridge University Press 1998

Mark Hancock: English Pronunciation in Use
4 Audio Cassettes/CD'S OUP 2004

Physics Lab-2

Code: PH-391

Contacts: (3P)

Credit: (2)

Group 1: Experiments on Electricity and Magnetism

- Determination of dielectric constant of a given dielectric material.
- Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
- Determination of the thermo-electric power at a certain temperature of the given thermocouple.
- Determination of specific charge (e/m) of electron by J.J. Thomson's method.

Group 2: Quantum Physics

- Determination of Planck's constant using photocell.
- Determination of Lande's g factor using Electron spin resonance spectrometer.
- Determination of Stefan's radiation constant
- Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
- Determination of Rydberg constant by studying Hydrogen/ Helium spectrum

Group 3: Modern Physics

- Determination of Hall co-efficient of semiconductors.
- Determination of band gap of semiconductors.
- To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells.

a) A candidate is required to perform 3 experiments taking one from each group. Initiative should be taken so that most of the Experiments are covered in a college in the distribution mentioned above. Emphasis should be given on the estimation of error in the data taken.

b) In addition a student should perform one more experiments where he/she will have to transduce the output of any of the above experiments or the experiment mentioned in c) into electrical voltage and collect the data in a computer using phoenix or similar interface.

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c) Innovative experiment: One more experiment designed by the student or the concerned teacher or both.

Note:

- i. Failure to perform each experiment mentioned in b) and c) should be compensated by *two* experiments mentioned in the above list.
- ii. At the end of the semester report should be sent to the board of studies regarding experiments, actually performed by the college, mentioned in b) and c)
- iii. Experiment in b) and c) can be coupled and parts of a single experiment.

Recommended Text Books and Reference Books:

For Both Physics I and II

1. B. Dutta Roy (Basic Physics)
2. R.K. Kar (Engineering Physics)
3. Mani and Meheta (Modern Physics)
4. Arthur Baiser (Perspective & Concept of Modern Physics)

Physics I (PH101/201)

Vibration and Waves

1. Kingsler and Frey
2. D.P. Roychaudhuri
3. N.K. Bajaj (Waves and Oscillations)
4. K. Bhattacharya
5. R.P. Singh (Physics of Oscillations and Waves)
6. A.B. Gupta (College Physics Vol.II)
7. Chattopadhyaya and Rakshit (Vibration, Waves and Acoustics)

Optics

1. Möler (Physical Optics)
2. A.K. Ghatak
3. E. Hecht (Optics)
4. E. Hecht (Schaum Series)
5. F.A. Jenkins and H.E. White
6. Chita Ranjan Dasgupta (Degree Physics Vol 3)

Quantum Physics

1. Eisberg and Resnick
2. A.K. Ghatak and S. Lokenathan
3. S.N. Ghoshal (Introductory Quantum Mechanics)
4. E.E. Anderson (Modern Physics)
5. Haliday, Resnick and Crane (Physics vol.III)
6. Binayak Dutta Roy [Elements of Quantum Mechanics]

Crystallography

1. S.O. Pillai (a. Solid state physics b. Problem in Solid state physics)
2. A.J. Dekker
3. Ashcroft and Mermin
4. Ali Omar
5. R.L. Singhal
6. Jak Tareen and Trn Kutty (Basic course in Crystallography)

Laser and Holography

1. A.K. Ghatak and Thyagarajan (Laser)
2. Tarasov (Laser)
3. P.K. Chakraborty (Optics)
4. B. Ghosh and K.G. Majumder (Optics)
5. B.B. Laud (Laser and Non-linear Optics)
6. Bhattacharyya [Engineering Physics] Oxford

Physics II(PH 301)

Classical Mechanics (For Module 5.1 in PH 301)

H. Goldstein

A.K. Roychaudhuri

R.G. Takwal and P.S. Puranik

Rana and Joag

M. Spiegel (Schaum Series)

J.C. Upadhyaya (Mechanics)

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Electricity and Magnetism

1. Reitz, Milford and Christy
2. David J. Griffith
3. D. Chattopadhyay and P.C. Rakshit
4. Shadowitz (The Electromagnetic Field)

Quantum Mechanics

7. Eisberg and Resnick
8. A.K. Ghatak and S. Lokenathan
9. S.N. Ghoshal (Introductory Quantum Mechanics)
10. E.E. Anderson (Modern Physics)
11. Haliday, Resnick and Crane (Physics vol.III)
12. Binayak Dutta Roy [Elements of Quantum Mechanics]

Statistical Mechanics

1. Sears and Sallinger (Kinetic Theory, Thermodynamics and Statistical Thermodynamics)
2. Mondal (Statistical Physics)
3. S.N. Ghoshal (Atomic and Nuclear Physics)
4. Singh and Singh
5. B.B. Laud (Statistical Mechanics)
6. F. Reif (Statistical Mechanics)

Dielectrics

7. Bhattacharyya [Engineering Physics] Oxford

ME 391 : Machine Drawing-I

Credit : 2

Schematic product symbols for standard components in mechanical, electrical and electronic systems, welding symbols and pipe joints;

Orthographic projections of machine elements, different sectional views- full, auxiliary sections;

Isometric projection of components;

Assembly and detailed drawings of a mechanical assembly, such as a plumber block, tool head of a shaping machine, tailstock of a lathe, welded pipe joints indicating work parts before welding, etc.

(At least six sheets must be drawn)

Books:

1. Text Book on Engineering Drawing, Narayana/ Kannaia H, Scitech
2. Mechanical Engineering Drawing and Design, S. Pal and M. Bhattacharyya
3. Machine Drawing by N.D. Bhatt
4. Machine Drawing by P.S. Gill

Workshop Practice-II

Code: ME-392

Cr-2

Pattern Making; pattern material, pattern allowances and types of patterns; (5P)

Mould making Practice: Uses of moulding tools: green sand moulding, gating system, risering system, core making; (6P)

Making a typical product using sheet metal; (3P)

Basic Forging processes like upsetting, drawing down and forge welding; (5P)

Practicing Resistance Spot Welding, Shielded Metal Arc Welding and Gas Welding; (7P)

Machining of typical products involving lathe, milling/shaping operations and finishing process(es); Machining of gears. (10P)

Applied Mechanics Lab

Code: ME-393

Cr-2

N.B: Minimum six(6) experiments from the list to be conducted by the students.

Verification of Varignon's theorem;

Determining spring stiffness under tension and compressive loads; Strain gauge based strain/ deflection/ force measurement of a cantilever beam;

Tension Test and Compression Test of ductile and brittle materials: stress-strain diagram, determination of yield strength, ultimate strength, modulus of elasticity, percentage elongation and percentage reduction in areas, observation of fractured surfaces;

Bend and rebend test of flat test pieces, determination of bending stresses;

Torsion Test;

Hardness Tests: Brinell/ Vickers and Rockwell tests, Shore hardness test;

Experiments on friction: determination of coefficient of friction;

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Experiments to observe speed ratios obtained using belt pulley and gears, and to evaluate torque and energy required.

SEMESTER - IV

Theory

NUMERICAL METHODS

Code : M(CS) 401

Contacts : 2L+1T

Credits :2

Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors. (4)

Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation. (5)

Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms. (3)

Numerical solution of a system of linear equations:

Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method. (6)

Numerical solution of Algebraic equation:

Bisection method, Regula-Falsi method, Newton-Raphson method. (4)

Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method. (6)

Text Books:

1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis.
3. J.B.Scarborough: Numerical Mathematical Analysis.
4. Jain, Iyengar, & Jain: Numerical Methods (Problems and Solution).

References:

1. Balagurusamy: Numerical Methods, Scitech.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.

MATHEMATICS

Code: M 402

Contacts: 3L +1T = 4

Credits: 4

Note 1: The entire syllabus has been divided into four modules.

Note 2: Structure of Question Paper

There will be two groups in the paper:

Group A: Ten questions, each of 2 marks, are to be answered out of a total of 15 questions, covering the entire syllabus.

Group B: Five questions, each carrying 10 marks, are to be answered out of (at least) 8 questions.

Students should answer at least one question from each module.

[At least 2 questions should be set from each of Modules II & IV.

At least 1 question should be set from each of Modules I & III. Sufficient questions should be set covering the whole syllabus for alternatives.]

Module I: Fourier Series & Fourier Transform [8L]

Topic: Fourier Series:

Sub-Topics: Introduction, Periodic functions: Properties, Even & Odd functions: Properties, Special wave forms: Square wave, Half wave Rectifier, Full wave Rectifier, Saw-toothed wave, Triangular wave.

(1)

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Euler's Formulae for Fourier Series, Fourier Series for functions of period 2π , Fourier Series for functions of period $2l$, Dirichlet's conditions, Sum of Fourier series. Examples. (1)

Theorem for the convergence of Fourier Series (statement only). Fourier Series of a function with its periodic extension. Half Range Fourier Series: Construction of Half range Sine Series, Construction of Half range Cosine Series. Parseval's identity (statement only). Examples. (2)

Topic: Fourier Transform:

Sub-Topics: Fourier Integral Theorem (statement only), Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only), Fourier Cosine & Sine Transforms. Fourier, Fourier Cosine & Sine Transforms of elementary functions. (1)

Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation. Examples. Fourier Transform of Derivatives. Examples. (1)

Convolution Theorem (statement only), Inverse of Fourier Transform, Examples. (2)

Module II : Calculus of Complex Variable [13L]

Topic: Introduction to Functions of a Complex Variable.

Sub-Topics: Complex functions, Concept of Limit, Continuity and Differentiability. (1)

Analytic functions, Cauchy-Riemann Equations (statement only). Sufficient condition for a function to be analytic. Harmonic function and Conjugate Harmonic function, related problems. (1)

Construction of Analytic functions: Milne Thomson method, related problems. (1)

Topic: Complex Integration.

Sub-Topics: Concept of simple curve, closed curve, smooth curve & contour. Some elementary properties of complex Integrals. Line integrals along a piecewise smooth curve. Examples. (2)

Cauchy's theorem (statement only). Cauchy-Goursat theorem (statement only). Examples. (1)

Cauchy's integral formula, Cauchy's integral formula for the derivative of an analytic function, Cauchy's integral formula for the successive derivatives of an analytic function. Examples. (2)

Taylor's series, Laurent's series. Examples (1)

Topic: Zeros and Singularities of an Analytic Function & Residue Theorem.

Sub-Topics: Zero of an Analytic function, order of zero, Singularities of an analytic function. Isolated and non-isolated singularity, essential singularities. Poles: simple pole, pole of order m . Examples on determination of singularities and their nature. (1)

Residue, Cauchy's Residue theorem (statement only), problems on finding the residue of a given function, evaluation of definite integrals: $\int_0^{\infty} \frac{\sin x}{x} dx$, $\int_0^{2\pi} \frac{d\theta}{a + b \cos \theta + c \sin \theta}$, $\oint_C \frac{P(z)}{Q(z)} dz$ (elementary cases, $P(z)$ & $Q(z)$ are polynomials of 2^{nd} order or less). (2)

Topic: Introduction to Conformal Mapping.

Sub-Topics: Concept of transformation from z -plane to w -plane. Concept of Conformal Mapping. Idea of some standard transformations. Bilinear Transformation and determination of its fixed point. (1)

Module III: Probability [8L]

Topic: Basic Probability Theory

Sub-Topics: Classical definition and its limitations. Axiomatic definition.

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Some elementary deduction: i) $P(O)=0$, ii) $0 \leq P(A) \leq 1$, iii) $P(A')=1-P(A)$ etc. where the symbols have their usual meanings. Frequency interpretation of probability. (1)

Addition rule for 2 events (proof) & its extension to more than 2 events (statement only). Related problems. Conditional probability & Independent events. Extension to more than 2 events (pairwise & mutual independence). Multiplication Rule. Examples. Baye's theorem (statement only) and related problems. (3)

Topic: Random Variable & Probability Distributions. Expectation.

Sub-Topics: Definition of random variable. Continuous and discrete random variables. Probability density function & probability mass function for single variable only. Distribution function and its properties (without proof). Examples. Definitions of Expectation & Variance, properties & examples. (2)

Some important discrete distributions: Binomial & Poisson distributions and related problems.

Some important continuous distributions: Uniform, Exponential, Normal distributions and related problems. Determination of Mean & Variance for Binomial, Poisson & Uniform distributions only. (2)

Module IV: Partial Differential Equation (PDE) and Series solution of Ordinary Differential Equation (ODE) [13L]

Topic: Basic concepts of PDE.

Sub-Topics: Origin of PDE, its order and degree, concept of solution in PDE. Introduction to different methods of solution: Separation of variables, Laplace & Fourier transform methods. (1)

Topic: Solution of Initial Value & Boundary Value PDE's by Separation of variables, Laplace & Fourier transform methods.

Sub-Topics:

PDE I: One dimensional Wave equation. (2)

PDE II: One dimensional Heat equation. (2)

PDE III: Two dimensional Laplace equation. (2)

Topic: Introduction to series solution of ODE.

Sub-Topics: Validity of the series solution of an ordinary differential equation. General method to solve $P_0 y'' + P_1 y' + P_2 y = 0$ and related problems. (2)

Topic: Bessel's equation.

Sub-Topics: Series solution, Bessel function, recurrence relations of Bessel's Function of first kind. (2)

Topic: Legendre's equation.

Sub-Topics: Series solution, Legendre function, recurrence relations and orthogonality relation. (2)

TOTAL LECTURES : 42

Text Books:

2. Brown J.W and Churchill R.V: Complex Variables and Applications, McGraw-Hill.
3. Das N.G.: Statistical Methods, TMH.
4. Grewal B S: Higher Engineering Mathematics, Khanna Publishers.
5. James G.: Advanced Modern Engineering Mathematics, Pearson Education.
6. Lipschutz S., and Lipson M.L.: Probability (Schaum's Outline Series), TMH.

References:

1. Bhamra K. S.: Partial Differential Equations: An introductory treatment with applications, PHI
2. Dutta Debashis: Textbook of Engineering Mathematics, New Age International Publishers.
3. Kreyzig E.: Advanced Engineering Mathematics, John Wiley and Sons.
4. Potter M.C, Goldberg J.L and Aboufadel E.F.: Advanced Engineering Mathematics, OUP.
5. Ramana B.V.: Higher Engineering Mathematics, TMH.
6. Spiegel M.R., Lipschutz S., John J.S., and Spellman D., : Complex Variables, TMH.

ME-401: Fluid mechanics & Hydraulic Machines

Contacts: 4L

Credit: 4

Fluid mechanics

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Module No.	Syllabus	Contact Hrs
1	1. Review of fluid properties and fluid statics. Hydraulic forces on submerged surfaces; forces on vertical, horizontal, inclined and curved surfaces.	02
	2. Kinematics of fluid flow: fluid flow and classifications. Continuity equation in 1D & 3D. Potential flow & Stream function; types of flow lines.	03
2	3. Dynamics of fluid: equations of motion; Euler's equation; Bernoulli's equation; Applications of Bernoulli's equation.	04
	4. Momentum Analysis of flow systems; the linear momentum equation for steady flow, differential approach.	03
3	5. Flow through pipes; Darcy – Weisbach equation of friction loss; hydraulic grade line and total energy line.	03
4	6. Basic principle for flow through orifices, V-notches (rectangular v), weirs (rectangular). Flow through open channels; use of Chezy's formula.	04
5	7. Dimensional Analysis & Model investigation applied to flow systems – Buckingham Pi theorem. Dimensionless numbers in fluid flow.	02
	8. Flow of fluid around submerged bodies; basic concepts of drag and lift.	02
	9. Boundary layer – definition; Boundary layer separation – basic concept.	02

Hydraulic Machines

Module No.	Syllabus	Contact Hrs
6	Hydraulic Turbines; Principles and Classifications; Design & working principle of a Pelton Wheel, efficiency and performance curves. Francis Turbine, Kaplan Turbine. Function of Draft Tube. Cavitation in Turbines.	05
7	Reciprocating Pumps: Components & Principles, Classification, discharge, work done, power requirement.	05
8	Centrifugal pumps: Components, working principle, head & efficiency. Multistage Centrifugal pumps. Pump characteristics, NPSH & Cavitation.	05

Total=40

Books Recommended

1. Fluid Mechanics & Turbo Machines – M.M.Das, PHI, 2010.
2. Fluid Mechanics & Machinery – R.K.Bansal, Luxmi Publications.
3. Fluid Mechanics & Machinery – C.Ratnam, A.V.Kothapalli, I.K. International Publishing House Ltd, 2010.
4. Introduction to Fluid Mechanics & Fluid Machines – Som & Biswas, TMH.
5. Fluid Mechanics & Machinery – C.S.P Ojha, R.Berndtsson, P.N. Chandramouli, OUP.
6. Introduction to Fluid Mechanics – Fox & Macdonald, Wiley.
7. Fluid Mechanics – Fundamentals & Applications – Cengel & Cimbala, TMH.
8. Ojha, C S P, Berndtsson. R, Chandramouli. P. N.

ME-402 Mechanisms

Contact Week / Semester= 12 minimum

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Contact per week: 3L

Credit: 3

Module	Syllabus	Contact Hrs.
1.A	Introduction to mechanisms, Difference between Machine and Mechanism; Classification of Pairs of Elements, Kinematic chain, types of joints in a chain; Four-bar linkage: motions of links, Grashof's criterion of movability.	2L
B	Degrees of freedom for plane Mechanisms, Gruebler's criterion for plane mechanism, Kinematic inversions – four Inversions of a Slider-Crank Chain.	3L
2.	Velocity analysis in Mechanisms: Relative velocity method – slider crank mechanism, four bar mechanism, Crank and slotted lever mechanism; Instantaneous centre method – Kennedy's theorem; Acceleration analysis: Acceleration Images, Klein's construction, analytical expression of velocity & acceleration.	7L
3.	Belt-drive – introduction; Law of belting, Length of flat belt for open and cross belt connections; Stepped pulley for open flat belt; Tension in flat belt and V-belts; Power transmitted in belt drive	4L
4.	Gear terminology, Laws of gearing, types of gears – Spur, Bevel, Helical, Worm; tooth profile, interference; Gear trains – simple, compound, epicyclic gear train; Speed-torque analysis of gear trains.	6L
5.	Classification of Cams and followers; Radial Cam, Analysis of knife-edge, roller and flat face follower motion – constant velocity, simple harmonic, constant acceleration & deceleration; Offset follower.	6L
6. A	Kinematic Synthesis: Introduction to problems of function generation, path generation and rigid body guidance; Type, Number and Dimensional Synthesis; Two and three position synthesis of four bar mechanism and slider –crank mechanism : Graphical – pole, Relative pole and Inversion method; Analytical solution - Freudenstein's Method.	5L
B	Study of lower pair Mechanisms- Pantograph, Parallel linkage mechanisms, Straight line mechanism, Automobile steering mechanism, Hooks joint.	3L

Note to the Teachers :

1. Stress should be given on the concept of different topics.
2. All relevant deductions should be worked out and explained.
3. Sufficient number of problems from each topic should be worked out during the class and should also be assigned as home assignment.

Books Recommended :

1. Elements of Mechanism – Daughy and James, McGraw Hill
2. Theory of Machines – S S Rattan, Tata McGraw Hill
3. Theory of Mechanisms & Machines – A.Ghosh & A.K.Mallik, AEWP
4. Design of Machinery – R.L.Norton, Tata McGraw Hill
5. Mechanism & Machine Theory – Rao, R.V. Dukupati, Wiley
6. Theory of Machines, V.P.Singh, Dhanpat Rai & Co

ME403 : Primary Manufacturing Processes

Contacts : 4L

Credits : 4

S/L	Module/Sub module	Contact Hours	
		Sub module	Module
1.	Introduction		
	□ Manufacturing; Definitions and broad grouping	1	1
2.	Casting		
	□ Introduction History Definition Major Classification Casting Materials	1	15

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	<ul style="list-style-type: none"> ❑ Sand mould casting Moulding sands: composition, properties & testing Design of gating system: sprue, runner, ingate & riser Estimation of powering time Foundry equipments, Furnaces Melting, pouring and solidification Type of patterning, use of a core Different type of sand mould casting Floor mould casting Centrifugal casting Shell mould & CO2 casting Investment casting 	12	
	<ul style="list-style-type: none"> ❑ Permanent mould casting Die casting, types, methods, advantages & applications Slush casting, principle & use 	1	
	<ul style="list-style-type: none"> ❑ Casting defects, types, causes & remedy 	1	
3.	Welding		
	<ul style="list-style-type: none"> ❑ Introduction to metallic parts Major grouping of joining processes, welding, brazing and soldering Broad classification of welding processes, types and principles 	1	12
	<ul style="list-style-type: none"> ❑ Fusion welding, types, principles, equipments, characteristics & applications Sources of heat-chemical action, Gas welding & thermit welding Sources of heat-electrical energy, Arc welding Submerged arc welding TIG & MIG; Plasma arc welding Resistance welding; Spot & butt welding 	6	
	<ul style="list-style-type: none"> ❑ Solid state welding Principles, advantages & applications of: Hot forge welding, Friction welding Pressure & percussion welding 	2	
	<ul style="list-style-type: none"> ❑ Precision welding processes: Ultrasonic welding Laser beam welding Electron beam welding 	2	
	<ul style="list-style-type: none"> ❑ Welding defects, types, causes & remedy 	1	
4.	Forming Processes		
	<ul style="list-style-type: none"> ❑ Forging Introduction, definition, classification, hot forging & cold forging, characteristics & applications Forging material operations, equipments & tools: Smith forging Drop forging Pressing or press forging Forging dies, materials & design 	3	12
	<ul style="list-style-type: none"> ❑ Rolling Introduction, basic principles, hot rolling & cold rolling, characteristics & applications Rolling processes & applications, operations, equipments & roll stands 	3	
	<ul style="list-style-type: none"> ❑ Wire drawing & extensions Basic principles & requirements Classification, methods & applications 	2	

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	<input type="checkbox"/> Press tool works Basic principles, systems, operations & applications Shearing, parting, blanking, piercing & notching Cupping(drawing), Spinning & deep drawing Blanks & forces needed for shearing & drawing operations Coining & embossing	4	
Total Contact Hrs=40			

Text Books:

1. Manufacturing technology, Foundry, Forming & Welding-P.N Rao.
2. Manufacturing Science-A Ghosh & A Mullick.
3. Manufacturing Engineering & Technology-S Kalpakjian; Pub:Addison Wesley.
4. Principles of manufacturing materials & processes-James & Campbell.

Reference Books:

1. Manufacturing engineering & technology-K Jain.
2. Materials & processes in manufacturing-E.P Degarmo, Black & Kohser, Pub: Wiley(10th ed.)
3. Processes & materials of manufacturing-R.A Lindberg.
4. Introduction to manufacturing technology-PP Date, Pub: Jaico.
5. Manufacturing processes-S.K Sharma & S Sharma, Pub: I.K International.

Practical

NUMERICAL METHODS

Code : M(CS) 491

Credits :1

1. Assignments on Newton forward /backward, Lagrange's interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.
4. Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
5. Assignments on ordinary differential equation: Euler's and Runge-Kutta methods.
6. Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.

ME 491: Fluid mechanics & Hydraulic Machines Lab

Contacts: 3L

Credit: 2

Fluid flow measurements: Determining coefficient of discharge for venturimeter, orificemeter, weirs;
 Experiment to verify Bernouli's theorem;
 Flow through pipes: Reynold's experiments; Pipe friction in laminar and turbulent flow regimes; Pitot tube experiments on viscous flow and boundary layer theory;
 Determination of metacentric height of a floating vessel;
 Experiments on Fluid Machinery : Pumps, jet pumps, Blowers, Compressors;
 Experiments on Hydro-Turbines: Francis and Pelton turbines.

(At least six experiments must be conducted)

ME 492: Manufacturing Technology Lab

Contacts: 3L

Credit: 2

Sand preparation and testing: specimen preparation for testing permeability, clay content, grain fineness number, moisture content, green compression strength, green shear strength, splitting strength, hardness, etc.;;
 Casting of metals after preparation of suitable moulds; Experiments on properties of post casting, fettling, cleaning, deburring, and polishing operations;
 Practicing smithy or forging of carbon steels and testing for its property changes;
 Laboratory experiments in Fabrication processes to observe effects of varying process parameters in GMAW and SMAW and Testing for Joint defects.

(At least six experiments must be conducted)

ME 493: Material Testing Lab

Contacts: 3L

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Credit: 2

Impact tests: Charpy and Izod tests;

Test for drawability of sheet metals through cupping test;

Fatigue test of a typical sample.

Sample preparation and etching of ferrous and non-ferrous metals and alloys for metallographic observation;

Experiments on heat treatment of carbon steels under different rates of cooling including quenching, and testing for the change in hardness and observing its microstructural changes through metallographic studies.

Observation of presence of surface/ sub-surface cracks using different non-destructive techniques, such as dye penetration (DP) test, magnaflux test, ultrasonic or eddy current test.

(At least six experiments must be conducted)

ME 494: Machine Drawing-II

Contacts: 3L

Credit: 2

Assembly and detailed drawings of a mechanical assembly, such as a simple gear box, flange coupling, welded bracket joined by stud bolt on to a structure, etc.

Practicing AutoCAD or similar graphics softwares and making orthographic and isometric projections of different components.

(At least six assignments must be conducted)

References:

1. Text Book on Engineering Drawing, Narayana and Kannaia H, Scitech.
2. Mechanical Engineering Drawing and Design, S. Pal and M. Bhattacharyya.
3. Machine Drawing by N.D. Bhatt.
4. Machine Drawing by P.S. Gill.
5. Engineering Drawing and Graphics + AutoCAD by K. Venugopal, New Age International Pub.
6. Engineering Drawing with an Introduction to AutoCAD by D.A. Jolhe, Tata-McGraw-Hill Co.

V Semester

AUE 501 : Dynamics of Machines

Contacts : 3L

Credit : 3

Dynamics of reciprocating machines: Static force analysis, Inertia forces in reciprocating parts: analytical method: velocity and acceleration of reciprocating parts, crankshaft torque considering and neglecting the weight of connecting rod; turning moment on crank-shaft, dynamically equivalent system, correction couple.

Graphical method: Klein's construction.

8L

Turning moment diagrams: Coefficient of fluctuation of speed and energy, Flywheels, application as punching press
3L

Governors: Centrifugal governors: Watt, Porter, Proell, Hartnell; stability criterion, controlling force, governor effort and power, friction and insensitiveness. 5L

Brakes and Dynamometers: Brakes: Block or shoe brake, Band brake, Band and Block brake, Internal Expanding Shoe brake, Braking of a vehicle; Dynamometer: Prony brake dynamometer, Rope brake dynamometer, Belt transmission dynamometer. 4L

Balancing: Rotating mass: single rotating mass, balancing of several masses rotating in same plane and in different plane

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Reciprocating mass: Partial balancing of primary force, Partial balancing of locomotives: Variation of tractive force (or effort), swaying couple, hammer blow, coupled locomotives, Primary and secondary balancing of Multi-cylinder Inline Engines. 6L

Vibrations: Introduction: Fundamentals of vibration, Free vibrations: longitudinal vibrations; energy method, Rayleigh method; Transverse vibrations; natural frequency of a shaft or beam, whirling speed.

Damped vibrations: over damped, under damped, critically damped vibrations, logarithmic decrement, forced damped vibration, magnification factor, vibration isolation and transmissibility.

Torsional vibration: free torsional vibration single rotor 10L

References:

- 1) Theory of Machines and Mechanisms by J.J.Shigley and J.J.Uicker, McGrawhill.
- 2) Theory of Machines by S.S.Rattan, TMH.
- 3) Design of machinery by R.L.Norton, , McGrawhill
- 4) Theory of Machines by R.K.Bansal , laxmi Publications
- 5) Mechanism and Machine Theory by J.S.Rao and R.V.Dukkipati, New Age International

AUE 502 : Heat Transfer

Contacts: 3L :

Credit : 3

Introduction: Modes of heat transfer. 1L

Conduction: Fourier law of heat conduction for isotropic material. Thermal conductivity. Derivation of the energy equation in three dimensions including transient effect. Non dimensional - thermal diffusivity and Fourier number. One dimensional solution with and without heat generation in slab, cylinder and sphere. Analogy with electrical circuits. Critical thickness of insulation. 10L

Fins: Rectangular and pin fins. Fin effectiveness and efficiency. 4L

Conduction-Unsteady state: Lumped parameter approach and physical significance of time constant, Biot number, Validity of lumped parameter approach. Introduction to Heissler Chart.3L

Radiation : Physical mechanism of thermal radiation, laws of radiation, definition of black body, emissive power, intensity of radiation, emissivity, reflectivity, transmittivity, irradiation, radiosity. Radiation exchange between black bodies, concept of Gray-Diffuse Isotropic (GDI) surface. Radiation exchange between GDI surfaces by radiation network and radiosity matrix method. Radiation shielding. 7L

Convection: Introduction, Newton's law of cooling and significance of the heat transfer coefficient. Momentum and energy equations in two dimensions, nondimensionalisation, importance of non-dimensional quantities and their physical significance. Order of magnitude analysis for flow over a flat plate. Velocity and thermal boundary layer thickness by integral method. Analogies between momentum, heat and mass transfer. 7L

Heat exchangers: Types of heat exchangers, parallel and counter flow types, Introduction to LMTD. Correction factors, fouling factor.-Effectiveness of heat exchanger .NTU method for heat exchangers. 4L

References :

1. Heat Transfer - A Basic Approach by M.N.Ozisik, McGrawhill.
2. Heat Transfer by J.P.Holman, 8th ed., McGrawhill.
3. Heat and Mass Transfer by R. K. Rajput. (S. Chand ,2010)
4. Fundamental of Engineering Heat and Mass Transfer by R.C. Sachdeba (New Age Science,2010)

AUE 503 : Design of Machine Elements

Contacts : 4L

Credit : 4

Introduction: Definition, General procedures and considerations in Machine Design, design stresses, factor of safety, engineering material and application. 2L

Limits, Fits and Tolerances: Indian Standard System for Limits and Fits, Preferred Numbers, Fundamental Deviation for Holes and Shafts. 3L

joints- Types of cotter joint, Knuckle joint, Riveted joints, Design of Riveted joints,

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Welding processes, Types of Weld joints, Strength of different Fillet weld joints and butt joints, Stresses for different Welded joints. 12L

Design of Variable Loads: Endurance limit of materials, Notch sensitivity, Goodman and Soderberg Criteria, Design of Shaft. 6L

Shafts, Keys and Couplings: Design of shafts on the basis of Strength, Design of shafts on the basis of Rigidity, Types of keys, Design of Sunk keys, Effect of keyways, Types of Shaft Couplings, Design of Muff, Split muff and Flange Coupling. 12L

Design of springs: Helical compression, Tension springs under static and variable loads, Laminated Springs. 5L

Design of Belt and Chain Drives: Selection of Belt Drives, Types of Belt Drives, Materials of Belts, Belt joints, Types of Flat Belt Drives, Design of Flat Belt and V belt Drives. Design of chain Drives. 8L

References:

1. Mechanical Engineering Design by J.F.Shigley, McGrawhill.2003
2. Design of Machine Elements by M.F.Spotts, Prentice Hall.1998
3. Mechanical Analysis and Design by A.H.Burr and J.B.Cheathak, 2nd ed., Prentice Hall.1995
4. Fundamentals of Machine Elements - Hawrock, Jacobson - McGraw Hill 1993.
5. Design of machine elements by V. B. Bhandari, Tata McGraw Hill Pub.1994
6. A Text Book of Machine Design by R.S.Khurmi and J.K.Gupta, S.Chand Pub.2005

AUE 504(A) : Automotive Chassis

Contacts : 3L

Credit : 3

INTRODUCTION

Types of chassis layout with reference to power plant locations and drive, Vehicle frames. various types of frames. Constructional details, Materials. Testing of vehicle frames. Unitised frame body construction: Loads acting on vehicle frame, chassis lubrication, and calculation of stresses on sections. 3L

FRONT AXLE AND STEERING SYSTEM

Types of front axles. Construction details. Materials. Front wheel geometry viz. Castor, Camber, King pin inclination, Toe-in Conditions for true rolling motion of wheels during steering. Steering geometry. Ackerman and Davis steering system. Constructional details of steering linkages. Different types of steering gear boxes. Steering linkages and layouts. Power and power assisted steering. 5L

DRIVE LINE

Effect of driving thrust and torque reactions. Hotch kiss drive, torque tube drive and radius rods. Propeller shaft. Universal joints. Constant velocity universal joints. Front wheel drive.3L

FINAL DRIVE AND DIFFERENTIAL

Different types of final drive. Worm and worm wheel, straight bevel gear, Spiral bevel gear and hypoid gear final drives. Double reduction and twin speed final drives. Differential principles. Construction details of differential unit. Non-slip differential. Differential locks - Differential housings. 5L

REAR AXLES

Construction of rear axles. Types of loads acting on rear axles. Full floating. Three quarter floating and semifloating rear axles. Rear axle housing. Construction of different types of axle housings. Multi axled vehicles. Construction details of multi drive axle vehicles. 5L

SUSPENSION SYSTEM

Need of suspension system - Types of front and rear suspension system - Suspension springs - Constructional details and characteristics of leaf, coil and torsion bar springs - Independent suspension - Rubber suspension - Pneumatic suspension - constructional details of telescopic shock absorbers. Types, vibrations and riding comfort, role axis of spring suspension. Two & 4. wheel independent suspension 5L

WHEEL & TYRES

Types of wheels, construction, wired wheels, tyres, construction, types, radial, bias & belted bias, comparison, slip angle, under and over steering, tread patterns, tyre re-treading cold and hot, tyre specification tubeless tyre. 3L

BRAKING SYSTEM

Necessity of brake, stopping distance and time. Brake efficiency, weight transfer, brake shoe theory, determination of braking torque, braking systems -mechanical, hydraulic, disc, drum, parking and emergency brakes, power, servo and

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electrical brakes, details of hydraulic system, mechanical system and components. types of master cylinders, factors influencing operation of brakes such as operating temperature, lining, brake clearance, pedal pressure, linkages etc, Different types of retarders like eddy current and hydraulic retarder. Anti lock braking systems.

5L

References:

1. Jack E Rjavee Automotive Technology- A system approach, Thomson Asia Pte Ltd. Singapore, 3rd edition 2004
2. De A Automobile Engineering, Galgotia Publishers Pvt Ltd , 2004
3. Ramalingam K K Scitech Publication (India) Pvt. Ltd. 2nd edition 2004
4. Joseph Heitner, Automotive Mechanics Principle and Practice East west press, 2nd edition 1999

AUE- 504(B) Fluid Power Control

Contact ; 3L

Credit: 3

Introduction : Fluid power & its Application, Hydraulic symbols. 3L

Pumps: Gear, Vane, Piston & their types of pumps. 8L

Control Valve: Relief valve, Un loader valve, Pressure reducing valve, Different types of flow control valve, Direction control valve. 10L

Air filter, Lubrication & Regulators, Pneumatic control elements, Air cylinders. 3L

Hydraulic Actuators : Linear and rotary, Hydraulic actuator and their circuit. 5L

Pneumatic: Pneumatic safety circuits, Pneumatic logistic control. 5L

References

1. HE Merritt - Hydraulic Control System; Wiley New York
2. Esposito – Fluid Power; Pearson Education
3. Andrew Parr – Hydraulics and Pneumatic; Jaico Publishers

AUE 505: Machine Tools and Machining Technology

Contacts: 3L

Credit : 3

Metal cutting:

Tool geometry and single point cutting tools, orthogonal and oblique cutting, rake, cutting tool signature; Chip shape and chip formation, chip tool interface, chip flow, built up edge, machined surface. 4L

Force systems during turning, Merchant's circle diagram for cutting forces, force systems at chip tool interface and shear plane, velocity relationships, derivations of expressions and problems.

Energy of cutting process, derivation of expression; Principle of heat generations in metal cutting;

Machining economics- machining cost, optimum production rate, derivation of expressions.

Cutting tool materials, cutting fluids, tool life 10L

Conventional Machining: Constructional Details and Working of Lathe, Drilling machine, Milling machine, Shaper and Planer; Tooling, Attachments and Operations Performed, Process Geometry, Cutting Conditions, Calculation of Time of Machining (T_m) and Material Removal Rate (MRR), problems. 12L

Non traditional machining: basic concepts and application of EDM, ECM, USM, PAM, EBM, AJM, WJM, LBM and Explosive forming. 10L

References:

1. Production Technology by R.K.Jain and S.C.Gupta, Khanna Publishers.
2. Manufacturing Science by A. Ghosh and A. Mullick, East West Publishers.
3. A text book of Production Engineering by P.C.Sharma , S.Chand.2002
4. Manufacturing Technology – Metal Cutting and Machine Tools by Rao P.N, Tata McGraw Hill. 1998
5. Manufacturing Engineering and Technology by S. Kalpakjian, Addison Wesley
6. Elements of Workshop Technology by Hajra Choudhury, Vol-I and Vol-II Media promoters' pub. 2007
7. H.M.T. Production Technology-Hand Book, Tata McGraw Hill. 1980
8. Workshop Technology by W.A.J. Chapman Part I, II & III. 1976, 1998

AUE591 Seminar I (Trg)

Contact: 3P

Credit: 2

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Student will deliver seminar talk regarding training, which they have taken in the preceding summer vacation. They have to submit a report in this respect.

AUE592 Engine component Laboratory.

Contact: 3P

Credit: 2

Identification of tools and their function.

Study of various design of 4-stroke & 2- stroke S.I. & C.I. engines. Dismantling and assembling of engines. Comparison of engine component for various design. Ignition systems, fuel systems in SI and CI Engine, Cooling Systems.

AUE593 Design Practice.

Contact: 3P

Credit: 2

Drawing board exercises compatible to the course of AUE 503 (Design of Machine elements.).

AUE594 Professional Elective Laboratory I.

AUE594 (A) Chassis Component Laboratory

Contact: 3P

Credit: 2

Study and measurement of various design of automobile chassis. Dismantling & Assembling and experimentation (where ever possible) of steering system, braking system, differential mechanism, gear box, transmission system.

AUE- 594(B) Fluid Power Control Laboratory

Contact 3P

Credit: 2

Pneumatic circuit for sorting device, stamping device, valve actuation, toppling device, clamping device

Electro hydraulic circuit to develop system pressure, to actuate double acting cylinder, continuous reciprocation of a double acting cylinder. Speed control of double acting cylinder.

VI Semester

AUE 601 : Automotive Petrol & Diesel Engines

Contacts : 3L

Credit : 3

Introduction: Basic air standard cycle Otto, Diesel & dual fuel cycle, comparison between Otto, Diesel and Dual fuel cycles. Concept of Fuel-air cycles and actual cycles. Comparison of four stroke and two stroke engine operation.

5L

Fuels: Basic properties of SI and CI engine fuels, rating of fuels, equation of combustion, calculation of A/F ratio and equivalence ratio. 3L

Combustion in SI engines: Stages of combustion, flame propagation, rate of pressure rise.

Abnormal combustion: Phenomena of knocking. Effect of engine variables on knock. 3L

SI Engine Fuel System: Air-fuel mixtures, mixture requirements at different loads and speeds. Carburetor and its working principle. Calculation of mass flow rate of fuel and A/F ratio. Essential parts of a carburetor.

4L

Petrol Injection strategies: M.P.F.I. GDI and Port fuelling techniques. 3L

Ignition System: Magneto and Battery ignition systems, Firing order and its significance.

Ignition timing and Spark advance mechanism.

2L

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Combustion in CI engines: Combustion in CI engines and Stages of combustion, ignition delay, factors affecting delay period. Abnormal combustion, Knock in CI engines, comparison of knock in CI & SI engines.

4L

Fuel Injection System: Requirements, function of components, Jerk and distributor type Pumps. Fuel injector, types of injection nozzle, Spray characteristics, injection Timing.

4L

Supercharging and Turbo Charging: Necessity and limitation, Type of supercharging and turbo charging, Relative merits and demerits.

2L

2-stroke engines: Types of two stroke engines - Terminologies and definitions - Theoretical scavenging methods. Types of scavenging pumps Advantages and disadvantages of two stroke engines.

3L

Engine Testing: Performance testing of petrol and diesel engine. Measurement of IP, BP, FP, Mechanical efficiency, Brake thermal Efficiency, Volumetric efficiency and specific fuel consumption. Heat balance chart,

3L

References :

1. V. Ganesan, Internal Combustion Engines, Tata McGraw Hill Co., Third Edition, 2007.
2. K.K. Ramalingam, "Automobile Engineering", Scitech Publications Pvt. Ltd., 2005
3. M.L. Mathur and R.P. Sharma "Internal Combustion engines" Dhanpat Rai Publication ,

AUE-602 POWER UNITS AND TRANSMISSION

Contacts: 3L

Credit: 3

Total periods: 36L

Transmission: Requirements of transmission system, Explain with Lay out of Front wheel drive, rear wheel drive, four wheel drive system, Two and Three wheeler drive arrangement, Hybrid vehicle drive (series, parallel & combination drive lines) 2L

Clutch: Principle, Requirements, Types, Construction and operation of different types of clutch, Clutch operating system, Torque capacity, Performance curve, Clutch plate: requirement, construction and material, Linings: properties, types, material, Over running clutch, Clutch fault and diagnosis, Numerical. 7L

Gearbox: Necessity, Types, Function, Construction and working details of sliding mesh gearbox, constant mesh gearbox, synchromesh gearbox, Determination of gear ratios for vehicles, Gear box design, Gear shifting mechanism, Overdrive gears, Transfer box, Trouble shooting, Numerical 7L

Fluid flywheel: Principle of operation, Construction details. Torque capacity, Performance characteristics 2L

Torque converter: Principle of operation, Construction, Performance characteristics, Multistage and Polyphase torque converters. 3L

Automatic Transmission: Epicyclic (simple and compound planet) gearbox, Determination of gear ratios for vehicles, Construction & operation of four forward & reverse & three forward & reverse automatic gear box, Automatic overdrive, Clutches and brakes in epicyclic gear train, Hydraulic control system for automatic transmission, Numerical. 6L

Hydrostatic drive system: Types, Principles, Advantage & limitation, Construction & working of hydrostatic drive. 2L

Electric drive: Principle of early and modified Ward Leonard control system, Advantage and limitations. 2L

Continuously variable transmission(CVT): Operating principle, basic layout & operation, advantage & disadvantages. 2L

Automatic Transmission Applications: Chevrolet Turboglide, Toyota ECT-i, Mercedes Benz automatic transmission. 3L

References:

1. Heldt.P.M., " Torque converters ", Chilton Book Co., 1992.
2. Josepe Heitner Automotive Mechanics – Principle and Practice, East West Press 2nd edition 1999.

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- Judge.A.W., " Modern Transmission systems ", Chapman and Hall Ltd., 1990.
- De A Automobile Engineering, Galgotia Publication Pvt. Ltd. 2004
- N. K. Giri, "Automotive Mechanics", Khanna Publishers, Delhi, Eighth Edition
- Crouse. W.H., Anglin., D.L., " Automotive Transmission and Power Trains construction ", McGraw-Hill, 1976.

AUE 603: Metrology and Measurement

Contacts: 3L

Credit: 3

Basic concepts: Definition of terms, calibration, standards, generalized measurement systems, static and dynamic performance characteristic; Analysis of experimental data; Instrumentation for measurement of position and displacement, force, temperature, proximity and range. Concept of feedback; Open and close loop control systems, transducers and devices for engineering applications, digital readouts, data acquisition and processing.

12L

Metrology: Introduction, Measuring instruments, Measuring range, Sensitivity, Repeatability, Precision and Accuracy.

3L

Standards : Definitions of line standard, end standard and wavelength standard, Sub divisions of standards. Slip gauges.

2L

Measurement of angles : Introduction, Bevel vernier protractor, Sine bar, Angel gauges, Spirit level, Autocollimator, Angle dekkor, Rotary tables, Precision polygon, Calibration of polygons.

3L

Measurement of internal and external tapers.

2L

Measurement of threads : Introduction, Screw thread terminology, Pitch error, Angle error, Measurement of major and minor diameter, Measurement of effective diameter by one wire, two wire and three wire method. Best size wire.

4L

Measurement of surface finish : Introduction, Surface texture, Surface roughness terminologies, Methods of measuring surface finish, Stylus probe instruments, Taylor-Hobson talysurf, Sample length or cutoff length, Analysis of surface traces.

4L

Gear measurements : Introduction, Terminology of gear tooth, Errors in manufacturing gears, Rolling test, Measurement of tooth thickness, Parkinson gear tester.

2L

Inspection of straightness, flatness, and alignment.

Interferometry and use of optical flats.

Measurement of coordinates using Coordinate Measuring Machine.

4L

References:

- Mechanical measurements by T. G. Beckwith, N. L. Buck and R. D. Marangoni, 5th ed, Pearson, 1993.
- Engineering Metrology by R. K. Jain-20th Edition, Khanna, 2007
- A Text Book of Engineering Metrology by I. C. Gupta-5th wedition, Dhanpat Rai, 2004
- Fundamentals of Dimensional Metrology by C. Dotson, R. Harlow and R. Thomson.-4th edition;Thomson, 2003
- Instrumentation, Measurement and Analysis by B. C. Nakra and K. K. Chaudhari, TMH,1985
- Measurement System- Application and Design by E. O. Doebelin, 4th ed, MGH, 1990
- A course in electronics & electrical measurement & instrumentation, J B Gupta-13th Edition,EKataria,2008
- Electrical and electronics measurement and instrumentation- R.K. Rajput, S. Chand, 2010

AUE 604(A) : Vehicle Body Engineering

Contacts: 3L

Credit: 3

Car body details: Saloon car, Hatch back car, convertible, limousine, SUV, MUV 3L

Bus body details: Single Decker and double Decker bus, Mini bus. 3L

Commercial vehicle body details: Flat platform, Drop side, Tipper body, Tanker body. 3L

Interior Ergonomics : Interior car space nomenclature. Driver and passenger ergonomics with seating space arrangements for cars. Different types of car seats. Seat comfort, suspension seats, split frame seating, seat adjustment mechanisms. Dash board instruments, electronic displays. Visibility, driver's visibility, methods of improving visibility. Different types of car doors and window regulators. 5L

Aerodynamic effect: Pressure distribution on vehicle surface. Air resistance on vehicle, Wind tunnel testing. Flow visualization around vehicle. Effects of Drag and Lift on vehicle motion. Methods of reducing air drag. Effect of side force and wind thrust. 5L

Safety aspect: Driver's safety, Impact protection basics, Physics of impact between deformable bodies, occupant and cargo restraint, passive restraint systems, Use of air bags, side impact analysis. Bumper system. Energy absorbent foams.

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Mechanisms in vehicle applied to safety. Prototype making, initial tests, vehicle crash tests on full scale model. 5L

Body materials: Different types of ferrous and non-ferrous materials used in vehicle such as cast iron, Steel, Alloy steel, plastic, G.R.P, semi-rigid polyurethane. 5L

Painting: Corrosion of vehicle body. Anticorrosion method. Paint and painting process. 2L

Body repairing: Repairing of small dents, Repairing of rusted body panels, Repairing of front end collision, Rear end collision, Side collision, Roll-over damage. Repairing shop equipments. 3L

References:

1. J.Powloski - "Vehicle Body Engineering" - Business Books Ltd, London -1989
2. Crouse W and Anglin D, Automotive Mechanics Tata McGraw hill publication 10th edition, 2004
3. Jack E Rjavee, Automotive Technology- A system approach, Thomson Asia Pte Ltd, Singapore, 3rd edition, 2004
4. K Sing Automobile Engineering vol-I Standard Publishers Distributor 2003

ME 604(B) :Mechatronics

Contacts: 3L

Credits : 3

Introduction to Mechatronics: Definition, Mechatronics in manufacturing, products and design. Comparison between Traditional and Mechatronics approach. 3L

Electronics: Review of fundamentals of electronics, logic gates and their operations, Data conversion devices, sensors, microsensors, transducers, electrical contacts, actuators, and switches, contactless input devices, signal processing devices; relays, output devices. Drives: Stepper motors, servo drives. 10L

Mechanical: Ball screws, linear motion bearings, transfer systems.

Hydraulics: Hydraulic elements, actuators and various other elements. Design of hydraulic circuits. 3L

Control Systems: Open loop and closed loop control, block diagrams, transfer functions, Laplace transforms; Mathematical model of physical system; PI and PID controllers, 8085 microprocessor, PLC controller and Ladder diagrams, hydraulic and pneumatic controllers; Time domain analysis, transient response of first and second order systems; Introduction to nonlinear control; State space analysis, optimal and adaptive control; Introduction to discrete-time systems and Z-transform. Design and fabrication of Mechatronics systems. 15L

References :

1. Automatic Control Engineering by F.H.Raven, 5th ed., McGrawHill International.
2. Modern Control Engineering by K.Ogata, 3rd ed., Prentice Hall.
3. Mechatronics, Bolton, Pearson Education
4. Automatic Control Systems by B.C.Kuo, 6th ed., Prentice Hall.
5. Mechatronics , HMT Ltd., TMH.
6. Machine design for mobile and industrial applications by G.W.Kurtz, J.K.Schueller, P.W.Claar, SAE.
7. Mechatronics, Mohali, TM

AUE 605A : Design of automotive system

Contacts : 3L

Credit : 3

Engine design: 10L

Piston; design of piston, piston pin, piston ring.

Cylinder; design of cylinder block, cylinder head

Connecting rod; design of connecting rod small end and big end shank.

Valve; design of inlet and exhaust valve.

Flywheel; mass of flywheel, stresses of flywheel, design of rim, arms and hub. 4L

Gear; Design considerations of gears - strength of gear teeth, Lewis equation, dynamic tooth load, wear load. Design of spur gear, helical gears, herring bone gears, bevel gears and worm gears. **Gear box;** differential gear box, gear train, layout of gear box. 7L

Clutch; types of clutch, material of friction surface, design of single and multi disc clutch, cone clutch, calculation of heat generation and heat dissipation. Design of clutch operating system. 5L

Journal bearing, ball and roller bearing; bearing material, boundary layer lubrication, design factor of bearing, hydrostatic hydrodynamic theory, heat balance of bearing.

types of roller bearings, bearing life, static load capacity, dynamic load capacity. 5L

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Brake; types of brake, design of disc brake, & expanding brake, calculation of heat generation. Design of break system including master cylinder, wheel cylinder, drum & disc brake. 5L

References :

1. Computer Aided Mechanical Design and Analysis by V.Ramamurhti, 3rd ed., TMH.
2. Mechanical Analysis and Design by A.H.Burr and J.B.Cheatham, 2nd ed., Prentice Hall.1995.
3. Mechanical Engineering Design by J.E.Shigley, McGrawhill.2003
4. Fundamentals of Machine Elements - Hawrock, Jacobson - McGraw Hill1993.
5. Design of machine elements by V. B. Bhandari, Tata McGraw Hill Pub.1994
6. A Text Book of Machine Design by R.S.Khurmi and J.K.Gupta, S.Chand Pub.2005

AUE- 605(B) Material Handling

Contact ; 3P

Credit: 3

Introduction : Scope & importance of material handling. Principles of material handling. Unit load concept.

3L

Classification : Intermittent discharge type equipment such as Power trucks, Fork lift trucks etc. 8L

Continuous discharge type equipment: Belt conveyors, chain conveyor, Roller conveyors. Discharge capacity, Power calculation. Pneumatic and hydraulic conveyors. 15L

Hoisting equipment: Winches, Elevators and cranes.

8L

Reference Books:

1. Apple J.M – Material Handling system design : John Willey & Sons.
2. Allegri T.H - Material Handling principles and practice : CBS Publishers & Distributors, New Delhi.
3. Spivako Vsky A and Dyachkov, V – Conveyors and related Equipment; Peace Publishers, Moscow.

AUE 606 (HU) : Production Management & Operation Research

Contacts: 3L+1T

Credit: 4

Production management objectives, functions and its relations to other management functions of an organization. Classical Production Systems- batch, job, continuous, Mass and flow productions; Cobb- Douglas production function, Planning functions; Organizational policies in respect with production planning and control, Productivity-concept, Craig and Harris productivity measurement model, factors affecting productivity, productivity improvement, Scheduling, and Sequencing techniques for optimal plant facility utilization, Line balancing; fundamental concepts of Material Requirement Planning (MRP) and MRP II.

12L

Operations Management concepts, characteristics, Basic operations management tools- Linear Programming Problems, Graphical approach, Simplex method, Big-M, Two Phase, Duality, Transportation and Assignment problems, Waiting line theory- $\{ M / M / 1 : (\infty / FCFS) \}$ model, Inventory management- definition, basic concepts, classical EOQ model, Economic Production Quantity (EPQ) model, Game theory- fundamental concepts, pure and mixed strategies, with and without saddle point problems, Project Management: CPM and PERT

12L

References:

1. Production Systems: Planning Analysis & Control, James L. Riggs, John Wiley & Sons, 1981.
2. Production and Operations Management, Kanishka Bedi, Oxford university press, 2004.
3. Industrial Engg. & Production Management, M. Mahajan, -2nd revised Edition; Dhanpat Rai & Co, 2002
4. Operations Research – Theory and Application, J.K.Sharma - 2nd revised Edition; Macmillan Publishers, 2003
5. Quantitative Techniques in Management, N. D. Vohra- 4th , Tata McGraw-Hill, 2010

AUE691 Metrology & measurement laboratory.

Contact: 3P

Credit: 2

Experiment involving: Measurement of position, displacement velocity, force, temperature proximity / range.

Measurement of various product features using mechanical, pneumatic, optical and electronics

Instruments, interferometer, surface roughness measurement, measurement of threads, gears.

Experiments and exercises involving hardware & software modular based offline and online product gauging and inspection , information recording and processing etc.

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AUE692 Applied thermodynamics & Heat transfer laboratory.

Contact: 3P

Credit: 2

Experiments on: Thermal conductivity of solids, liquids and gasses. Natural forced convection, emissivity and absorptivity. Heat exchanger: LMTD, mass transfer.

AUE 693 : CAD Application in Automotive Engineering - I

Contacts : 3P

Credit : 2

At the end of the course; the students will be able to acquire basic knowledge on automobile part designing using design software apart from automobile production.

.INTRODUCTION:

Introduction to Automobile CAD software's; Generation of software's; History of CAD/CAM/CAE; industrial looks on CAD software's; Historical development.

.PART DESIGN FUNDAMENTALS:

Introduction to Design tools like Extrude; Revolve; Shell; Pad etc needed to generate solid models using various software; Material addition and subtraction about axis and plane; types of geometrical dimensional limits; numerous approaches to specify solid feature creation.

ASSEMBLY DESIGN FUNDAMENTALS:

Design tools needed to create and manage assemblies and sub assemblies; analyzing and modeling an assembly; designing in context; process to insert parts from given and maintained catalogue. Assembly modeling of automotive mechanicals like: Connecting Rod, Piston and its accessories

GENERATIVE SURFACING AND OPERATION:

Introduction to Surface; Surface modeling tools like Datum points; Datum curves; Splines etc; Surface operation tools like boundary; trim; split etc used to create final surface products. Modeling of complicated shaped solid using surface modeling with exercise. Surface modeling of exterior parts like bonnet, trunk lid etc.

MODELING OF CYLINDER; PISTON and CONNECTING ROD:

Choice of material for cylinder and piston; piston friction; piston slap; design of cylinder; piston; piston pin; piston rings; piston failures; lubrication of piston assembly; material for connecting rod; determining minimum length of connecting rod; small end and big end design; shank design; design of big end cap bolts; connecting rod failures.

MODELING OF CRANKSHAFT; VALVES AND FLYWHEEL:

Material for crankshaft; design of crankshaft under bending and twisting; balancing weight calculations; design aspects of intake and exhaust manifolds; inlet and exhaust valves; valves springs; tappets; valve train. Materials and design of flywheel.

Overview of **FINITE ELEMENT MODELING and ANALYSIS** with exercise.

Reference:

1. Rao, P. N. and Tiwari, N. K., "Computer Aided Manufacturing", Tata McGraw-Hill 2008.
2. Groover, Mikell P., "CAD/CAM", Pearson Education; 2008.
3. Joseph Edward., "Mechanical Engg. Design", McGraw Hill.
4. Norton, R. L., "Machine Design – An Integrated Approach", Addison Wesley.
5. Shyam and Tickoo, "CATIA V5 R20 Engineers Designing".

AUE695 (A) Vehicle maintenance laboratory.

Contact: 3P

Credit: 2

Dismantling and fitting of wheel assembling. Brake bleeding and fuel system bleeding. Door assembling and window regulator study. Tappet valve clearance adjustment. Air brake system & antilock braking system study and fault detection. Study of fuel spray nozzle.

AUE695 (B) Mechatronics laboratory.

Contact: 3P

Credit: 2

Experiments on open & closed loop positional control, using positional and velocity feedback.

Use of analog and digital servo systems, PID control.

Experiments in pneumatic & hydraulic drives and actuators.

Use of logic gates,

Microprocessor and PLC programming for simple control operations.

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VII Semester

AUE 701: Vehicle Dynamics

Contacts : 3L

Credit : 3

Resistance to motion, air gradient and friction resistance, Tractive effort draw bar pull, Tractive effort vs speed graph, Gear ratio selection, power calculation of vehicle. 6L

Stability of vehicle: stability analysis, when vehicle is moving on level ground, reaction and maximum tractive effort for the front wheel, rear wheel and all wheel driven vehicle. Stability analysis when vehicle traveling on both longitudinally and laterally inclined road. Stability of vehicle when taking turn on level and inclined road. 6L

Forces on suspension: Load on suspension in fore and aft direction. Load on suspension both for rigid and independent suspension system. Effect of braking and accelerating on suspension, Conditions for maximum load on suspension, considering gyroscopic effect. Stability of 2 wheelers and 3 wheeler vehicle. 8L

Vehicle Handling: Slip angle, Over steer and under steer and its relation with slip angle, Ackerman angle, Steady state and transient cornering, Lateral force developed during cornering. Cornering stiffness, Power consumed by tyre. 5L

Gyroscope: Precisional motions and gyroscopic stability, gyroscopic couple, effect on stability of four wheel vehicle. 3L

Riding characteristic: Effect of inflation pressure on tire, tire life, tire wear. Over loading and wrong loading Driving habit. Wheel wobble and its effect. 3L

Effect of braking: Braking torque inside the drum brake and disc brake system, Force analysis on brake pedal, master cylinder and wheel cylinder, Wheel braking torque on the surface of tyre, requirement of antilock braking system. 5L

References :

- 1 . Giri N K Automobile Mechanics, Khanna Publication 8th edition 2006
- 2 . Giri N K Automotive Technology Khanna Publication 1st edition 2004
3. Gupta K M Automobile Engineering vol. I & II, Umesh Publication 1st edition Reprint 2006
4. De. A., "Automobile Engineering", Galgotia Publications Pvt. Ltd., Revised edition 2010
4. De. A., "Vehicle Dynamics", Galgotia Publications Pvt. Ltd., 2010

AUE 702 : Automotive Electrical Systems and Electronics

Contacts : 3L

Credit : 3

Starting system: Condition of starting, Behavior of starter during starting, and its characteristics, Principle and construction of starter motor, working of different starter device units, care and maintenance of starter motor. Starter Switches. 5L

D.C Machine: Main construction Features, Armature Winding, Commutator, Basic principle of d.c generator, Slip-ring, Commutation, Operating characteristics and application of dc generator, armature reaction, total loss in dc generation, Working principle of dc motor, Types of dc motor and its characteristics, speed control of dc motor, Three point starter- basic construction and working principle. 5L

Lighting system & Accessories: Details of head light and side light, Head light aiming, Speedometer, Odometer, Horn, Horn-Relay, Wiper system, Trafficator, Positive and Negative Earth System, Principle of transformer and its application, Stepper- motor, Different types of relay and its application. 5L

Automotive Electronics: Transfer function, Application of control system in automobile industry, open-loop system and closed-loop system, vehicle motion control, Various Microcontroller based operation in a vehicle. 3L

Transducer & Sensors: Introduction, Mechanical spring devices, Resistive transducer, Capacitive Transducer, Strain gauges, Thermistor, Thermocouples, LVDT, RVDT, Photoelectric transducer, Digital displacement transducer, Oxygen

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Sensors, Position sensors-Fuel metering/vehicle speed sensor and detonation sensor- Altitude sensor, Flow sensor, Solenoids. 5L

Electronic Fuel Injection and Ignition System: Introduction, Feed back carburetor system, Multi port injection, Ignition system controls, Electronic Ignition System, Advantage of Electronic Ignition System., Solid-State ignition system. 5L

Digital Engine control System: Engine cranking and warm up control, Acceleration enrichment, Integrated engine control system, Exhaust emission control engineering. 3L

Reference:

1. Judge. A. W., Modern Electrical Equipment of Automobiles, Chapman & Hall, London, 1992
2. Young, A. P., & Griffiths. L., Automoboles Electrical Equipment, English Language Book Society & New Press, 1990.
3. Crouse. W. H., Automobile Electrical Equipment, McGraw Hill Book Co Lnc., New York, 1980.
4. Spreadbury. F. G. Electrical Ignition Equipment, Constable & Co. Ltd., London 1962.
5. Kholi. P. L., Automotive Electrical Equipment, Tata McGraw-Hill Co. Ltd. New Delhi, 1975.
6. J.B. Gupta., Electrical Machine.
7. Automotive hand Book, Robert Bosch, Bently Publishers, 1997.

AUE 703 (A) Combustion & Pollution Control in Automobile.

Contacts : 3L

Credit : 3

Introduction: General Scenario on automotive Pollution, Pollutants-sources-formation-effects-transient operational effects on pollution. 3L

Engine Combustion and Pollutant Formation: HC, CO, NO_x, Particulate Matters, Aldehyde emissions, Effect of operating variables on emission formation. 3L

Emission Control Efforts: Supply of fuel – establishment of national test centers, construction of road networks. 3L

Emission Standards : Evaluation of Emission Standards – Mandatory Tests for Emission measurement – Type Approval & Production Conformity Tests – Driving Cycles, Bharat Stages & Euro emission standards. 5L

Control Techniques for SI and CI: Design changes, optimization of operating factors, Control of Crankcase emission, Evaporative emission, Exhaust emission - exhaust gas recirculation, air injector PCV system, thermal reactors, catalytic converters. 8L

Test Procedure & Instrumentation for Emission Measurement: Test procedures- Measurements of invisible emissions -ORSAT apparatus, NDIR analyzer, Flame ionization detectors, Chemiluminescent analyzer, Gas analyzer, Measurements of visible emissions – Comparison methods & Obscure methods - Smoke meters, Emission standards. 10L

Reference:

1. B.P. Pundir, “Engine Emissions”, Narosa Publishing House, 2007.
2. V. Ganesan, Internal Combustion Engines, Tata McGraw Hill Co., 2004.
3. K.K. Ramalingam, “Automobile Engineering”, Scitech Publications Pvt. Ltd., 2005
4. Amitosh De, “Automobile Engineering”, Galgotia Publications Pvt. Ltd., 2004
5. Dr. N.K. Giri, “Automobile Mechanic”, Khanna Publishers, 2006
6. Heywood. J.B., Internal Combustion Engine Fundamentals, McGraw Hill Book Co., 1995.
7. Automobiles and Pollution SAE Transaction, 1995.

AUE703(B): ROBOTICS AND ROBOT APPLICATIONS

Contacts: 3L

Credit: 3

INTRODUCTION: Robot definition, Robotic systems - Its role in automated manufacturing; Robot anatomy; Robot classifications and specifications; Basic Robot motions -Point to point control, Continuous path control. 4L

COMPONENTS AND OPERATIONS: Robot kinematics, Forward and Reverse transformation, Homogeneous Transformations. Robot Actuators and Control; Pneumatic, Hydraulic and Electrical drives and Controls used in Robots. Robot End-effectors, Mechanical, Magnetic and Vacuum Grippers, Gripping forces RCC and Design features of grippers. 14L

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SENSING AND MACHINE VISION: Robot Sensors, Different types of Contact and Non-contact Sensors; Robot Vision and their interfaces. 5L

ROBOT PROGRAMMING: Robot Languages and Programming Techniques. 8L

INDUSTRIAL APPLICATIONS: Applications of Robots in Materials Handling, Machine loading/unloading, Inspection, Welding, Spray painting and Finish coating, and Assembly, etc. 5L

Reference:

1. Industrial Robotic Technology - Programming and Application by M.P.Groover et. al., McGrawHill
2. Robotics for Engineers by Y.Koren, McGrawhill.
3. Robots Modelling Control and Applications with Software by P.G.Ranky and C.Y.Ho, Springer Verlag Berlin.
4. Robotics Technology and Flexible Automation by S.R.Deb, TMH.
5. Robotics Control, Sensing, Vision and Intelligence by K.S. Fu., R.C. Gonzalez, C.S.G.Lee, McGraw Hill.

AUE 704(A) : Transport Management

Contacts: 3L

Credit : 3

Automobile Industry:

History and development of the automobile industry; Market trends; Current scenario in Indian auto industry; Auto ancillary industries; Role of the Automobile industry in National growth – Society/ Association and Partnership. 3L

Vehicle maintenance

Vehicle Maintenance: Objectives of Maintenance; Type of Maintenance -Scheduled and unscheduled maintenance - Planning and scope - Evaluation of PMI programme – Work scheduling - Overtime - Breakdown analysis - Cost of Operation - Maintenance Cost; Indirect & Direct Cost. Preventive maintenance system in transport industry- tyre maintenance procedures- Causes for uneven tyre wear; remedy maintenance procedure for better fuel economy, Fleet maintenance programme. 4L

Motor vehicle Act:

i) Driving licence: Necessity; age limit to obtain D.L; learners D.L; permanent D.L: grant; restrictions; renewal; endorsement; disqualification; suspension; fees; documents; educational qualifications required for driving two wheelers, cars, trucks; buses; oil tankers; carriers; driving on hills; Driving schoolbus: requirements; Effectiveness of different DLs; Maintenance of state registers of D.L; Conductors licence: necessity; grant; age limit; disqualifications; revocation; uniforms.

ii) Vehicle registration: Necessity; area of registration; time given for registration; format and documents to be attached and fees; period of registration; renewal; suspension; Temporary and permanent registration; vehicle fitness; refusal; NOC; registration for embassy vehicles; production of vehicle at the time of registration; Migration of vehicle from one state to other; Hire purchase; lease or hypothecation; transfer of registration on sale; removal of hypothecation clause; Transfer of ownership; Change of residence or place of business; death of owner; sale or purchase; Alteration in motor vehicle; age limit of vehicles; attachment of trailers; Maintenance of state registers of motor vehicles, uniforms.

iii) Motor insurance: Types; scope; limitations; liability of insurance Cost; insurance documents-claim form; estimate and bills; Necessity for insurance against third party risk; Requirements and limits of liability of insurance policies; Procedure to be followed for settlement of a claim after an accident; Surveyor and loss assessor; Surveyors report; Certificate of insurance: transfer; Compensation to third party deaths; Motor accident claims tribunal (MACT); Transit insurance.

iv) Vehicle permit & Traffic Regulation: Type of permit, Control of permit, traffic signs and traffic regulation: General provisions; Central Govt. rules and provisions regarding construction; maintenance of vehicle; emissions and safety provisions. Control of traffic – limits of speed; weight; length and height; power to restrict and erect traffic signs; design of traffic signs and its colour scheme; Signals; Safety measures for drivers and pillion riders; Precautions at unguarded railway crossings Schemes for investigation of accidents and wayside amenities; Traffic navigation; global positioning system. 8L

Vehicle parts, supply management and budget: Cost of inventory - Balancing inventory cost against downtime - Time management - Time record keeping - Energy management. Stores management – Function, Objectives, Type of Stores, Stocking & Issuing of Materials; Parts Control – Identification, Methods of Parts Control - Bin tag systems;

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Scientific Inventory Management – Classification of Items (ABC Analysis), Economic Order Quantity (EOQ); Budget - Budget activity, Capital expenditures, Classification of vehicle expenses. 7L

Fleet management and Data processing : Definition of fleet; Description of fleet- luxury cars; buses; trucks; cash vans; tanker, tipper, municipal, fire-fighting vehicles, breakdown service vehicle etc, Management of the Fleet; Data processing systems- Software, Modems ,Computer controlling of fleet activity. 3L

Scheduling and fare structure:

Route planning - Scheduling of transport vehicles - Preparation of timetable – preparation of vehicle and crew schedule - Costs, Fare structure – Fare concessions - Methods of fare collection - Preparation of fare table. 5L

Organization and Management Training and Operations:

Forms of ownership, Principle of transport management -Internal organization, centralized condition, decentralized condition (Engineering, traffic and administration), Staff administration: Industrial relation, Basic principles of supervising, Organizing time and people, Job instruction training, Training devices and techniques, Recruitment, Driver checklist, Tests for driver and mechanic, Welfare, Health and safety. 6L

References:

1. S.K. Sharma & Savita Sharma, “Industrial Engineering & Operation Management”, S.K.Kataria & Sons, 2007-2008.
2. S.L. Bhandarkar, “Vehicle Transport Management”, Dhanpat Rai & Co. (Pvt.) Ltd., 2006
3. Government Publication, The Motor Vehicle Act, 1989
4. JOHN Doke, " Fleet management ", McGraw Hill Co, 1984.
5. S. K. Srivastav,, “Economics of Transport”

AUE 704(B) : Modern Vehicle Technology

Contacts: 3L

Credit: 3

Trends in Automotive Power Plants: Fuel Cell Technology For Vehicles: What is fuel cell, Type of fuel cell, Advantages of fuel cell. Current state of the technology. Potential and challenges. Advantages and disadvantages of hydrogen fuel. Stratified charged / lean burn engines - Hydrogen engines - Electrical and Hybrid Vehicles- Magnetic track vehicles. 8L

Suspension, Brakes and Safety: Air suspension - semi-active and fully active suspension system- advantages of fully active suspension - Antiskid braking system- Retarders- Regenerative braking – safety cage - air bags - crash resistance - passenger comfort 6L

Vehicle Operation and Control: Fundamentals of Automotive Electronics – sensors, actuators, processors- Computer Control for pollution, noise and for fuel economy - Electronic Fuel Injection and Ignition system- Computer controlled carburetor system- Fuel Injection systems – SPFI, MPFI, DI, Pilot Injection, Unit Injection, CRDI; 7L

Two Wheeler Technology: DTS- i, DTS – Fi, DTS – Si; 3L

Latest Engine Technology Features: Advances in diesel engine technology, GDI, Variable Valve Timing, Electromagnetic Valves, Cam less engine 4L

X-By Wire Technology: What is X-By Wire, Advantage over hydraulic systems. Throttle by wire, Brake by wire, Steering by wire, advantages and disadvantages of drive wire technology 4L

42 Volt system: Need; benefits; potentials and challenges; technology Implications for the automotive industry; technological evolution due to adoption of 42 volt systems. 4L

References:

1. K.K. Ramalingam, “Automobile Engineering”, Scitech Publications Pvt. Ltd., 2005

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2. Dr. N.K. Giri, "Automobile Mechanic", Khanna Publishers, 2006
3. *Bosch Hand book*, 3rd edition, SAE, 1993.

AUE 705(A) : Non-Destructive Testing and Application

Contacts : 3L

Credit : 3

Non-Destructive Testing (NDT), Nondestructive Evaluation (NDE), Nondestructive Inspection (NDI)

:

Visual/ Optical Examination: Principal, Procedure, Instrument, Applications.	3L
Liquid Penetrating technique: Principle, Procedure, Applications.	3L
Magnetic Particle Testing : Principle, Procedure, Applications.	3L
Eddy Current Testing : Principle, Procedure, Applications.	3L
Ultrasonic Testing: Principle, Procedure, Applications.	3L
Radiography: Principle, Procedure, Applications.	3L
Thermography: Principle, Procedure, Applications.	3L
Acoustic emission testing : Principle, Procedure, Applications.	3L
Comparison and Selection of NDT Methods : Inspection of Raw materials, Inspection of Secondary Processing, In-service Damage Inspection.	3L
Common Application of NDT : a) Characterization of materials, b) Defect analysis, c) Case study.	
Codes Standards, Specifications and Procedures :	5L

References:

1. Non-Destructive Testing by Warren J.Mcgomnagle, McGrawhill.
2. Non-Destructive Testing by Baldev Raj et. al., Narosa Publishing House.

AUE- 705(B) Maintenance Engineering

Contact ; 3L

Credit: 3

Introduction: Importance of maintenance. Different types of maintenance.

Preventive Maintenance: Design of maintenance schedule for different equipment.

Break down Maintenance: Identification of faults, corrective measures, Method of maintenance.

Overhauling: Case study of engine overhauling, cooling system overhauling, Brake system overhauling.

Maintenance and repair of vehicle body passenger car, bus body coach.

Reference :

1. Herbert E. Fisher – Automotive Engines.
2. Hein Heister – Vehicle and Engine Technology.
3. Automobile Engineering. Vol – 1 – American Technical Society , Chicago.

AUE791: Engine Testing & Pollution Measurement laboratory (ETPM lab.).

Contact:3P

Credit: 2

Performance test of petrol & diesel (4-stroke & 2-stroke) engine both at full and part load.

Morse test of multi cylinder engine.

Heat balance of petrol and diesel engine. Measurement of exhaust emission by gas analyzer.

Diesel smoke measurement.

AUE792 :Project Part I.

Contact: 6P

Credit: 3

Students will be given either individual or group project involving manufacturing / design of automobile components to be supervised by faculty members. This is to expose the students to do work either individually or jointly. A report regarding the project will have to be submitted by the students.

AUE793 :Seminar II (Training).

Contact: 2P

Credit: 2

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Students will deliver seminar talk about the training , which they would doing in preceding summer vacation. They will have to submit a report regarding training.

AUE794: Seminar on Assign topics.

Contact: 2P

Credit: 1

Topic(s) regarding automobile engineering will be allotted to the students. Students will be asked to deliver seminar talk. They will be required to submit a report about the topic(s).

VIII Semester

AUE 801(HU): Engineering Economy and Financial Management

Contacts: 3L

Credit: 3

Engineering Economics:

Interaction between economic theory and production, concept of firm industry and economy. 1L
Consumer behavior, utility ,indifference curves and maps. 2L

Demand functions, Distinction between need, want & Demand. Types of demand and its exceptions.

Determinants of demand , Elasticity of demand along with problems. 2L

Concept of production function including Cobb- Douglas homogeneous function ,isoquant curves, law of production, law of supply ,economics of scale. 2L

Cost functions, short run total and average and marginal cost curves, Long run cost curves as envelope

Curves with graphical explanations. 2L

Price and output decision under different markets like monopoly and perfect competition. 1L

Relationship between marginal revenue, price and elasticity. 1L

Financial accounting and Management:

Meaning and definition, Functions of Financial Management , accounting principles and concepts, Rules of double entry system, classifications of accounts- personal , real & nominal , journal –concepts and problems, Ledger posting and balancing of ledger, Trial balance problems, Trading and profit, loss accounts and balance Sheet without adjustments 6L

Ratio analysis – Meaning , purpose and limitation of ratio analysis, classification of various ratios. 2L

Working capital management along with operating cycle concept 3L

Capital budgeting –meaning ,concept and various evaluation methods (pay back period , NPV,IRR,PI) 5L

Break even analysis and marginal costing , Operating and financial leverages with problems. 3L

Cost Accountancy:

Definition and scope of cost accountancy. Types of costs, ascertainment of direct material and labour costs, Preparation of cost sheet . 2L

Overhead classification, methods of absorption of overhead –percentages methods, machine hour rate, man hour rate, and hourly rate method, Allocation and distribution of overheads. 4L

References:

1. Engineering Economy and financial Management by Seikh Salim and Partha Chatterjee (1st Ed. HPH)
2. Managerial economics and financial Analysis by Reddy and Chary(Sept. 2006, SCITECH)
3. Financial Management by A..P Rao. (10th Ed. 2009, EPH)
4. Financial Management by T.Ramachandran (3rd reprint 2007 SCITECH,)
5. Financial Management by S M Inamdar (18th Ed. 2008, EPH)

AUE802(A):Off Road Vehicles

Contacts: 3L

Credit : 3

Introduction: Classification of off road vehicles and their application.

1L

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- Shovels:** types of shovel. Construction details of diesel, electric and hydraulic shovel. Operating principals, operating cycle. Production capacity, cost of production. 10L
- Draglines:** types of Dragline. Construction, Operating cycle, Production capacity, cost of production. 6L
- Dumpers:** types of dumpers, construction and operation. Carrying capacity, matching with shovel capacity. 6L
- Road making and maintenance Machines:** Different types of Dozer, construction and operation dozer capacity grader and its construction. Application of dozer and grader. 6L
- Scraper:** construction operation and application. 3L
- Maintenance:** Maintenance of shovel, draglines, Dumpers, Dozers Graders and Scrapers. 4L

Reference

1. Abrosimov, K. Bran berg, A and Katayer, K. Road Making Machinery, M I R. Publishers Moscow. 1971
2. De, A. Latest Development of Heavy Earth Moving Machinery, Annapurna Publishers, Dhanbad 1995
3. Nichols, Herber L (Jr.), Moving the Earth, Galgotia Publishing House, New Delhi, 1962.
4. Rudnev, V. K. , Digging of soils by earthmover with Power Parts, Oxanian Press Pvt. Ltd., New Delhi, 1985

AUE 802(B):Automotive Air-conditioning.

Contacts : 3L
Credit : 3

Introduction of Air-conditioning system: simple vapour compression refrigeration system(V.C.R.S), , Driers, Lubricants, Refrigeration components and controls: components, condenser, evaporators, valves electrical circuits and devices, etc. 10L

Refrigerants: refrigerants and their properties, 3L

Psychometrics: human comfort, Psychometrics processes 5L

Air-conditioning equipment: components and controls, Installation of Air conditioning system in vehicle

Load estimation : heat transfer from exterior wall, passenger, Equipment and infiltrated air. Heater system for winter conditioning, Requirement of air and air distribution systems, duct design, duct systems. 8L

Power required for Air-conditioning system of passenger car, multi utility and commercial vehicle. 3L

Maintenance and repair: Air-conditioning system . 3L

References:

1. Stoecker W F & Jones J W Refrigeration & Air-conditioning. Tata. Mc Graw- Hill Publishing Company Limited, 1982
2. Giri N K Automotive Technology, Khanna Publishers 2004
3. De A Automobile engineering, Galgotia publishing house 2004

AUE 802(C) : CAD/CAM and modern manufacturing methods

Courses : 3L
Credits : 3

CAD: Design process and introduction to CAD,

Computer Graphics: concept of rasterisation, linear interpolation algorithms (DDA and Bresenham), different geometrical transformations,

Geometric modeling: wire frame, surface and solid modeling; different techniques of solid modeling, Free form surfaces – Bezier Surfaces, B-splines and NURBS.

Concept of a) Engineering analysis, b) Design Evaluation and Review with basics of Rapid prototyping, c) automated drafting.

Benefits of CAD

10L

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- CAM:** Introduction to Numerical control, Advantages and application, CNC (open loop and closed loop), DNC and Adaptive control Components of NC and CNC machine tool, Manual programming for lathe and Computer-Assisted Part Programming using APT. 10L
- GT:** Group Technology, different approaches of grouping – PFA Chart ; Rank order clustering , part classification and Coding system, composite part, different GT machine cells and layout ,From-To chart. 6L
- FMS:** comparison between automated GT and FMS, level of flexibility, Classification, different components, benefits, cutting tool management system in FMS 5L
- CIM:** Introduction, Functional classification of CIM database, Communication network in CIM, advantages. 5L

References:

1. Automation, Production Systems and Computer Integrated Manufacturing, M. P. Groover, Prentice Hall of India.
2. CAD/CAM, M.P.Groover and W.Zimmers Jr., Prentice Hall of India
3. CAD/CAM, P.N.Rao, Tata McGraw Hill Pub.
4. CAD, CAM, CIM by P.Radhakrishnan and S.Subramanyan, New Age International Publishers.

AUE 803 (A) Alternate Fuels and Energy Systems

Courses : 3L
Credits : 3

Introduction: Important properties(Calorific value , Flash point, fire point, pour point, cloud point,viscosity, Cetane and Octane number etc) of a fuel. General characteristics of SI & CI Engines fuels,estimation of petroleum reserve, need for alternate fuel, availability of various alternative fuels, general useof Alcohols,LPG,Hydrogen,CNG, LNG, Vegetable oils and Biogas. 5L

Solar Energy: Semiconductor and Photovoltaic effect, Solar Cell, advantages & disadvantages of SolarEnergy, application of solar energy. 3L

Alcohols: Properties as engine fuels, merits and demerits, alcohol as SI and CI engine fuel, alcohols with gasoline& diesel blends, Combustion characteristics and emission characteristics in engines. 5L

Natural Gas: Source and composition of CNG, Properties, advantages &disadvantages, performance and emission characteristics of CNG. 5L

LPG: Source, Compositions & Properties, Performance & Emission of LPG. Components of LPG kit .

Hydrogen: Production, Storage ,Handling, Safety ,properties and Performance of Hydrogen.

Vegetable Oils & Bio-diesel: Composition & Properties of various vegetable oils for engines; 10L Transesterification reaction and bio-diesel production , Performance and emission characteristics of Bio-diesel.

Fuel Cells: Types of fuel cell, advantages & disadvantages and applications. 3L

References:

1. Maheswar Dayal, Energy today & tomorrow, I & B Horishr India,1982
2. V. Ganesan, Internal Combustion Engines, Tata McGraw Hill Co., 2004
3. SAE paper Nos.840367, 841156,841333,841334.
5. The properties and performance of modern alternate fuels SAE paper No 841210.
6. Bechtold.R.L. Alternative Fuels Guide Book, SAE, 1997.

AUE 803(B) : Quality Control and Reliability Engineering

Contacts: 3L
Credit:3

Quality concepts: Quality factors influencing quality, Dimensions of quality, Quality costs, Quality assurance, Quality planning, Organization for quality, Bureau of Indian standards, ISO 9000, Quality circles, KAIZEN-TQM concepts, Quality audit.

8L

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Statistical process control: Statistical tools used in quality in SQC, Variation in processes, Control charts, Variables, Attributes, Establishing and interpreting control charts, \bar{X} , R chart, p chart, c chart, u chart. Process capability, Analysis of process capability.

8L

Acceptance Sampling: Lot-by-lot sampling, types probability of acceptance in single, double, multiple sampling techniques, O.C curves, producers' risk and consumers' risk, AQL, LTPD, AOQL concepts, Standard sampling plans for AQL and LTPD-uses of standard sampling plans.

8L

Life Testing-Reliability System Approach: Life testing-objectives-classification, failure characteristics, Reliability definition, Reliability parameters, Mean time to failure, Maintainability and Availability, Failure data analysis, System reliability-series and parallel systems, Standby system, System reliability in terms of probability of failure-MTBF-Acceptance sampling based on reliability test OC curves.

12L

References:

1. Fundamentals of Quality control and Improvement by Amitava Mitra-2nd; PHI, 2000
2. Statistical Quality Control by D.C. Montgomery- 4th Edition; J. Wiley, 2002
3. Concepts in Reliability Engineering by L. S. Srinath, EWP, 1985.
4. Reliability: For Technology, Engineering, and Management by [Paul Kales](#), Prentice Hall, 1998.

AUE 803(C) : Finite Element Methods and its Application

Contacts : 3L

Credit : 3

Introduction : Review of various approximate methods in structural analysis. Stiffness and flexibility matrices for simple cases. Basic concepts of finite element method. Formulation of governing equations and convergence criteria.

5L

Discrete Elements: Use of bar and beam elements in structural analysis. Computer implementation of procedure for these elements.

5L

Continuum Elements: Different forms of 2D elements and their applications for plane stress, plane strain and axisymmetric problems.

8L

Consistent and lumped formulation. Use of local coordinates. Numerical integration.

ISO Parametric Elements: Definition and use of different forms of 2D and 3D elements. Computer implementation of formulation of these elements for the analysis of typical structural parts.

Solution Schemes: Different methods of solution of simultaneous equations governing static, dynamic and stability problems. General purpose software packages.

10L

References:

1. Segerlind. L.J., Applied Finite Element Analysis, Secon Edition, John Wiley and Sons Inc., New York, 1984.
2. Bathe.K.J. and Wilson. E.L., Numerical methods in finite element analysis, Prentice Hall of India Ltd., 1983.
3. Cook. R.D., Concepts and Applications of Finite Element analysis, 3rd Edition, John Wiley & Sons, 1989.
4. Krishnamurthy. C.S., Finite Element Analysis, Tata McGraw Hill., 1987
5. Ramamurthi.V., Computer Aided Design in Mechanical Engineering, Tata McGraw Hill, 1987.

Elective Papers – III

AUE 821 : Alternate Fuels and Energy Systems

Contacts : 4L

Credit : 4

Introduction: Important

AUE 891 : Automative Electrical & Electronics

Contact : 3p

Credits : 2

Characteristics of amplifiers, study of logic gates, Adder & flip flops. Study of SCR & ic timer.

Syllabus for B.Tech(Automobile Engineering) up to Fourth Year

Revised Syllabus of B.Tech in AUE for the students who were admitted in Academic Session 2010-2011)



D/A and A/D converter. Assembly language programming exercise. Interfacing A/D converter and simple data acquisition. Interfacing stepper motor control and CRT terminal. Micro controller programming and interfacing. Study of battery charging system and setting of regulators and cutout.

AUE 892 : Auto scanning Laboratory

Contact : 3P

Credits : 2

Study of vehicle lifting machine.

Study and experiment on wheel balancing machine. Study & experiment on wheel alignment machine. Study & experiment on head light focusing of vehicles underbody inspection of vehicle either by lifting the vehicle or bringing the vehicle over under ground inspection pit.

AUE 893 : Project Part II

Contact : 12P

Credits : 6

Students will be allotted either new project or continuation of project I from previous semester individually or in a group. They will require to submit report regarding their project work.

AUE 894 : Comprehensive Viva- voce

Contact : 0-0-0

Credits : 2

Students are required to appear before a board of examiners, where they will be tested about the overall knowledge of the entire Automobile Engineering subjects and laboratory work.