ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

AUTOMOBILE ENGINEERING

For
AUTOMOBILE ENGINEERING FOUR DEGREE COURSE
(Applicable for batches admitted from 2013-2014)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

COURSE STRUCTURE

I Year – I SEMESTER

S. No.	Subject	T	P	Credits
1	English – I	3+1	--	3
2	Mathematics - I	3+1	--	3
3	Engineering Chemistry	3+1	--	3
4	Engineering Mechanics	3+1	--	3
5	Computer Programming	3+1	--	3
6	Environmental Studies	3+1	--	3
7	Engineering Chemistry Laboratory	--	3	2
8	English - Communication Skills Lab - I	--	3	2
9	C Programming Lab	--	3	2
	Total Credits			**24**

I Year – II SEMESTER

S. No.	Subject	T	P	Credits
1	English – II	3+1	--	3
2	Mathematics – II (Mathematical Methods)	3+1	--	3
3	Mathematics – III	3+1	--	3
4	Engineering Physics	3+1	--	3
5	Professional Ethics and Human Values	3+1	--	3
6	Engineering Drawing	3+1	--	3
7	English - Communication Skills Lab - II	--	3	2
8	Engineering Physics Lab	--	3	2
9	Engineering Physics – Virtual Labs - Assignments	--	2	--
10	Engg.Workshop & IT Workshop	--	3	2
	Total Credits			**24**

II Year – I SEMESTER

S. No.	Subject	T	P	Credits
1	Metallurgy & Materials Science	3+1*	--	3
2	Mechanics of Solids	3+1*	--	3
3	Thermodynamics	3+1*	--	3
4	Automotive Engines	3+1*	--	3
5	Electrical & Electronics Engineering	3+1*	--	3
6	Computer aided Engineering Drawing Practice	3+1*	--	3
7	Electrical & Electronics Engg. Lab	--	3	2
8	Mechanics of Solids & Metallurgy Lab	--	3	2
	Total Credits			**21**

II Year – II SEMESTER

S. No.	Subject	T	P	Credits
1	Kinematics of Machinery	3+1*	--	3
2	Thermal Engineering	3+1*	--	3
3	Fluid Mechanics & Hydraulic Machinery	3+1*	--	3
4	Production Technology	3+1*	--	3
5	Industrial Engg. & Management	3+1*	--	3
6	Machine Drawing	3+1*	--	2
7	Thermal Engg. Lab	--	3	2
8	Fluid Mechanics & Hydraulic Machinery Lab	--	3	2
	Total Credits			**22**

III Year – I SEMESTER

S. No.	Subject	T	P	Credits
1	Dynamics of Machinery	3+1*	--	3
2	Managerial Economics & Financial Analysis	3+1*	--	3
3	Design of Machine Elements	3+1*	--	3
4	Vehicle Transport Management	3+1*	--	3
5	Heat Transfer	3+1*	--	3
6	Fuels and Combustion	3+1*	--	3
7	Heat Transfer Lab	--	3	2
8	Production Technology Lab	--	3	2
9	IPR & Patents	--	3	2
	Total Credits			**24**

III Year – II SEMESTER

S. No.	Subject	T	P	Credits
1	Machine Tools & Metrology	3+1*	--	3
2	Instrumentation & Control Systems	3+1*	--	3
3	Automotive Electrical and Autotronics	3+1*	--	3
4	Alternative Energy sources for Automobiles	3+1*	--	3
5	**Departmental Elective – I**	3+1*	--	3
6	Product Design and Assembly Automation	3+1*	--	3
7	Metrology & Machine Tools Lab	--	3	2
8	Auto Scanning & Vehicle Testing Lab	--	3	2
	Total Credits			**22**

IV Year – I SEMESTER

S. No.	Subject	T	P	Credits
1	**Departmental Elective – II**	3+1*	--	3
2	Vehicle Dynamics	3+1*	--	3
3	CAD/CAM	3+1*	--	3
4	Finite Element Methods	3+1*	--	3
5	Automotive Pollution & Control (Open Elective)	3+1*	--	3
6	Automotive Chassis & Suspension	3+1*	--	3
7	Automobile Engineering Lab & Instrumentation Lab	--	3	2
8	CAD/CAM Lab	--	3	2
	Total Credits			**22**

IV Year – II SEMESTER

S. No.	Subject	T	P	Credits
1	Automotive Control Systems	3+1*	--	3
2	Vehicle Maintenance	3+1*	--	3
3	**Departmental Elective – III**	3+1*	--	3
4	**Departmental Elective – IV**	3+1*	--	3
5	Project Work	--	--	9
	Total Credits			**21**

OPEN ELECTIVE:
1. Automotive Pollution and Control
2. Advanced Materials
3. Industrial Hydraulics and Pneumatics

Elective-I:
1. Vehicle Body Engg. & Safety
2. Interactive Computer Graphics
3. Robotics
4. Automotive Aerodynamics

Elective-II:
1. Micro Processors & Micro Controllers
2. Computational Fluid Dynamics
3. Operation Research
4. Condition Monitoring

Elective-III:
1. Automotive Safety
2. Automotive Manufacturing
3. Auto Air Conditioning
4. Experimental Stress Analysis

Elective-IV:
1. Management Science
2. Principles of Entrepreneurship
3. Simulation of SI and CI Engines
4. Modern Vehicle Technology

SYLLABUS

	T	P	C
	3+1	0	3

ENGLISH –I
(Common to All Branches)

DETAILED TEXT-I English Essentials: Recommended Topics:

1. **IN LONDON: M.K.GANDHI**
   OBJECTIVE: To apprise the learner how Gandhi spent a period of three years in London as a student.
   OUTCOME: The learner will understand how Gandhi grew in introspection and maturity.

2. **THE KNOWLEDGE SOCIETY- APJ KALAM**
   OBJECTIVE: To make the learners rediscover India as a land of Knowledge.
   OUTCOME: The learners will achieve a higher quality of life, strength and sovereignty of a developed nation.

3. **THE SCIENTIFIC POINT OF VIEW- J.B.S. HALDANE**
   OBJECTIVE: This essay discusses how scientific point of view seeks to arrive at the truth without being biased by emotion.
   OUTCOME: This develops in the student the scientific attitude to solve many problems which we find difficult to tackle.

4. **PRINCIPLES OF GOOD WRITING:**
   OBJECTIVE: To inform the learners how to write clearly and logically.
   OUTCOME: The learner will be able to think clearly and logically and write clearly and logically.

5. **MAN'S PERIL**
   OBJECTIVE: To inform the learner that all men are in peril.
   OUTCOME: The learner will understand that all men can come together and avert the peril.

6. **THE DYING SUN—SIR JAMES JEANS**
   OBJECTIVE: This excerpt from the book "The Mysterious Universe" presents the mysterious nature of the Universe and the stars which present numerous problems to the scientific mind. Sir James Jeans uses a poetic approach to discuss the scientific phenomena.
   OUTCOME: This provides the students to think about the scientific phenomena from a different angle and also exposes the readers to poetic expressions.

7. **LUCK—MARK TWAIN**
   OBJECTIVE: This is a short story about a man's public image and his true nature. The theme of the story is that luck can be a factor of life, so that even if one is incompetent but lucky, one can still succeed.
   OUTCOME: The story is humourous in that it contains a lot of irony. Thus this develops in the learner understand humourous texts and use of words for irony.

Text Book : 'English Essentials' by Ravindra Publications

NON-DETAILED TEXT:

(From Modern Trailblazers of Orient Blackswan)
(Common single Text book for two semesters)
(Semester I (1 to 4 lessons)/ Semester II (5 to 8 lessons)

1. **G.D.Naidu**
   OBJECTIVE: To inspire the learners by G.D.Naidu's example of inventions and contributions.
   OUTCOME: The learner will be in a position to emulate G.D.Naidu and take to practical applications.

2. **G.R.Gopinath**
   OBJECTIVE: To inspire the learners by his example of inventions.
   OUTCOME: Like G.R.Gopinath, the learners will be able to achieve much at a low cost and help the common man.

3. **Sudhamurthy**
   OBJECTIVE: To inspire the learners by the unique interests and contributions of Sudha Murthy.
   OUTCOME: The learner will take interest in multiple fields of knowledge and make life worthwhile through social service.

4. **Vijay Bhatkar**
   OBJECTIVE: To inspire the learner by his work and studies in different fields of engineering and science.
   OUTCOME: The learner will emulate him and produce memorable things.

Text Book : 'Trail Blazers' by Orient Black Swan Pvt. Ltd. Publishers

MATHEMATICS – I (DIFFERENTIAL EQUATIONS)
(Common to All Branches)

UNIT I: Differential equations of first order and first degree:
Linear-Bernoulli-Exact-Reducible to exact.
Applications : Newton's Law of cooling-Law of natural growth and decay-orthogonal trajectories.
Subject Category
ABET Learning Objectives   a   d   e
ABET internal assessments   1   2   6
JNTUK External Evaluation   A   B   E

UNIT II: Linear differential equations of higher order:
Non-homogeneous equations of higher order with constant coefficients with RHS term of the type e^{ax}, Sin ax, cos ax, polynomials in x, e^{ax} V(x), xV(x).
Applications: LCR circuit, Simple Harmonic motion
Subject Category
ABET Learning Objectives   a   d   e
ABET internal assessments   1 2 6
JNTUK External Evaluation   A   B   E

UNIT III Laplace transforms:
Laplace transforms of standard functions-ShiftingTheorems, Transforms of derivatives and integrals – Unit step function –Dirac's delta function- Inverse Laplace transforms– Convolution theorem (with out proof).
Application: Solutions of ordinary differential equations using Laplace transforms.
Subject Category
ABET Learning Objectives   a e
ABET internal assessments   1 2 6
JNTUK External Evaluation   A   B   E

UNIT IV Partial differentiation:
Introduction- Total derivative-Chain rule-Generalized Mean Value theorem for single variable (without proof)-Taylors and Mc Laurent's series for two variables– Functional dependence-Jacobian.
Applications: Maxima and Minima of functions of two variables with constraints and without constraints.
Subject Category
ABET Learning Objectives   a   c   e
ABET internal assessments   1 2 6
JNTUK External Evaluation   A   B   E

UNIT V First order Partial differential equations:
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions –solutions of first order linear (Lagrange) equation and nonlinear (standard type) equations
Subject Category
ABET Learning Objectives   a e
ABET internal assessments   1 2 6
JNTUK External Evaluation A B E

UNIT VI Higher order Partial differential equations:

Solutions of Linear Partial differential equations with constant coefficients- Method of separation of Variables

Applications: One- dimensional Wave, Heat equations - two-dimensional Laplace Equation.

Books:
1. **B.S.GREWAL,** Higher Engineering Mathematics, 42nd Edition, Khanna Publishers
2. **ERWIN KREYSZIG,** Advanced Engineering Mathematics, 9th Edition, Wiley-India
3. **GREENBERG,** Advanced Engineering Mathematics, 2nd edition, Pearson edn
4. **DEAN G. DUFFY,** Advanced engineering mathematics with MATLAB, CRC Press
5. **PETER O'NEIL,** advanced Engineering Mathematics, Cengage Learning.

Subject Category	ABET Learning Objectives	ABET Internal Assessments	JNTUK External Evaluation	Remarks
Theory Design Analysis Algorithms Drawing Others	a) Apply knowledge of math, science, & engineering b) Design & conduct experiments, analyze & interpret data c) Design a system/process to meet desired needs within economic, social, political, ethical, health/safety, manufacturability, & sustainability constraints d) Function on multidisciplinary teams e) Identify, formulate, & solve engineering problems f) Understand professional & ethical responsibilities g) Communicate effectively h) Understand impact of engineering solutions in global, economic, environmental, & societal context i) Recognize need for & be able to engage in lifelong learning j) Know contemporary issues k) Use techniques, skills, modern tools for engineering practices	1. Objective tests 2. Essay questions tests 3. Peer tutoring based 4. Simulation based 5. Design oriented 6. Problem based 7. Experiential (project based) based 8. Lab work or field work based 9. Presentation based 10. Case Studies based 11. Role-play based 12. Portfolio based	A. Questions should have: B. Definitions, Principle of operation or philosophy of concept. C. Mathematical treatment, derivations, analysis, synthesis, numerical problems with inference. D. Design oriented problems E. Trouble shooting type of questions F. Applications related questions G. Brain storming questions	

ENGINEERING CHEMISTRY

UNIT-I: WATER TECHNOLOGY

Hard Water – Estimation of hardness by EDTA method – Potable water- Sterilization and Disinfection – Boiler feed water – Boiler troubles – Priming and foaming , scale formation, corrosion, caustic embrittlement, turbine deposits – Softening of water – Lime soda, Zeolite processes – Reverse osmosis – Electro Dialysis, Ion exchange process

Objectives : For prospective engineers knowledge about water used in industries (boilers etc.) and for drinking purposes is useful; hence chemistry of hard water, boiler troubles and modern methods of softening hard water is introduced.

UNIT-II : ELECTROCHEMISTRY

Concept of Ionic conductance – Ionic Mobilities – Applications of Kohlrausch law – Conductometric titrations – Galvanic cells – Electrode potentials – Nernst equation – Electrochemical series – Potentiometric titrations – Concentration cells – Ion selective electrode –Glass electrodes – Fluoride electrode; Batteries and Fuel cells

Objectives : Knowledge of galvanic cells, electrode potentials, concentration cells is necessary for engineers to understand corrosion problem and its control ; also this knowledge helps in understanding modern bio-sensors, fuel cells and improve them.

UNIT-III : CORROSION

Causes and effects of corrosion – theories of corrosion (dry, chemical and electrochemical corrosion) – Factors affecting corrosion – Corrosion control methods – Cathodic protection –Sacrificial Anodic, Impressed current methods – Surface coatings – Methods of application on metals (Hot dipping, Galvanizing, tinning , Cladding, Electroplating, Electroless plating) – Organic surface coatings – Paints – Their constituents and their functions.

Objectives : the problems associated with corrosion are well known and the engineers must be aware of these problems and also how to counter them

UNIT-IV : HIGH POLYMERS

Types of Polymerization – Stereo regular Polymers – Physical and Mechanical properties of polymers – Plastics – Thermoplastics and thermo setting plastics – Compounding and Fabrication of plastics – Preparation and properties of Polyethylene, PVC and Bakelite – Elastomers – Rubber and Vulcanization – Synthetic rubbers – Styrene butadiene rubber – Thiokol – applications.

Objectives : Plastics are materials used very widely as engineering materials. An understanding of properties particularly physical and mechanical properties of polymers / plastics / elastomers helps in selecting suitable materials for different purposes.

UNIT-V : FUELS

Coal – Proximate and ultimate analysis – Numerical problems based on analysis – Calorific vaule – HCV and LCV – Problems based on calorific values; petroleum – Refining – Cracking – Petrol – Diesel knocking; Gaseous fuels – Natural gas – LPG, CNG – Combustion – Problems on air requirements.

Objectives : A board understanding of the more important fuels employed on a large scale is necessary for all engineer to understand energy – related problems and solve them.

UNIT-VI : CHEMISTRY OF ADVANCED MATERIALS

Nanometerials (Preparation of carbon nanotubes and fullerenes – Properties of nanomaterials – Engineering applications) – Liquid crystals (Types – Application in LCD and Engineering Applications) – Fiber reinforced plastics – Biodegradable polymers – Conducting polymers – Solar cells (Solar heaters – Photo voltaic cells – Solar reflectors – Green house concepts – Green chemistry (Methods for green synthesis and Applications) – Cement – Hardening and setting – Deterioration of cement concrete

Objectives : With the knowledge available now, future engineers should know at least some of the advanced materials that are becoming available. Hence some of them are introduced here.

TEXT BOOKSS
1. Jain and Jain (Latest Edition), Engineering Chemistry, Dhanpat Rai Publishing company Ltd,
2. N.Y.S.Murthy, V.Anuradha, KRamaRao "A Text Book of Engineering Chemistry", Maruthi Publications
3. C.Parameswara Murthy, C.V.Agarwal, Adhra Naidu (2006) Text Book of Engineering Chemistry, B.S.Publications
4. B.Sivasankar (2010), Engineering Chemistry, McGraw-Hill companies.
5. Ch.Venkata Ramana Reddy and Ramadevi (2013) , Engineering Chemistry, Cengage Learning

REFERENCES
1. S.S. Dara (2013) Text Book of Engineering Chemistry, S.Chand Technical Series
2. K.Sesha Maheswaramma and Mridula Chugh (2013), Engineering Chemistry, Pearson Publications.
3. R.Gopalan, D.Venkatappayya, Sulochana Nagarajan (2011), Text Book of Engineering Chemistry, Vikas Publications.
4. B.Viswanathan and M.Aulice Scibioh (2009), Fuel Cells, Principals and applications, University Press.

ENGINEERING MECHANICS

Objectives: The students completing this course are expected to understand the concepts of forces and its resolution in different planes ,resultant of force system, Forces acting on a body, their free body diagrams using graphical methods. They are required to understand the concepts of centre of gravity and moments of inertia and their application, Analysis of frames and trusses, different types of motion, friction and application of work - energy method.

UNIT – I
Objectives: The students are to be exposed to the concepts of force and friction , direction and its application.
Introduction to Engg. Mechanics – Basic Concepts.
Systems of Forces : Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems. Introduction **,** limiting friction and impending motion, coulomb's laws of dry friction , coefficient of friction, cone of friction
UNIT II
Objectives: The students are to be exposed to application of free body diagrams. Solution to problems using graphical methods and law of triangle of forces.
Equilibrium of Systems of Forces : Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Spatial Systems for concurrent forces. Lamis Theorm, Graphical method for the equilibrium of coplanar forces, Converse of the law of Triangle of forces, converse of the law of polygon of forces condition of equilibrium.
UNIT – III
Objectives : The students are to be exposed to concepts of centre of gravity.
Centroid : Centroids of simple figures (from basic principles) – Centroids of Composite Figures
Centre of Gravity : Centre of gravity of simple body (from basis principles), centre of gravity of composite bodies, pappus theorem.
UNIT IV
Objective: The students are to be exposed to concepts of moment of inertia and polar moment of inertia including transfer methods and their applications.
Area moments of Inertia : Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia. **Mass Moment of Inertia :** Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.
UNIT – V
Objectives : The students are to be exposed to motion in straight line and in curvilinear paths, its velocity and acceleration computation and methods of representing plane motion.
Kinematics : Rectilinear and Curvelinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion. **Kinetics :** Analysis as a Particle and Analysis as a Rigid Body in Translation – Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies.

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UNIT – VI
Objectives: The students are to be exposed to concepts of work, energy and particle motion
Work – Energy Method : Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method.

TEXT BOOKS:

1. Engg. Mechanics - S.Timoshenko & D.H.Young., 4th Edn - , Mc Graw Hill publications.
2. Engineering Mechanics: Statics and Dynamics 3rd edition, Andrew Pytel and Jaan Kiusalaas; Cengage Learning publishers.

REFERENCES:
1. Engineering Mechanics statics and dynamics – R.C.Hibbeler, 11th Edn – Pearson Publ.
2. Engineering Mechanics , statics – J.L.Meriam, 6th Edn – Wiley India Pvt Ltd.
3. Engineering Mechanics , dynamics – J.L.Meriam, 6th Edn – Wiley India Pvt Ltd.
4. Engineering Mechanics , statics and dynamics – I.H.Shames, – Pearson Publ.
5. Mechanics For Engineers , statics - F.P.Beer & E.R.Johnston – 5th Edn Mc Graw Hill Publ.
6. Mechanics For Engineers, dynamics - F.P.Beer & E.R.Johnston – 5th Edn Mc Graw Hill Publ.
7. Theory & Problems of engineering mechanics, statics & dynamics – E.W.Nelson, C.L.Best & W.G. McLean, 5th Edn – Schaum's outline series - Mc Graw Hill Publ.
8. Engineering Mechanics , Fedinand . L. Singer , Harper – Collins.
9. Engineering Mechanics statics and dynamics , A Nelson, Mc Graw Hill publications
10. Engineering Mechanics, Tayal. Umesh Publ.

COMPUTER PROGRAMMING

Objectives: Formulating algorithmic solutions to problems and implementing algorithms in C

UNIT I:
Unit objective: Notion of Operation of a CPU, Notion of an algorithm and computational procedure, editing and executing programs in Linux
Introduction: Computer systems, Hardware and Software Concepts,
Problem Solving: Algorithm / Pseudo code, flowchart, program development steps, computer languages: machine, symbolic and highlevel languages, Creating and Running Programs: Writing, Editing(vi/emacs editor), Compiling(gcc), Linking and Executing in under Linux.
BASICS OF C: Structure of a C program, identifiers, basic data types and sizes. Constants, Variables, Arthmetic , relational and logical operators, increment and decrement operators, conditional operator, assignment operator, expressions, type conversions, Conditional Expressions, precedence and order of evaluation, Sample Programs.

UNIT II:
Unit objective: understanding branching, iteration and data representation using arrays
SELECTION – MAKING DECISION: TWO WAY SELECTION: if-else, null else, nested if, examples, Multi-way selection: switch, else-if, examples**.**
ITERATIVE: loops- while, do-while and for statements , break, continue, initialization and updating, event and counter controlled loops, Looping applications: Summation, powers, smallest and largest.
ARRAYS: Arrays- concepts, declaration, definition, accessing elements, storing elements, Strings and String Manipulations, 1-D arrays, 2-D arrays and character arrays, string manipulations, Multidimensional arrays, array applications: Matrix operations, checking the symmetricity of a Matrix**.**
STRINGS: concepts, c strings.

UNIT III:
Objective: Modular programming and recursive solution formulation
FUNCTIONS- MODULAR PROGRAMMING: functions, basics, parameter passing, storage classes extern, auto, register, static, scope rules, block structure, user defined functions, standard library functions, recursive functions, Recursive solutions for fibonacci series, towers of Hanoi, header files, C Preprocessor, example c programs, Passing 1-D arrays, 2-D arrays to functions.

UNIT IV:
Objective: Understanding pointers and dynamic memory allocation
POINTERS: pointers- concepts, initialization of pointer variables, pointers and function arguments, passing by address- dangling memory, address arithmetic, character pointers and functions, pointers to pointers, pointers and multi-dimensional arrays, dynamic memory management functions, command line arguments

UNIT V:
Objective: Understanding miscellaneous aspects of C
ENUMERATED, STRUCTURE AND UNION TYPES: Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures,

structures and functions, pointers to structures, self referential structures, unions, typedef, bit-fields, program applications
BIT-WISE OPERATORS: logical, shift, rotation, masks.

UNIT VI:
Objective: Comprehension of file operations
FILE HANDLING: Input and output- concept of a file, text files and binary files, Formatted I/O, File I/O operations, example programs

Text Books:
1. Problem Solving and Program Design in C, Hanly, Koffman, 7th ed, PERSON
2. Programming in C, Second Edition Pradip Dey and Manas Ghosh, OXFORD Higher Education
3. Programming in C, A practical approach Ajay Mittal PEARSON
4. The C programming Language by Dennis Richie and Brian Kernighan
5. Programming in C, B. L. Juneja, Anith Seth, Cengage Learning.

Reference Books and web links:
1. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE
2. Programming with C, Bichkar, Universities Press
3. Programming in C, Reema Thareja, OXFORD
4. C by Example, Noel Kalicharan, Cambridge

	T	P	C
	3+1	0	3

ENVIRONMENTAL STUDIES

Course Learning Objectives:
The objectives of the course is to impart
1. Overall understanding of the natural resources
2. Basic understanding of the ecosystem and its diversity
3. Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities
4. An understanding of the environmental impact of developmental activities

5. Awareness on the social issues, environmental legislation and global treaties

Course Outcomes:
The student should have knowledge on
1. The natural resources and their importance for the sustenance of the life and recognise the need to conserve the natural resources
2. The concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web
3. The biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity
4. Various attributes of the pollution and their impacts and measures to reduce or control the pollution along with waste management practices
5. Social issues both rural and urban environment and the possible means to combat the challenges
6. The environmental legislations of India and the first global initiatives towards sustainable development.
7. About environmental assessment and the stages involved in EIA and the environmental audit

Syllabus:

UNIT - I
Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance –Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, acid rains, ozone layer depletion, population growth and explosion, effects. Role of information Technology in Environment and human health.
Ecosystems: Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

UNIT - II
Natural Resources: Natural resources and associated problems
Forest resources – Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people
Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources

Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity
Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources.
Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT - III

Biodiversity and its conservation: Definition: genetic, species and ecosystem diversity-classification - Value of biodiversity: consumptive use, productive use, social-Biodiversity at national and local levels. India as a mega-diversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, man-wildlife conflicts. - Endangered and endemic species of India – Conservation of biodiversity: conservation of biodiversity.

UNIT - IV

Environmental Pollution: Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies.
Solid Waste Management: Sources, classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products.

UNIT - V

Social Issues and the Environment: Urban problems related to energy -Water conservation, rain water harvesting-Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Environmental Protection Act -Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act-Issues involved in enforcement of environmental legislation. -Public awareness.

UNIT - VI

Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism
The student should submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

Text Books:
1.   Environmental Studies by R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.
2.   A Textbook of Environmental Studies by Shaashi Chawla, TMH, New Delhi
3.   Environmental Studies by P.N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai

Reference:
1.   Text Book of Environmental Studies by Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2.   Environmental Studies by K.V.S.G. Murali Krishna, VGS Publishers, Vijayawada
3.   Environmental Studies by Benny Joseph, Tata McGraw Hill Co, New Delhi
4.   Environmental Studies by Piyush Malaviya, Pratibha Singh, Anoop singh: Acme Learning, New Delhi
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ENGINEERING CHEMISTRY LABORATORY

List of Experiments

1. Introduction to chemistry laboratory – Molarity, Normality, Primary, Secondary standard solutions, Volumetric titrations, Quantitative analysis, Quantitative analysis etc.,

2. Trial experiment – Estimation of HCI using standard Na_2co_3 solutions

3. Estimation of $KMnO_4$ using standard Oxalic acid solution.

4. Estimation of Ferric iron using standard $K_2Cr_2O_7$ solution.

5. Estimation of Copper using standard $K_2Cr_2O_7$ solution.

6. Estimation of Total Hardness water using standard EDTA solution.

7. Estimation of Copper using standard EDTA solution.

8. Estimation of Copper using Colorimeter

9. Estimation of pH of the given sample solution using pH meter.

10. Conductometric Titrations between strong acid and strong base

11. Conductometric Titrations between strong acid and Weak base

12. Potentiometric Titrations between strong acid and strong base

13. Potentiometric Titrations between strong acid and Weak base

14. Estimatinog of Zinc using standard potassium ferrocyanide solution

15. Estimation of Vitamin – C

TEXT BOOKSS
1. Dr.Jyotsna Cherukuis(2012)Laboratory Manual of Engineering Chemistry-II, VGS Techno Series
2. Chemistry Practical Manual, Lorven Publications
3. K. Mukkanti (2009) Practical Engineering Chemistry, B.S.Publication

ENGLISH – COMMUNICATION SKILLS LAB – I

Suggested Lab Manuals:
OBJECTIVE: To impart to the learner the skills of grammar as well as communication through listening, speaking, reading, and writing including soft, that is life skills.

BASIC COMMUNICATION SKILLS

UNIT 1	A. Greeting and Introductions	
	B. Pure Vowels	
UNIT 2	A. Asking for information and Requests	
	B. Diphthongs	
UNIT 3	A. Invitations	
	B. Consonants	
UNIT 4	A. Commands and Instructions	
	B. Accent and Rhythm	
UNIT 5	A. Suggestions and Opinions	
	B. Intonation	

Text Book:

'Strengthen your Communication Skills'   Part-A by Maruthi Publications

Reference Books:

1. INFOTECH English (Maruthi Publications)
2. Personality Development and Soft Skills (Oxford University Press, New Delhi)

T	P	C
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C PROGRAMMING LAB

Exercise l

a) Write a C Program to calculate the area of triangle using the formula
area = $(s (s\text{-}a) (s\text{-}b)(s\text{-}c))^{1/2}$ where s= (a+b+c)/2

b) Write a C program to find the largest of three numbers using ternary operator.

c) Write a C Program to swap two numbers without using a temporary variable.

Exercise 2

a) 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.

b) Write a C program to find the roots of a quadratic equation.

c) Write a C program, which takes two integer operands and one operator form the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)

Exercise 3

a) Write a C program to find the sum of individual digits of a positive integer and find the reverse of the given number.

b) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the

c) Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

Exercise 4

a) Write a C Program to print the multiplication table of a given number n up to a given value, where n is entered by the user.

b) Write a C Program to enter a decimal number, and calculate and display the binary equivalent of that number.

c) Write a C Program to check whether the given number is Armstrong number or not.

Exercise 5

a) Write a C program to interchange the largest and smallest numbers in the array.

b) Write a C program to implement a liner search.

c) Write a C program to implement binary search

Exercise 6

a) Write a C program to implement sorting of an array of elements .

b) Write a C program to input two m x n matrices, check the compatibility and perform addition and multiplication of them

Exercise 7

Write a C program that uses functions to perform the following operations:

    i.   To insert a sub-string in to given main string from a given position.

    ii.   To delete n Characters from a given position in a given string.

    iii.   To replace a character of string either from beginning or ending or at a specified locatio

Exercise 8

Write a C program that uses functions to perform the following operations using Structure:

    i) Reading a complex number   ii) Writing a complex number

    iii) Addition of two complex numbers   iv) Multiplication of two complex numbers

Exercise 9

Write C Programs for the following string operations without using the built in functions
        - to concatenate two strings
        - to append a string to another string
        - to compare two strings

Exercise 10

Write C Programs for the following string operations without using the built in functions
        - to find t he length of a string
        - to find whether a given string is palindrome or not

Exercise 11

a) Write a C functions to find both the largest and smallest number of an array of integers.

b) Write C programs illustrating call by value and call by reference cncepts.

Exercise 12

Write C programs that use both recursive and non-recursive functions for the following
         i) To find the factorial of a given integer.
        ii) To find the GCD (greatest common divisor) of two given integers.
        iii) To find Fibonacci sequence

Exercise 13

a) Write C Program to reverse a string using pointers

b) Write a C Program to compare two arrays using pointers

Exercise 14

a) Write a C program consisting of Pointer based function to exchange value of two integers using passing by address.

b) Write a C program to swap two numbers using pointers

Exercise 15

Examples which explores the use of structures, union and other user defined variables

Exercise 16

a) Write a C program which copies one file to another.

b) Write a C program to count the number of characters and number of lines in a file.

c) Write a C Program to merge two files into a third file. The names of the files must be entered using command line arguments.

	T	P	C
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ENGLISH –II
(Common to All Branches)

DETAILED TEXT-II : Sure Outcomes: English for Engineers and Technologists

Recommended Topics :
1. **TECHNOLOGY WITH A HUMAN FACE**
   OBJECTIVE: To make the learner understand how modern life has been shaped by technology.
   OUTCOME: The proposed technology is people's technology. It serves the human person instead of making him the servant of machines.
2. **CLIMATE CHANGE AND HUMAN STRATEGY**
   OBJECTIVE: To make the learner understand how the unequal heating of earth's surface by the Sun, an atmospheric circulation pattern is developed and maintained.
   OUTCOME: The learner's understand that climate must be preserved.
3. **EMERGING TECHNOLOGIES**
   OBJECTIVE: To introduce the technologies of the 20th century and 21st centuries to the learners.
   OUTCOME: The learner will adopt the applications of modern technologies such as nanotechnology.
4. **WATER- THE ELIXIR OF LIFE**
   OBJECTIVE: To inform the learner of the various advantages and characteristics of water.
   OUTCOME: The learners will understand that water is the elixir of life.
5. **THE SECRET OF WORK**
   OBJECTIVE:**:** In this lesson, Swami Vivekananda highlights the importance of work for any development.
   OUTCOME: The students will learn to work hard with devotion and dedication.
6. **WORK BRINGS SOLACE**
   OBJECTIVE: In this lesson Abdul Kalam highlights the advantage of work.
   OUTCOME: The students will understand the advantages of work. They will overcome their personal problems and address themselves to national and other problems.

Text Book : 'Sure Outcomes' by Orient Black Swan Pvt. Ltd. Publishers

NON-DETAILED TEXT:

<p align="center">(From Modern Trailblazers of Orient Blackswan)
(Common single Text book for two semesters)
(Semester I (1 to 4 lessons)/ Semester II (5 to 8 lessons)</p>

5. **J.C. Bose**

    OBJECTIVE: To apprise of J.C.Bose's original contributions.

    OUTCOME: The learner will be inspired by Bose's achievements so that he may start his own original work.

6. **Homi Jehangir Bhaba**

    OBJECTIVE: To show Bhabha as the originator of nuclear experiments in India.

    OUTCOME: The learner will be inspired by Bhabha's achievements so as to make his own experiments.

7. **Vikram Sarabhai**

    OBJECTIVE: To inform the learner of the pioneering experiments conducted by Sarabhai in nuclear energy and relevance of space programmes.

    OUTCOME: The learner will realize that development is impossible without scientific research.

8. **A Shadow- R.K.Narayan**

    OBJECTIVE: To expose the reader to the pleasure of the humorous story

    OUTCOME: The learner will be in a position to appreciate the art of writing a short story and try his hand at it.

Text Book : 'Trail Blazers' by Orient Black Swan Pvt. Ltd. Publishers

	T	P	C
	3+1	0	3

MATHEMATICS – II

(MATHEMATICAL METHODS)

(Common to All Branches)

UNIT I Solution of Algebraic and Transcendental Equations:
Introduction- Bisection Method – Method of False Position – Iteration Method – Newton-Raphson Method (One variable and Simultaneous Equstions)
Subject Category
ABET Learning Objectives   a e k
ABET internal assessments   1 2 4 6
JNTUK External Evaluation A B E

UNIT II Interpolation:
Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences- Backward differences –Central differences – Symbolic relations and separation of symbols- Differences of a polynomial-Newton's formulae for interpolation – Interpolation with unevenly spaced points - Lagrange's Interpolation formula
Subject Category
ABET Learning Objectives   a e
ABET internal assessments   1 2 4 6
JNTUK External Evaluation A B E

UNIT III Numerical solution of Ordinary Differential equations:
Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method-Runge-Kutta Methods
Subject Category
ABET Learning Objectives   a e
ABET internal assessments   1 2 4 6
JNTUK External Evaluation A B E

UNIT IV Fourier Series:
Introduction- Determination of Fourier coefficients – even and odd functions –change of interval– Half-range sine and cosine series
application: Amplitude, spectrum of a periodic function
Subject Category
ABET Learning Objectives   a e d
ABET internal assessments   1 2 6
JNTUK External Evaluation A B E

UNIT V Fourier Transforms:
Fourier integral theorem (only statement) – Fourier sine and cosine integrals - sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms
Subject Category
ABET Learning Objectives   a d e k
ABET internal assessments   1 2 6
JNTUK External Evaluation A B E

UNIT VI Z-transform:

Introduction– properties – Damping rule – Shifting rule – Initial and final value theorems -Inverse z transform- -Convolution theorem – Solution of difference equation by Z -transforms.

BOOKS:

1. **B.S. GREWAL,** Higher Engineering Mathematics, 42nd Edition, Khanna Publishers
2. **DEAN G. DUFFY,** Advanced Engineering Mathematics with MATLAB, CRC Press
3. **V.RAVINDRANATH and P. VIJAYALAXMI,** Mathematical Methods, Himalaya Publishing House
4. **ERWYN KREYSZIG,** Advanced Engineering Mathematics, 9th Edition, Wiley-India

Subject Category	ABET Learning Objectives	ABET Internal Assessments	JNTUK External Evaluation	Remarks
Theory Design Analysis Algorithms Drawing Others	a) Apply knowledge of math, science, & engineering b) Design & conduct experiments, analyze & interpret data c) Design a system/process to meet desired needs within economic, social, political, ethical, health/safety, manufacturability, & sustainability constraints d) Function on multidisciplinary teams e) Identify, formulate, & solve engineering problems f) Understand professional & ethical responsibilities g) Communicate effectively h) Understand impact of engineering solutions in global, economic, environmental, & societal context i) Recognize need for & be able to engage in lifelong learning j) Know contemporary issues k) Use techniques, skills, modern tools for engineering practices	1. Objective tests 2. Essay questions tests 3. Peer tutoring based 4. Simulation based 5. Design oriented 6. Problem based 7. Experiential (project based) based 8. Lab work or field work based 9. Presentation based 10. Case Studies based 11. Role-play based 12. Portfolio based	A. Questions should have: B. Definitions, Principle of operation or philosophy of concept. C. Mathematical treatment, derivations, analysis, synthesis, numerical problems with inference. D. Design oriented problems E. Trouble shooting type of questions F. Applications related questions G. Brain storming questions	

3+1   0   3

MATHEMATICS – III
(LINEAR ALGEBRA & VECTOR CALCULUS)
(Common to All Branches)

UNIT I Linear systems of equations:

Rank-Echelon form, Normal form – Solution of Linear Systems – Direct Methods- Gauss Elimination - Gauss Jordon and Gauss Seidal Methods.

Application: Finding the current in a electrical circuit.

Subject Category

ABET Learning Objectives   a e k

ABET internal assessments   1 2 6 4

JNTUK External Evaluation   A B E

UNIT II Eigen values - Eigen vectors and Quadratic forms:

Eigen values - Eigen vectors– Properties – Cayley-Hamilton Theorem - Inverse and powers of a matrix by using Cayley-Hamilton theorem- Quadratic forms- Reduction of quadratic form to canonical form – Rank - Positive, negative definite - semi definite - index – signature.

Application: Free vibration of a two-mass system.

Subject Category

ABET Learning Objectives   a d e k

ABET internal assessments   1 2 4 6

JNTUK External Evaluation   A B E

UNIT III Multiple integrals:

Review concepts of Curve tracing (Cartesian - Polar and Parametric curves)-

Applications of Integration to Lengths, Volumes and Surface areas of revolution in Cartesian and Polar Coordinates.

Multiple integrals - double and triple integrals – change of variables – Change of order of Integration

Application: Moments of inertia

Subject Category

ABET Learning Objectives   a e d

ABET internal assessments   1 2 6

JNTUK External Evaluation   A B E

UNIT IV Special functions:

Beta and Gamma functions- Properties - Relation between Beta and Gamma functions- Evaluation of improper integrals

Application: Evaluation of integrals

Subject Category

ABET Learning Objectives   a e

ABET internal assessments   1 2 6

JNTUK External Evaluation   A B E

UNIT V Vector Differentiation:

Gradient- Divergence- Curl - Laplacian and second order operators -Vector identities

Application: Equation of continuity, potential surfaces

Subject Category

ABET Learning Objectives   a e

ABET internal assessments   1 2 6

JNTUK External Evaluation   A B E

UNIT VI Vector Integration:

Line integral – work done – Potential function – area- surface and volume integrals Vector integral theorems: Greens, Stokes and Gauss Divergence Theorems (Without proof) and related problems.

application: work done, Force

Subject Category

ABET Learning Objectives   a e

ABET internal assessments   1 2 6

JNTUK External Evaluation A B E

BOOKS:

1. **GREENBERG,** Advanced Engineering Mathematics, 9th Edition, Wiley-India
2. **B.V. RAMANA,** Higher Engineering Mathematics, Tata McGrawhill
3. **ERWIN KREYSZIG,** Advanced Engineering Mathematics, 9th Edition, Wiley-India
4. **PETER O'NEIL,** Advanced Engineering Mathematics, Cengage Learning
5. **D.W. JORDAN AND T. SMITH,** Mathematical Techniques, Oxford University Press

Subject Category	ABET Learning Objectives	ABET Internal Assessments	JNTUK External Evaluation	Remarks
Theory Design Analysis Algorithms Drawing Others	a) Apply knowledge of math, science, & engineering b) Design & conduct experiments, analyze & interpret data c) Design a system/process to meet desired needs within economic, social, political, ethical, health/safety, manufacturability, & sustainability constraints d) Function on multidisciplinary teams e) Identify, formulate, & solve engineering problems f) Understand professional & ethical responsibilities g) Communicate effectively h) Understand impact of engineering solutions in global, economic, environmental, & societal context i) Recognize need for & be able to engage in lifelong learning j) Know contemporary issues k) Use techniques, skills, modern tools for engineering practices	1. Objective tests 2. Essay questions tests 3. Peer tutoring based 4. Simulation based 5. Design oriented 6. Problem based 7. Experiential (project based) based 8. Lab work or field work based 9. Presentation based 10. Case Studies based 11. Role-play based 12. Portfolio based	A. Questions should have: B. Definitions, Principle of operation or philosophy of concept. C. Mathematical treatment, derivations, analysis, synthesis, numerical problems with inference. D. Design oriented problems E. Trouble shooting type of questions F. Applications related questions G. Brain storming questions	

ENGINEERING PHYSICS

UNIT-I
PHYSICAL OPTICS FOR INSTRUMENTS
"Objective Designing an instrument and enhancing the resolution for its operation would be effective as achieved through study of applicational aspects of physical Optics"
INTERFACE : Introduction – Interference in thin films by reflection – Newton's rings.
DIFFRACTION : Introduction – Fraunhofer diffraction - Fraunhofer diffraction at double slit (qualitative) – Diffraction grating – Grating spectrum – Resolving power of a grating – Rayleigh's criterion for resolving power.
POLARIZATION : Introduction – Types of Polarization – Double refraction – Quarter wave plate ad Half Wave plate.

UNIT-II
COHERENT OPTICS – COMMUNICATIONS AND STRUCTURE OF MATERIALS
Objectives while lasers are trusted Non-linear coherent sources established for the fitness of instrumentation, establishing a structure property relationship for materials requires allotment of an equivalent footing in convening the physics knowledge base.
LASERS: Introduction – coherent sources – Characteristics of lasers – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Three and Four level pumping schemes – Ruby laser – Helium Neon laser.
FIBER OPTICS : Introduction – Principle of Optical Fiber – Acceptance angle and acceptance cone – Numerical aperture.
CRYSTALLOGRAPHY : Introduction – Space lattice – Basis – Unit Cell – Lattice parameters – Bravais lattices – Crystal systems – Structures and packing fractions of SC,BCC and FCC
X-RAY DIFFRACTION TECHNIQUES : Directions and planes in crystals – Miller indices – Separation between successive [h k l] planes – Bragg's law.

UNIT-III
MAGNETIC, ELECTRIC FIELD RESPONSE OF MATERIALS & SUPERCONDUCTIVITY
"Objective many of the Electrical or Electronic gadgets are designed basing on the response of naturally abundant and artificially made materials, while their response to E- or H- fields controls their performance.
MAGNETIC PROPERTIES : Magnetic permeability – Magnetization – Organ or magnetic moment – Classification of Magnetic materials – Dir, para, Ferro, anti ferro and ferri-magnetism – Hysteresis curve
DIELECTRIC PROPERTIES : Introduction – Dielectric constant – Electronic, ionic and orientational polarization – internal fields – Clausius – Mossotti equation – Dielectric loss, Breakdown and Strength.
SUPERCONDUCTIVITY : General properties – Meissner effect – Type I and Type II superconductors – BCS Theory Flux quantization London's equations – Penetration depth – DC and AC Josephson effects – SQUIDS.

UNIT – IV
ACOUSTICS AND EM – FIELDS:

Objective: The utility and nuances of ever pervading SHM and its consequences would be the first hand-on to as it clearly conveyed through the detailed studies of Acoustics of Buildings, while vectorial concepts of EM fields paves the student to gear – up for a deeper understanding.

ACOUSTICS: Sound absorption, absorption coefficient and its measurements, Reverberations time – Sabine's formula, Eyring's formula.

ELECTRO-MAGNETIC FIELDS: Gauss and stokes theorems (qualitative) – Fundamental laws of electromagnetism – Maxwell's Electromagnetic Equations (Calculus approach).

UNIT – V
QUANTUM MECHANICS FOR ELECTRONIC TRANSPORT

Objective: The discrepancy between classical estimates and laboratory observations of physical properties exhibited by materials would be lifted out through the understanding quantum picture of sub-atomic world dominated by electron and its presence.

QUANTUM MECHANICS: Introduction to matter waves – Schrodinger Time Independent and Time Dependent wave equations – Particle in a box.

FREE ELECTRON THEORY: Classical free electron theory – electrical conductivity – Mean free path – Relaxation time and drifty velocity – Quantum free electron theory – Fermi – Dirac (analytical) and its dependence on temperature – Fermi energy – density of states – derivations for current density.

BAND THEORY OF SOLIDS: Bloch theorem (qualitative) – Kronig – Penney model – Origin of energy band formation in solids – Classification of materials into conductors, semi – conductors & insulators – Concepts of effective mass of electron - concept of hole.

UNIT – VI
SEMICONDUCTOR PHYSICS:

Objective: In the wake of ever increasing demand for the space and power the watch word "small is beautiful", understanding the physics of electronic transport as underlying mechanism for appliances would provide a knowledge base.

Introduction – Intrinsic semiconductor and carrier concentration – Equation for conductivity – Extrinsic semiconductor and carrier concentration – Drift and diffusion – Einstein's equation – Hall Effect – direct & indirect band gap semiconductors – Electronic transport Mechanism for LEDs, Photo conductors and solar cells.

TEXT BOOKS
1. Solid state Physics by A.J. Dekker (Mc Millan India Ltd)
2. A text book of Engineering Physics by M.N. Avadhanulu & P.G. Kshirasagar (S. Chand publications)
3. Engineering Physics b;y M.R. Srinivasan (New Age international publishers)

REFERENCE BOOKS
1. 'Introduction to solid state physics' by Charles Kittle (Willey India Pvt.Ltd)
2. 'Applied Physics' by T. Bhimasenkaram (BSP BH Publications)
3. 'Applied Physics' by M.Arumugam (Anuradha Agencies)
4. 'Engineering Physics' by Palanisamy (Scitech   Publishers)
5. 'Engineering Physics' by D.K.Bhattacharya (Oxford University press)
6. 'Engineering Physics' by Mani Naidu S (Pearson Publications)
7. 'Engineering Physics' by Sanjay D Jain and Girish G Sahasrabudhe (University Press)
8. 'Engineering Physics' by B.K.Pandey & S. Chaturvedi (Cengage Learning)

Professional Ethics and Human Values

UNIT I : Human Values:

Morals, Values and Ethics – Integrity – Work Ethics – Service Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality- Character.

UNIT II : Engineering Ethics:

The History of Ethics-Purposes for Engineering Ethics-Engineering Ethics-Consensus and Controversy –Professional and Professionalism –Professional Roles to be played by an Engineer –Self Interest, Customs and Religion-Uses of Ethical Theories-Professional Ethics-Types of Inquiry – Engineering and Ethics-Kohlberg's Theory – Gilligan's Argument –Heinz's Dilemma.

UNIT III : Engineering as Social Experimentation:

Comparison with Standard Experiments – Knowledge gained – Conscientiousness – Relevant Information – Learning from the Past – Engineers as Managers, Consultants, and Leaders – Accountability – Role of Codes – Codes and Experimental Nature of Engineering.

UNIT IV : Engineers' Responsibility for Safety and Risk:

Safety and Risk, Concept of Safety – Types of Risks – Voluntary v/s Involuntary Risk- Short term v/s Long term Consequences- Expected Probability- Reversible Effects- Threshold Levels for Risk-Delayed v/s Immediate Risk- Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

UNIT V : Engineers' Responsibilities and Rights:

Collegiality-Techniques for Achieving Collegiality –Two Senses of Loyalty-obligations of Loyalty-misguided Loyalty – professionalism and Loyalty- Professional Rights –Professional Responsibilities – confidential and proprietary information-Conflict of Interest-solving conflict problems – Self-interest, Customs and Religion- Ethical egoism-Collective bargaining-Confidentiality-Acceptance of Bribes/Gifts-when is a Gift and a Bribe-examples of Gifts v/s Bribes-problem solving-interests in other companies-Occupational Crimes-industrial espionage-price fixing-endangering lives- Whistle Blowing-types of whistle blowing-when should it be attempted-preventing whistle blowing.

UNIT VI : Global Issues:

Globalization- Cross-culture Issues-Environmental Ethics-Computer Ethics-computers as the instrument of Unethical behaviour-computers as the object of Unethical Acts-autonomous computers-computer codes of Ethics-Weapons Development-Ethics and Research-Analysing Ethical Problems in Research-Intellectual Property Rights.

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Text Books:

1. "Engineering Ethics and Human Values" by M.Govindarajan,   S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009

2. "Professional Ethics and Morals" by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications
3. "Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran- Laxmi Publications
4. "Professional Ethics and Human Values" by Prof.D.R.Kiran-
5. "Indian Culture, Values and Professional Ethics" by PSR Murthy-BS Publication
6. "Ethics in Engineering" by Mike W. Martin and Roland Schinzinger – Tata McGraw-Hill – 2003.
7. "Engineering Ethics" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.

ENGINEERING DRAWING

Objective: Engineering drawing being the principle method of communication for engineers, the objective to introduce the students, the techniques of constructing the various types of polygons, curves and scales. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

UNIT I
Objective: The objective is to introduce the use and the application of drawing instruments and to make the students construct the polygons, curves and various types of scales. The student will be able to understand the need to enlarge or reduce the size of objects in representing them.
Polygons, Construction of regular polygons using given length of a side; Ellipse, arcs of circles and Oblong methods; Scales – Vernier and Diagonal scales.

UNIT II
Objective: The objective is to introduce orthographic projections and to project the points and lines parallel to one plane and inclined to other.
Introduction to orthographic projections; projections of points; projections of straight lines parallel to both the planes; projections of straight lines – parallel to one plane and inclined to the other plane.

UNIT III
Objective: The objective is to make the students draw the projections of the lines inclined to both the planes.
Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclinations and traces.

UNIT IV
Objective: The objective is to make the students draw the projections of the plane inclined to both the planes.
Projections of planes: regular planes perpendicular/parallel to one plane and inclined to the other reference plane; inclined to both the reference planes.

UNIT V
Objective: The objective is to make the students draw the projections of the various types of solids in different positions inclined to one of the planes.
Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the planes.

UNIT VI
Objective: The objective is to represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthographic view and vice versa.
Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

TEXT BOOKS:
1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers.

3. Engineering Graphics by PI Varghese, McGrawHill Publishers

REFERENCE BOOKS:
1. Engineering Graphics for Degree by K.C. John, PHI Publishers
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers
3. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age

	T	**P**	**C**
	0	**3**	**2**

ENGLISH – COMMUNICATION SKILLS LAB – II

Suggested Lab Manuals:

OBJECTIVE: To impart to the learner the skills of grammar as well as communication through listening, speaking, reading, and writing including soft, that is life skills.

ADVANCED COMMUNICATION SKILLS

UNIT 6	Body language
UNIT 7	Dialogues
UNIT 8	Interviews and Telephonic Interviews
UNIT 9	Group Discussions
UNIT 10	Presentation Skills
UNIT 11	Debates

Text Book:

'Strengthen your Communication Skills' Part-B by Maruthi Publications

Reference Books:

1. INFOTECH English (Maruthi Publications)
2. Personality Development and Soft Skills (Oxford University Press, New Delhi)

I Year – II SEMESTER

T	P	C
0	3	2

ENGINEERING PHYSICS LAB

List of Experiments

1. Determination of wavelength of a source-Diffraction Grating-Normal incidence
2. Newton's rings –Radius of Curvature of Plano_Convex Lens.
3. Determination of thickness of a thin object using parallel interference fringes.
4. Determination of Rigidity modulus of a material- Torsional Pendulum.
5. Determination of Acceleration due to Gravity and Radius of Gyration- Compound Pendulum.
6. Melde's experiment – Transverse and Longitudinal modes.
7. Verification of laws of stretched string – Sonometer.
8. Determination of velocity of sound – Volume resonator.
9. L C R Senes Resonance Circuit
10. Study of I/V Characteristics of Semiconductor diode
11. I/V characteristics of Zener diode
12. Thermistor characteristics – Temperature Coefficient
13. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.
14. Energy Band gap of a Semiconductor p.n junction.
15. Hall Effect for semiconductor.

REFERENCE:
1. Engineering Physics Lab Manual by Dr.Y. Aparna & Dr.K.Venkateswarao (V.G.S.Book links)
2. Physics practical manual, Lorven Publications.

Engineering Physics
Virtual Labs - Assignments

List of Experiments

1. Hall Effect
2. Crystal Structure
3. Hysteresis
4. Brewster's angle
5. Magnetic Levitation / SQUID
6. Numerical Aperture of Optical fiber
7. Photoelectric Effect
8. Simple Harmonic Motion
9. Damped Harmonic Motion
10. LASER – Beam Divergence and Spot size

URL : WWW.vlab.co.in

ENGINEERING WORKSHOP & IT WORKSHOP

ENGINEERING WORKSHOP:

Course Objective: To impart hands-on practice on basic engineering trades and skills.
Note: At least two exercises to be done from each trade.

Trade:

Carpentry	1. T-Lap Joint
	2. Cross Lap Joint
	3. Dovetail Joint
	4. Mortise and Tennon Joint
Fitting	1. Vee Fit
	2. Square Fit
	3. Half Round Fit
	4. Dovetail Fit
Black Smithy	1. Round rod to Square
	2. S-Hook
	3. Round Rod to Flat Ring
	4. Round Rod to Square headed bolt
House Wiring	1. Parallel / Series Connection of three bulbs
	2. Stair Case wiring
	3. Florescent Lamp Fitting
	4. Measurement of Earth Resistance
Tin Smithy	1. Taper Tray
	2. Square Box without lid
	3. Open Scoop
	4. Funnel

IT WORKSHOP:

Objectives: Enabling the student to understand basic hardware and software tools through practical exposure

PC Hardware:
Identification of basic peripherals, assembling a PC, installation of system software like MS Windows, device drivers. Troubleshooting Hardware and software _ some tips and tricks.

Internet & World Wide Web:
Different ways of hooking the PC on to the internet from home and workplace and effectively usage of the internet, web browsers, email, newsgroups and discussion forums .Awareness of cyber hygiene(protecting the personal computer from getting infected with the viruses), worms and other cyber attacks .

Productivity tools Crafting professional word documents; excel spread sheets, power point presentations and personal web sites using the Microsoft suite of office tools

            (Note: Student should be thoroughly exposed to minimum of 12 Tasks)

PC Hardware

Task 1: Identification of the peripherals of a computer.

To prepare a report containing the block diagram of the CPU along with the configuration of each peripheral and its functions. Description of various I/O Devices

Task 2(Optional) : A practice on disassembling the components of a PC and assembling them to back to working condition.

Task 3: Examples of Operating systems- DOS, MS Windows, Installation of MS windows on a PC.

Task 4: Introduction to Memory and Storage Devices , I/O Port, Device Drivers, Assemblers, Compilers, Interpreters , Linkers, Loaders.

Task 5:

Hardware Troubleshooting (Demonstration):

Identification of a problem and fixing a defective PC(improper assembly or defective peripherals).

Software Troubleshooting (Demonstration):. Identification of a problem and fixing the PC for any software issues

Internet & Networking Infrastructure

Task 6: Demonstrating Importance of Networking, Transmission Media, Networking Devices-Gateway, Routers, Hub, Bridge, NIC ,Bluetooth Technology, Wireless Technology, Modem, DSL, Dialup Connection.

Orientation & Connectivity Boot Camp and web browsing: Students are trained to configure the network settings to connect to the Internet. They are trained to demonstrate the same through web browsing (including all tool bar options) and email access.

Task 7: **Search Engines & Netiquette:**

Students are enabled to use search engines for simple search, academic search and any other context based search (Bing, Google etc). Students are acquainted to the principles of micro-blogging, wiki, collaboration using social networks, participating in online technology forums

Task 8: Cyber Hygiene (Demonstration): Awareness of various threats on the internet. Importance of security patch updates and anti-virus solutions. Ethical Hacking, Firewalls, Multi-factor authentication techniques including Smartcard, Biometrics are also practiced

Word

Task 9 : MS Word Orientation:

Accessing, overview of toolbars, saving files, Using help and resources, rulers, formatting ,Drop Cap , Applying Text effects, Using Character Spacing, OLE in Word, using templates, Borders and Colors, Inserting Header and Footer, Using Date and Time option, security features in word, converting documents while saving

Task 10: Creating project : Abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check , Track Changes, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs.

Excel

Task 11: Using spread sheet features of EXCEL including the macros, formulae, pivot tables, graphical representations

Creating a Scheduler - Features to be covered:- Gridlines, Format Cells, Summation, auto fill, Formatting Text

LOOKUP/VLOOKUP

Task 12: Performance Analysis - Features to be covered:- Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

Power Point
Task 13: Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered during this week includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows, Hyperlinks, Inserting –Images, Clip Art, Tables and Charts in Powerpoint.

Task 14: Focusing on the power and potential of Microsoft power point. Helps them learn best practices in designing and preparing power point presentation. Topic covered during this week includes: - Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), Inserting – Background, textures, Design Templates, Hidden slides, OLE in PPT.

TEXT BOOK:
Faculty to consolidate the workshop manuals using the following references
1. Computer Fundamentals, Anita Goel, Pearson
2. Scott Mueller's Upgrading and Repairing PCs, 18/e, Scott. Mueller, QUE, Pearson,2008
3. Information Technology Workshop,3e, G Praveen Babu, M V Narayana BS Publications.
4. Comdex Information Technology , Vikas Gupta, dreamtech.

REFERENCE BOOK:
1. Essential Computer and IT Fundamentals for Engineering and Science Students, Dr. N.B. Venkateswarlu

METALLURGY & MATERIALS SCIENCE

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

UNIT – I
Learning Objective: To know the basic concepts of bonds in metals and alloys. To understand the basic requirements for the formation of solid solutions and other compounds.
Structure of Metals and Constitution of alloys: Bonds in Solids – Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size. Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

UNIT –II
Learning objectives: To understand the regions of stability of the phases that can occur in an alloy system in order to solve the problems in practical metallurgy.
Equilibrium Diagrams : Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, Cu-An, Cus-Sn and Fe-Fe3C.

UNIT –III
Learning objectives: To study the basic differences between cast irons and steels, their properties and practical applications.
Cast Irons and Steels: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

UNIT – IV
Learning objectives: To study the affect of various alloying elements on iron-iron carbide system. To understand the various heat treatment and strengthening processes used in practical applications.
Heat treatment of Alloys: Effect of alloying elements on Fe-Fe3C system, Annealing, normalizing, Hardening, TTT diagrams, tempering , Hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

UNIT – V
Learning objectives: To study the properties and applications of widely used non-ferrous metals and alloys so as to use the suitable material for practical applications.
Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

UNIT – VI

Learning objectives: To study the properties and applications of ceramic, composite and other advanced materials so as to use the suitable material for practical applications.

Ceramic and composite materials: Crystalline ceramics, glasses, cermaets, abrasive materials, nanomaterials – definition, properties and applications of the above.

Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and C – C composites.

TEXT BOOKS:
1. Introduction to Physical Metallurgy - Sidney H. Avener - McGrawHill
2. Essential of Materials science and engineering - Donald R.Askeland -Thomson.

REFERENCES :
1. Material Science and Metallurgy – Dr. V.D.kodgire.
2. Materials Science and engineering - Callister & Baalasubrahmanyam
3. Material Science for Engineering students – Fischer – Elsevier Publishers
4. Material science and Engineering - V. Rahghavan
5. Introduction to Material Science and Engineering – Yip-Wah Chung CRC Press
6. Material Science and Metallurgy – A V K Suryanarayana – B S Publications
7. Material Science and Metallurgy – U. C. Jindal – Pearson Publications

	T	P	C
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MECHANICS OF SOLIDS

Objective: The students completing this course are expected to understand the basic terms like stress, strain, poissons ratio…etc and different stresses induced in beams, thin cylinders, thick cylinders, columns. Further, the student shall be able to understand the shear stresses in circular shafts.

UNIT – I

Objective: After studying this unit student will know the basic terms like stress, strain poissons ratio…etc and stresses in bars of varying cross sections, composite bars, thermal stress in members, stresses on inclined planes with analytical approach and graphical approach, strain energy under different loadings and also problem solving techniques.

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

UNIT – II

Objective: After studying this unit student will know the construction of shear force diagrams and bending moment diagrams to the different loads for the different support arrangements and also problem solving techniques.

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

UNIT – III

Objective: After studying this unit student will know the bending and shear stress induced in the beams which are made with different cross sections like rectangular, circular, triangular, I, T angle sections and also problem solving techniques.

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

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

UNIT – IV

Objective: After studying this unit student will know how to finding slope and deflection for different support arrangements by Double integration method, Macaulay's method and Moment-Area and also problem solving techniques.

DEFLECTION OF BEAMS : Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams

subjected to point loads, - U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams.
Brief explanation of Statically Indeterminate Beams and solution methods.

UNIT – V
Objective: After studying this unit student will know how a cylinder fails, what kind of stresses induced in cylinders subjected to internal, external pressures and also problem solving techniques.
THIN CYLINDERS: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells.
THICK CYLINDERS: –lame's equation – cylinders subjected to inside & outside pressures –compound cylinders.

UNIT –VI
Objective: After studying this unit student will know shear stresses induced in circular shafts, discussing columns in stability point of view and columns with different end conditions.
TORSION: Introduction-Derivation- Torsion of Circular shafts- Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel.
COLUMNS:
Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula,

TEXT BOOKS:
   1. Strength of materials by Bhavikatti, Lakshmi publications.
   2. Solid Mechanics, by Popov
   3. Mechanics of Materials by - Ferdinand P Beer, E Russell Johnston, and John T Dewolf.

REFERENCES :
   1. Strength of Materials -By Jindal, Umesh Publications.
   2. Analysis of structures by Vazirani and Ratwani.
   3. Mechanics of Structures Vol-III, by S.B.Junnarkar.
   4. Strength of Materials by S.Timshenko
   5. Strength of Materials by Andrew Pytel and Ferdinond L. Singer Longman.

THERMODYNAMICS

Course Objectives:
To impart the knowledge of the thermodynamic laws and principles so as to enable the student to prepare an energy audit of any mechanical system that exchange heat and work with the surroundings.

UNIT – I
Objectives: The student should be able to understand the basic concepts like thermodynamic system, its boundary and related fundamental definitions. Distingvision between point function and path function shall be made with respect to energy, work and Heat.
Introduction: Basic Concepts : System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry –Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale – PMM I

UNIT – II
Objectives: To learn the first law of thermodynamics, which is also the energy conservation principle, and should be able to apply to different thermodynamic systems. To understand the concept of equality of temperature and the principle of operation of various temperature measuring devices. To learn the applications of steady flow energy equation to the various mechanical components.
Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation. Throttling and free expansion processes – deviations from perfect gas model – vander Waals equation of state – compressibility charts – variable specific heats – gas tables.

UNIT – III
Objectives: To understand the second law statements and the associated terms and should be able to apply the principles to heat engines. Should be able to analyse the concepts of Carnot cycle, entropy, availability and irreversibility. Should be able to understand the use of Maxwells relations and thermodynamic functions.
Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.

UNIT – IV
Objectives: should understand the process of steam formation and its representation on property diagrams with various phase changes and should be able to calculate the quality of steam after its expansion in a steam turbine, with the help of standard steam tables and charts.

Pure Substances, p-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

UNIT – V
Objectives: Should be able to use Psychrometric chart and calculate various psychrometric properties of air.
Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction , Volume fraction and partial pressure, Equivalent Gas const. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour, Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation , Carrier's Equation – Psychrometric chart.

UNIT – VI
Objectives: To understand the concept of air standard cycles and should be able to calculate the efficiency and performance parameters of the systems that use these cycles.
Power Cycles : Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericcson Cycle, Lenoir Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.
Refrigeration Cycles : Brayton and Rankine cycles – Performance Evaluation – combined cycles, Bell- Coleman cycle, Vapour compression cycle-performance Evaluation.

TEXT BOOKS :
    1. Engineering Thermodynamics , PK Nag 4th Edn , TMH.
    2. Thermodynamics – An Engineering Approach with student resources DVD – Y.A.Cengel & M.A.Boles , 7th Edn - McGrawHill

REFERENCES :
    1. Engineering Thermodynamics – Jones & Dugan PHI
    2. Thermodynamics – J.P.Holman , McGrawHill
    3. Basic Engineering Thermodynamics – A.Venkatesh – Universities press.
    4. An Introduction to Thermodynamics - Y.V.C.Rao – Universities press.
    5. Thermodynamics – W.Z.Black & J.G.Hartley, 3rd Edn Pearson Publ.
    6. Engineering Thermodynamics – D.P.Misra, Cengage Publ.
    7. Engineering Thermodynamics – P.Chattopadhyay – Oxford Higher Edn Publ.

AUTOMOTIVE ENGINES

Course Objectives: To make the student learn and understand the basic principles involved in the working of internal combustion engines, and their parts ,combustion phenomenon and principles, speed controllers and lubrication systems.

UNIT-I
Objectives: To make the students understand the development in internal combustion engines, classification and constructional details in detail.
Introduction: Historical development of Automobiles, Different Types of Automotive Power plants, principles of I.C engine operation and classification of engines, supercharging and turbo charging.
Two stroke and four stroke engines: different types of scavenging systems, scavenging efficiency. Valve and Port timing diagrams, special types of I.C engines like Sterling, Wankle rotary, variable compression ratio engines and Variable valve timing engines.
Automobile Engine Components: Classification, Function, Materials, Constructional details and Manufacturing process of various engine components.

UNIT-II
Objectives: To make the students understand the fuel admission in SI Engines and related systems.
Carburetion: Mixture requirements in SI Engines, fundamental of carburetion flow characteristics of carburetion, methods of mixture correction, calculation of throat and jet sizes of a carburetor, Types of carburetors and working. timed and continuous injection systems, multipoint fuel injection systems, Gasoline direct injection. Advantages of petrol injection, need to have a close control over air fuel ratio in SI Engines for emission reduction, cylinder port and manifold injection systems.

UNIT III
Objectives: To make the students understand the fuel admission in CI Engines and understand the functioning of various components involved in fuel injection in CI engines.
Fuel injection in CI Engines: Fuel filters, transfer pumps, injection pumps. Injection nozzles, their functions. Diesel fuel pumps: principle Delivery characteristics of fuel pumps, characteristic injection lag effect of injection, pressure waves in fuel lines, rotary distributor pumps.
Fuel spray characteristics: Types of injection nozzles and their characteristics, Multihole, pintle and Pintaux nozzles. Unit injectors.

UNIT – IV
Objectives: To make the students understand the combustion phenomenon in SI Engines and learn about the fuel characteristics.
Combustion in S.I. Engines : Normal Combustion and abnormal combustion – Importance of flame speed and effect of engine variables – Type of Abnormal combustion, pre-ignition and knocking (explanation of) – Fuel requirements and fuel rating, anti knock additives – combustion chamber – requirements, types.

UNIT – V
Objectives: To make the students understand the combustion phenomenon in CI Engines and learn about the fuel characteristics.

Combustion in C.I. Engines : Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence – open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

UNIT – VI
Objectives: To make the students understand the importance of Governors, lubrication systems and cooling system for effective functioning of internal combustion engines.
Governors: Maximum and minimum speed governors. Mechanical and pneumatic governors.
Lubrication Systems: Functions of the lubrication system, classification of lubricating oils, lubricating systems -wet sump lubrication - dry sump lubrication, oil filters, oil pumps, crankcase ventilation, oil additives. Air and water cooling systems, thermo syphon and forced water cooling systems.

Text Books:
1. ML Mathur & RPSharma -A course in Internal combustion Engines - Dhanpat Rai
2. I.C. Engines / V. GANESAN/ TMH
3. K Newton and Steeds -The Motor Vehicle, SAE Publications

References Books:
1. B.P. Obert I C Engines & Air Pollution – Harper & Row Publications
2. Bosch Gasoline Engines management – Bosch Publications
3. Bosch Diesel Engine management – Bosch Publication

ELECTRICAL & ELECTRONICS ENGINEERING

Preamble:

This course covers the topics related to analysis of various electrical circuits, operation of various electrical machines, various electronic components to perform well in their respective fields.

Learning Objectives:

    i. To learn the basic principles of electrical law's and analysis of networks.

    ii. To understand the principle of operation and construction details of DC machines.

    iii. To understand the principle of operation and construction details of transformer.

    iv. To understand the principle of operation and construction details of alternator and 3-Phase induction motor.

    v. To study the operation of PN junction diode, half wave, full wave rectifiers and OP-AMPs.

    vi. To learn the operation of PNP and NPN transistors and various amplifiers.

UNIT - I

ELECTRICAL CIRCUITS: Basic definitions, Types of network elements, Ohm's Law, Kirchhoff's Laws, inductive networks, capacitive networks, series, parallel circuits and star-delta and delta-star transformations.

UNIT - II

DC MACHINES : Principle of operation of DC generator – emf equation - types – DC motor types –torque equation – applications – three point starter, swinburn's Test, speed control methods.

UNIT - III

TRANSFORMERS: Principle of operation of single phase transformers – e.m.f equation – losses –efficiency and regulation.

UNIT - IV

AC MACHINES: Principle of operation of alternators – regulation by synchronous impedance method –principle of operation of 3-Phase induction motor – slip-torque characteristics - efficiency – applications.

UNIT V

RECTIFIERS & LINEAR ICs: PN junction diodes, diode applications (Half wave and bridge rectifiers). Characteristics of operation amplifiers (OP-AMP) - application of OP-AMPs (inverting, non inverting, integrator and differentiator).

UNIT VI

TRANSISTORS: PNP and NPN junction transistor, transistor as an amplifier, single stage CE Amplifier, frequency response of CE amplifier, concepts of feedback amplifier.

Outcomes:

    i. Able to analyse the various electrical networks.

    ii. Able to understand the operation of DC generators,3-point starter and conduct tl Swinburne's Test.

    iii. Able to analyse the performance of transformer.

    iv. Able to explain the operation of 3-phase alternator and 3-phase induction motors.

    v. Able to analyse the operation of half wave, full wave rectifiers and OP-AMPs.

    vi. Able to explain the single stage CE amplifier and concept of feedback amplifier.

TEXT BOOKS:

1. Electronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.
2. Electrical Technology by Surinder Pal Bali, Pearson Publications.
3. Electrical Circuit Theory and Technology by John Bird, Routledge Taylor &Francis Group

REFERENCE BOOKS:

1.Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah,TMH Publications
2.Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications,2nd edition
3. Basic Electrical Engineering by Nagsarkar,Sukhija, Oxford Publications,2nd edition
4. Industrial Electronics by G.K. Mittal, PHI

COMPUTER AIDED ENGINEERING DRAWING PRACTICE

Course Objective: To enhance the student's knowledge and skills in engineering drawing and to introduce drafting packages and commands for computer aided drawing and modeling.

UNIT-I:
Objective: The knowledge of projections of solids is essential in 3D modeling and animation. The student will be able to draw projections of solids. The objective is to enhance the skills they already acquired in their earlier course in drawing of projection and sections of solids.
PROJECTIONS OF PLANES & SOLIDS : Projections of Regular Solids inclined to both planes – Auxiliary Views. Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views.

UNIT-II:
The knowledge of development of surfaces of solids is required in designing and manufacturing of the objects. Whenever two or more solids combine, a definite curve is seen at their intersection. The intersection of solids also plays an important role in designing and manufacturing. The objective is to impart this knowledge through this topic.
DEVELOPMENT AND INTERPENETRATION OF SOLIDS: Development of Surfaces of Right Regular Solids – Prisms, Cylinder, Pyramid Cone and their parts. Interpenetration of Right Regular Solids – Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone.

UNIT-III:
Isometric projections provide a pictorial view with a real appearance. Perspective views provides a realistic 3D View of an object. The objective is to make the students learn the methods of Iso and Perspective views.
ISOMETRIC PROJECTIONS : Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Transformation of Projections: Conversion of Isometric Views to Orthographic Views – Conventions.
PERSPECTIVE PROJECTIONS: Perspective View: Points, Lines, Plane Figures and Simple Solids, Vanishing Point Methods(General Method only).

In part B computer aided drafting is introduced.
UNIT IV:
The objective is to introduce various commands in AutoCAD to draw the geometric entities and to create 2D and 3D wire frame models.
Introduction to Computer aided Drafting: Generation of points, lines, curves, polygons, dimensioning.
Types of modeling : object selection commands – edit, zoom, cross hatching, pattern filling, utility commands, 2D wire frame modeling, 3D wire frame modeling,.

UNIT V:

By going through this topic the student will be able to understand the paper-space environment thoroughly. View points and view ports: view point coordinates and view(s) displayed, examples to exercise different options like save, restore, delete ,joint , single option.

UNIT VI:
The objective is to make the students create geometrical model of simple solids and machine parts and display the same as an Isometric, Orthographic or Perspective projection.
Computer aided Solid Modeling: Isometric projections, orthographic projections of isometric projections ,Modeling of simple solids, Modeling of Machines & Machine Parts.

TEXT BOOKS :
1. Engineering Graphics, K.C. john, PHI Publications
2. Engineering drawing by N.D Bhatt , Charotar publications.

REFERENCES:
1. Mastering Auto CAD 2013 and Auto CAD LT 2013 – George Omura, Sybex
2. Auto CAD 2013 fundamentals- Elisemoss, SDC Publ.
3. Engineering Drawing and Graphics using Auto Cad – T Jeyapoovan, vikas
4. Engineering Drawing + AutoCAD – K Venugopal, V. Prabhu Raja, New Age
5. Engineering Drawing – RK Dhawan, S Chand
6. Engineering Drawing – MB Shaw, BC Rana, Pearson
7. Engineering Drawing – KL Narayana, P Kannaiah, Scitech
8. Engineering Drawing – Agarwal and Agarwal, Mc Graw Hill
9. Engineering Graphics – PI Varghese, Mc Graw Hill
10. Text book of Engineering Drawing with auto-CAD , K.venkata reddy/B.S . publications.

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ELECTRICAL & ELECTRONICS ENGINEERING LAB

Section A: Electrical Engineering:

The following experiments are required to be conducted as compulsory experiments:

1. Swinburne's test on D.C. Shunt machine(Predetermination of efficiency of a given D.C. Shunt machine working as motor and generator).

2. OC and SC tests on single phase transformer (Predetermination of efficiency and regulation at given power factors).

3. Brake test on 3-phase Induction motor (Determination of performance characteristics)

4. Regulation of alternator by Synchronous impedance method.

5. Speed control of D.C. Shunt motor by

    a) Armature Voltage control b) Field flux control method

6. Brake test on D.C. Shunt Motor.

Section B: Electronics Engineering:

1. PN junction Diode characteristics A. Forward bias, B. Reverse bias.(Cut in voltage & Resistance calculations)

2. Transistor CE Characteristics (Input and Output).

3. Full wave Rectifier with and without filters.

4. CE Amplifiers.

5. RC Phase Shift Oscillator.

6. Class A Power Amplifier.

	T	P	C
	0	3	2

MECHANICS OF SOLIDS & METALLURGY LAB

Course Objective: To impart practical exposure on the microstructures of various materials and their hardness evaluation. Also to impart practical knowledge on the evaluation of material properties through various destructive testing procedures.

NOTE: Any 6 experiments from each section A and B.

(A) MECHNICS OF SOLIDS LAB :
1. Direct tension test
2. Bending test on
a) Simple supported
b) Cantilever beam
3. Torsion test
4. Hardness test
a) Brinells hardness test
b) Rockwell hardness test
5. Test on springs
6. Compression test on cube
7. Impact test
8. Punch shear test

(B) METALLURGY LAB:
1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat treated steels.
6. Hardeneability of steels by Jominy End Quench Test.
7. To find out the hardness of various treated and untreated steels.

KINEMATICS OF MACHINERY

Objective: The students completing this course are expected to understand the nature and role of the kinematics of machinery, the mechanisms and machines. The course includes velocity and acceleration diagrams,analysis of mechanisms joints, Cams and their applications. It exposes the students to various kinds of power transmission devices like belt,rope , chain and gear drives and their working principles and their merits and demerits.

UNIT – I
Objective: The objective of this unit is to make student understand the purpose of kinematics, Kinematic joint and mechanism and to study the relative motion of parts in a machine without taking into consideration the forces involved.
MECHANISMS : Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely
constrained .
Khubralrs criteria , Grashoff's law , Degrees of freedom ,Kutzbach criterian for planar mechanisms, Mechanism and machines – classification of machines – kinematic chain – inversion of mechanism – inversion of mechanism – inversions of quadric cycle, chain – single and double slider crank chains.

UNIT – II
Objective: The objective of this unit is to make student understand various mechanisms for straight line motion and their applications including steering mechanism.
LOWER PAIR MECHANISM: Exact and approximate copiers and generated types – Peaucellier, Hart and Scott Russul – Grasshopper – Watt T. Chebicheff and Robert Mechanisms and straight line motion, Pantograph.
Conditions for correct steering – Davis Steering gear, Ackermans steering gear – velocity ratio; Hooke's Joint: Single and double – Universal coupling–application–problems.

UNIT – III
Objective : The objective of this unit is to make student understand the velocity and acceleration concepts and the methodology using graphical methods and principles and application of four bar chain. To understand the application of slider crank mechanism etc. and study of plane motion of the body
KINEMATICS: Velocity and acceleration – Motion of a link in machine – Determination of Velocity and acceleration diagrams – Graphical method – Application of relative velocity method four bar chain. Velocity and acceleration analysis of for a given mechanism, Kleins construction, Coriolis acceleration, determination of Coriolis component of acceleration.
Plane motion of body: Instantaneous center of rotation, centroids and axodes – relative motion between two bodies – Three centres in line theorem – Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

UNIT – IV

Objective The objective of this unit is to make student understand the theories involved in cams. Further the students are exposed to the applications of cams and their working principles.

CAMS

Definitions of cam and followers – their uses – Types of followers and cams – Terminology –Types of follower motion: Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.

Analysis of motion of followers: Roller follower – circular cam with straight, concave and convex flanks.

UNIT – V

Objective: The objective of this unit is to make student understand gears, power transmission through different types of gears including gear profiles and its efficiency.

Gears:

Higher pairs, friction wheels and toothed gears–types – law of gearing, condition for constant velocity ratio for transmission of motion, Form of teeth: cycloidal and involute profiles. Velocity of sliding – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact – Introduction to Helical, Bevel and worm gearing.

UNIT – VI

Objective: The objective of this unit is to make student understand various power transmission mechanisms and methodologies and working principles. Students are exposed to merits and demerits of each drive.

Power Transmissions : Introduction, Belt and rope drives, selection of belt drive- types of belt drives,V-belts, materials used for belt and rope drives, velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, Chains- length, angular speed ratio, classification of chains.

Introduction to gear Trains, Train value, Types – Simple and reverted wheel train – Epicyclic gear Train. Methods of finding train value or velocity ratio – Epicyclic gear trains. Selection of gear box- Differential gear for an automobile.

TEXT BOOKS:
1. Mechanism and Machine Theory by Ashok G. Ambekar, PHI Publishers
2. Theory of Machines – S. S Rattan- TMH
3. Theory of machines and Mechanisms – J.J Uicker, G.R.Pennock & J.E.Shigley - Oxford publishers.

REFERENCES:
1. Theory of Machines Sadhu Singh Pearsons Edn
2. Theory of machines and Machinery /Vickers /Oxford .
3. Theory of Machines by Thomas Bevan/ CBS
4. Kinematics of Machinery through Hyper Works – J.S. Rao – Springer Publ
5. Theory of Mechanisms and machines – A.Ghosh & A.K.Malik – East West Press Pvt. Ltd.

THERMAL ENGINEERING

Objectives: To make the student learn and understand the reasons and affects of various losses that occur in the actual engine operation, and to make the student understand functioning of various systems of reciprocating and rotary compressors, gas turbines and concepts of jet Propulsion.

UNIT – I
Objectives: To make the student learn and understand the reasons and affects of various losses that occurs in the actual engine operation. And to make the student understand functioning of various components of IC Engines
Actual Cycles and their Analysis: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blowdown-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles Of CI Engines.
I.C. ENGINES : Classification - Working principles, Valve and Port Timing Diagrams - Engine systems – Fuel, Carburetor, Fuel Injection System, Ignition, Cooling and Lubrication.

UNIT – II
Objectives: To make the student learn to perform testing on S.I and C.I Engines for the calculations of performance and emission parameters.
Testing and Performance of IC Engines: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart.

UNIT – III
Objectives: To make students learn about different types of compressors and to calculate power and efficiency of reciprocating compressors
COMPRESSORS – Classification –positive displacement and roto dynamic machinery – Power producing and power absorbing machines, fan, blower and compressor – positive displacement and dynamic types – reciprocating and rotary types.
Reciprocating : Principle of operation, work required, Isothermal efficiency, volumetric efficiency and effect of clearance, stage compression, undercooling, saving of work, minimum work condition for stage compression.

UNIT IV
Objectives : To make students learn mechanical details, and to calculate power and efficiency of rotary compressors
Rotary (Positive displacement type): Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations.
Dynamic Compressors: Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.
Axial Flow Compressors: Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency- pressure rise calculations – Polytropic efficiency.

UNIT – V

Objectives: To make students learn mechanical details, cycles, and to calculate power and efficiency of gas turbines.

GAS TURBINES: Simple gas turbine plant – Ideal cycle, essential components – parameters of performance – actual cycle – regeneration, inter cooling and reheating –Closed and Semi-closed cycles – merits and demerits, Brief concepts about compressors, combustion chambers and turbines of Gas Turbine Plant.

UNIT – VI

Objectives: To make students learn about jet propulsion & rockets and to calculate Thrust Power and Propulsion Efficiency.

JET PROPULSION: Principle of Operation –Classification of jet propulsive engines – Working Principles with schematic diagrams and representation on T-S diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo jet engines – Needs and Demands met by Turbo jet – Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation – Methods.

ROCKETS: Application – Working Principle – Classification – Propellant Type – Thrust, Propulsive Efficiency – Specific Impulse – Solid and Liquid propellant Rocket Engines.

TEXT BOOKS:
1. I.C. Engines / V. GANESAN- TMH
2. Thermal Engineering / Rajput / Lakshmi Publications.
3. Gas Turbines / V. GANESAN- TMH

REFERENCES:
1. IC Engines – Mathur & Sharma – Dhanpath Rai & Sons.
2. Engineering fundamentals of IC Engines – Pulkrabek / Pearson /PHI
3. I.C. Engines / Haywood/ McGrawHill
4. IC Engines/RK Rajput/Laxmi publications

FLUID MECHANICS & HYDRAULIC MACHINERY

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

UNIT I
Objective: After studying this unit student will know the concept of fluid and its properties, manometry, hydrostatic forces acting on different surfaces and also problem solving techniques.

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

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

UNIT II
Objective: In this unit student will be exposed to the basic laws of fluids, flow patterns, viscous flow through ducts and their corresponding problems.

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

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

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

UNIT III
Objective: At the end of this unit student will be aware of the concepts related to boundary layer theory, flow separation, basic concepts of velocity profiles, dimensionless numbers and dimensional analysis.

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

Dimensional Analysis: Similitude and modeling – Dimensionless numbers

UNIT IV
Objective: In this unit student will know the hydrodynamic forces acting on vanes and their performance evaluation.

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

UNIT V
Objective: At the end of this unit student will be aware of the importance, function and performance of hydro machinery.
Centrifugal pumps: classification, working, work done – manometric head- losses and efficiencies- specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.
Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

UNIT VI
Objective: After studying this unit student will be in a position to evaluate the performance characteristics of hydraulic turbines. Also a little knowledge on hydraulic systems and fluidics is imparted to the student.
Hydraulic Turbines: classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube- theory- functions and efficiency.
Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer. Hydraulic systems- hydraulic ram, hydraulic lift, hydraulic coupling. Fluidics – amplifiers, sensors and oscillators. Advantages, limitations and applications.

TEXT BOOKS:
1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.

REFERENCE BOOKS:
1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
3. Hydraulic Machines by Banga & Sharma, Khanna Publishers.
4. Instrumentation for Engineering Measurements by James W. Dally, William E. Riley ,John Wiley & Sons Inc. 2004 (Chapter 12 – Fluid Flow Measurements)
5. Fluid Mechanics and Hydraulic Machines by Domkundwar & Domkundwar, Dhanpatrai & Co.

PRODUCTION TECHNOLOGY

Course Objective:
To impart basic knowledge and understanding about the primary manufacturing processes such as casting, joining, forming and powder metallurgy and their relevance in current manufacturing industry; To introduce processing methods of plastics.

UNIT – I
Objective: To make the students understand fundamentals of casting
CASTING : Steps involved in making a casting – Advantage of casting and its applications. – Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Principles of Gating, Gating ratio and design of Gating systems

UNIT – II
Objective: To provide insight into sand casting and introduce other casting processes
Methods of melting and types of furnaces, Solidification of castings, Solidification of pure metals and alloys, short & long freezing range alloys. Risers – Types, function and design, casting design considerations, Basic principles and applications of Centrifugal casting, Die casting and Investment casting.

UNIT – III
Objective: To impart fundamentals of gas welding and arc welding
Welding : Classification of welding processes, types of welded joints and their
characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting.
Basic principles of Arc welding, Manual metal arc welding, Sub merged arc welding, Inert Gas welding- TIG & MIG welding.

UNIT – IV
Objective: To teach principles of advanced welding processes and their applications
Resistance welding, Solid state welding processes- Friction welding, Friction stir welding, Forge welding, Explosive welding; Thermit welding, Plasma welding, Laser welding, electron beam welding, Soldering & Brazing.
Heat affected zones in welding; pre & post heating, Weldability of metals, welding defects – causes and remedies – destructive and nondestructive testing of welds, Design of welded joints.

UNIT – V
Objective: To impart knowledge on bulk forming processes
Plastic deformation in metals and alloys, Hot working and Cold working, Strain hardening and Annealing.
Bulk forming processes: Forging - Types Forging, Smith forging, Drop Forging, Roll forging, Forging hammers, Rotary forging, forging defects; Rolling – fundamentals, types of rolling mills and products, Forces in rolling and power requirements. Extrusion and its characteristics. Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing.
Introduction to powder metallurgy – compaction and sintering, advantages and applications

UNIT – VI

Objective: To provide understanding of various sheet metal forming and processing of plastics.

Sheet metal forming - Blanking and piercing, Forces and power requirement in these operations, Deep drawing, Stretch forming, Bending, Springback and its remedies, Coining, Spinning, Types of presses and press tools.

Processing of Plastics: Types of Plastics, Properties, Applications and their processing methods, Blow and Injection molding.

TEXT BOOKS:

    a) Manufacturing Processes for Engineering Materials - Kalpakjian S and Steven R Schmid- Pearson Publ , 5th Edn.

    b) Manufacturing Technology -Vol I- P.N. Rao- TMH

    c) Fundamentals of Modern Manufacturing - Mikell P Groover- Wiley publ – 3rd Edition

REFERENCES :

1. Manufacturing Science – A.Ghosh & A.K.Malik – East West Press Pvt. Ltd
2. Process and materials of manufacture- Lindberg- PHI
3. Production Technology- R.K. Jain- Khanna
4. Production Technology-P C Sharma-S. Chand
5. Manufacturing Processes- H.S. Shaun- Pearson
6. Manufacturing Processes- J.P. Kaushish- PHI

INDUSTRIAL ENGINEERING MANAGEMENT

Course Objective:
To impart knowledge on scientific principles of management to improve productivity in manufacturing industry

UNIT – I
Objective: To introduce fundamentals of industrial engineering and management
Introduction: Definition of Industrial Engineering, Development, Applications, Role of an industrial engineer, Quantitative tools of IE and productivity measurement, Concepts of Management, Importance, Functions of management, Scientific management, Taylor's principles, theory X and theory Y, Fayol's principles of management.

UNIT – II
Objective: To teach basics of plant layout and its design.
Plant layout: Factors governing plant location, types of production layouts, advantages and disadvantages of process layout and product layout, applications, quantitative techniques for optimal design of layouts, Plant maintenance, preventive and breakdown maintenance.

UNIT – III
Objective: To introduce basic tools of operations management.
Operations Management: Importance, types of production, applications, work study, method study and time study, work sampling, PMTS, micro-motion study, rating techniques, MTM, work factor system, principles of Ergonomics, flow process charts, string diagrams and Therbligs.

UNIT – IV
Objective: To teach statistical quality control techniques
Statistical Quality Control: Quality control, its importance, Single and double sampling plans, OC curves and their uses; Control charts $-\bar{X}$ and R charts, $\bar{X}$ and S charts and their applications, numerical examples.

UNIT – V
Objective: To teach concepts of personnel management and value engineering
Resource management: Concept of human resource management, personnel management and industrial relations, functions of personnel management, Job-evaluation, its importance and types, merit rating, quantitative methods, wage incentive plans, types. Value analysis: value engineering, implementation procedure.

UNIT – VI
Objective: To provide fundamental principles of project management
Project management: PERT, CPM – differences & applications, Critical path, determination of floats, importance, project crashing, smoothing and numerical examples.

TEXT BOOKS:
   a) Industrial Engineering and Management by O.P Khanna, Khanna Publishers.

b) Industrial Engineering and Production Management, Martand Telsang, S.Chand & Company Ltd. New Delhi

REFERENCES:
1. Operations Management by J.G Monks, McGrawHill Publishers.
2. Production and Operations Management – R.Panneerselvam- PHI- 3rd Edition
3. Industrial Engineering by Banga & Sharma.
4. Principles of Management by Koontz O' Donnel, McGraw Hill Publishers.
5. PERT/CPM by L.S Srinath, East west Press.
6. Production and operations management by K.C Arora.
7. Statistical Quality Control by Gupta.
8. Manufacturing Organization and Management, Harold T. Amrine, John A. Ritchey, Colin L. Moodie & Joseph F. Kmec, Pearson
9. Production Management by Buffa,

MACHINE DRAWING

Course Objective: The student will acquire a knowledge of fastening arrangements such as welding, riveting the different styles of attachment for shaft. The student also is enabled to prepare the assembly of various machine or engine components and miscellaneous machine components.

Machine Drawing Conventions :

Need for drawing conventions – introduction to IS conventions

   a) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
   b) Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
   c) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
   d) Title boxes, their size, location and details - common abbreviations & their liberal usage
   e) Types of Drawings – working drawings for machine parts.

I.   Drawing of Machine Elements and simple parts
   Objective: To provide basic understanding and drawing practice of various joint, simple mechanical parts

Selection of Views, additional views for the following machine elements and parts with every drawing proportions.

   a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
   b) Keys, cottered joints and knuckle joint.
   c) Rivetted joints for plates
   d) Shaft coupling, spigot and socket pipe joint.
   e) Journal, pivot and collar and foot step bearings.

II.   Assembly Drawings:
   Objective: The student will be able to draw the assembly from the individual part drawing.

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

   a) Engine parts – stuffing boxes, cross heads, Eccentrics, Petrol Engine connecting rod, piston assembly.
   b) Other machine parts - Screws jacks, Machine Vices Plummer block, Tailstock.
   c) Valves : Steam stop valve, spring loaded safety valve, feed check valve and air cock.

NOTE : First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

TEXT BOOKS:
   1. Machine Drawing – Dhawan, S.Chand Publications
   2. Machine Drawing –K.L.Narayana, P.Kannaiah & K. Venkata Reddy / New Age/ Publishers

REFERENCES:
   1. Machine Drawing – N.Siddeswar, K.Kannaiah & V.V.S.Sastry - TMH
   2. Machine Drawing – P.S.Gill,
   3. Machine Drawing – Luzzader

4. Machine Drawing – Rajput
5. Machine Drawing – N.D. Junnarkar, Pearson
6. Machine Drawing – Ajeeth Singh, McGraw Hill
7. Machine Drawing – KC John, PHI
8. Machine Drawing – B Battacharya, Oxford
9. Machine Drawing – Gowtham and Gowtham, Pearson

THERMAL ENGINEERING LAB

Course objective: To provide hands on experience in operating various types of internal combustion engines and understand their functioning and performance.

1.   I.C. Engines valve / port timing diagrams.
2.   I.C. Engines performance test (4 -stroke diesel engines)
3.   I.C. Engines performance test on 2-stroke petrol.
4.   Evaluation of engine friction by conducting morse test on 4-stroke multi cylinder petrol engine.
5.   Determination of FHP by retardation and motoring test on IC engine.
6.   I.C. Engines heat balance.
7.   Economical speed test of an IC engine.
8.   Performance test on variable compression ratio engines.
9.   Performance test on reciprocating air compressor unit.
10.   Dis-assembly / assembly of different parts of two wheelers. 3 wheelers & 4 wheelers. Tractor & Heavy duty engines covering 2-stroke and 4 stroke, SI and CI engines.

FLUID MECHANICS & HYDRAULIC MACHINERY LAB

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

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

DYNAMICS OF MACHINERY

Course Objectives:
1. To equip the student with fundamental knowledge of dynamics of machines so that student can appreciate problems of dynamic force balance, transmissibility of forces, isolation of systems, vibrations.
2. Develop knowledge of analytical and graphical methods for calculating balancing of rotary and reciprocating masses.
3. Develop understanding of vibrations and its significance on engineering design
4. Develop understanding of dynamic balancing, flywheel analysis, gyroscopic forces and moments

UNIT – I
PRECESSION: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships, static and dynamic force analysis of planar mechanisms, (Demonstration of models in video show).

UNIT – II
FRICTION: Inclined plane, friction of screw and nuts, pivot and collar, uniform pressure, uniform wear, friction circle and friction axis: lubricated surfaces, boundary friction, film lubrication.
CLUTCHES: Friction clutches- single disc or plate clutch, multiple disc clutch, cone clutch, centrifugal clutch.
BRAKES AND DYNAMOMETERS: Simple block brakes, internal expanding brake, band brake of vehicle. General description and operation of dynamometers: Prony, Rope brake, Epicyclic, Bevis Gibson and belt transmission,

UNIT – III
TURNING MOMENT DIAGRAMS: Dynamic force analysis of slider crank mechanism, inertia torque, angular velocity and acceleration of connecting rod, crank effort and turning moment diagrams – fluctuation of energy – fly wheels and their design.

UNIT-IV
GOVERNERS: Watt, porter and proell governors, spring loaded governors – Hartnell and Hartung with auxiliary springs. sensitiveness, isochronism and hunting.

UNIT – V
BALANCING: Balancing of rotating masses single and multiple – single and different planes, use analytical and graphical methods. Primary, secondary, and higher balancing of reciprocating masses. analytical and graphical methods, unbalanced forces and couples – examination of "V" multi cylinder in line and radial engines for primary and secondary balancing, locomotive balancing, hammer blow, swaying couple, variation of tractive effort.

UNIT – VI
VIBRATIONS: Free Vibration of spring mass system – oscillation of pendulums, centers of oscillation and suspension. transverse loads, vibrations of beams with concentrated and distributed loads. Dunkerly's methods, Raleigh's method, whirling of shafts, critical speeds, torsional vibrations, two and three rotor systems, Simple problems on forced damped vibration, vibration isolation and transmissibility.

TEXT BOOKS:
1.   Theory of Machines / S.S Ratan/ Mc. Graw Hill Publ.
2.   Mechanism and machine theory by Ashok G. Ambedkar, PHI Publications.

REFERENCES:
1.   Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age
2.   Theory of Machines / Shiegly / MGH
3.   Theory of Machines / Thomas Bevan / CBS Publishers
4.   Theory of machines / Khurmi/S.Chand.

Course outcomes:

Upon successful completion of this course the student should be able to⬜

1. Analyze stabilization of sea vehicles, aircrafts and automobile vehicles
2. Compute frictional losses, torque transmission of mechanical systsms.
3. Analyze dynamic force analysis of slider crank mechanism and design of flywheel.
4. Understand how to determine the natural frequencies of continuous systems starting from the general equation of displacement.
5. Understand balancing of reciprocating and rotary masses.

MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS

Unit – I: (*The Learning objective of this Unit is to understand the concept and nature of Managerial Economic s and its relationship with other disciplines, Concept of Demand and Demand forecasting)

Introduction to Managerial Economics and demand Analysis:

Definition of Managerial Economics and Scope-Managerial Economics and its relation with other subjects-Concepts of Demand-Types-Determents-Law of Demand its Exception-Elasticity of Demand-Types and Measurement-Demand forecasting and its Methods.

(**The Learner is equipped with the knowledge of estimating the Demand for a product and the relationship between Price and Demand)

Unit – II: (*The Learning objective of this Unit is to understand the concept of Production function, Input Output relationship, different Cost Concepts and Concept of Cost-Volume-Profit Analysis)

Production and Cost Analyses:

Production function-Isoquants and Isocosts-Law of Variable proportions-Cobb-Douglas Production function-Economics of Sale-Cost Concepts-Opportunity Cost-Fixed vs Variable Costs-Explicit Costs vs Implicit Costs-Out of Pocket Costs vs Imputed Costs-Cost Volume Profit analysis-Determination of Break-Even Point (Simple Problem)

(**One should understand the Cost Concepts for decision making and to estimate the least cost combination of inputs).

Unit – III: (*The Learning Objective of this Unit is t understand the Nature of Competition, Characteristics of Pricing in the different market structure and significance of various pricing methods)

Introduction to Markets, Theories of the Firm & Pricing Policies:

Market Structures: Perfect Competition, Monopoly and Monopolistic and Oligopoly – Features – Price, Output Determination – Managerial Theories of firm: Maris and Williamson's models – Methods of Pricing: Limit Pricing, Market Skimming Pricing, Internet Pricing: Flat Rate Pricing, Usage sensitive, Transaction based pricing, Priority Pricing.

(** One has to understand the nature of different markets and Price Output determination under various market conditions)

Unit – IV: (*The Learning objective of this Unit is to know the different forms of Business organization and their Merits and Demerits both public & private Enterprises and the concepts of Business Cycles)

Types of Business Organization and Business Cycles:

Features and Evaluation of Sole Trader – Partnership – Joint Stock Company – State/Public Enterprises and their forms – Business Cycles – Meaning and Features – Phases of Business Cycle.

(**One should equipped with the knowledge of different Business Units)

Unit – V: (*The Learning objective of this Unit is to understand the different Accounting Systems preparation of Financial Statements and uses of different tools for performance evaluation)

Introduction to Accounting & Financing Analysis:

Introduction to Double Entry Systems – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow cash flow statements (Simple Problems)

(**The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis)

Unit – VI: (*The Learning objective of this Unit is to understand the concept of Capital, Capitalization, Capital Budgeting and to know the techniques used to evaluate Capital Budgeting proposals by using different methods)

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Need for Capital Budgeting-Techniques of Capital Budgeting-Traditional and Modern Methods.

(**The Learner is able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making)

Note: *Learning Objective
        ** Learning Assessment

TEXT BOOKS

1. Dr. N. Appa Rao, Dr. P. Vijay Kumar: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi – 2011
2. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011
3. Prof. J.V.Prabhakara rao, Prof. P. Venkatarao. 'Managerial Economics and Financial Analysis', Ravindra Publication.

REFERENCES:

1. V. Maheswari: Managerial Economics, Sultan Chand.
2. Suma Damodaran: Managerial Economics, Oxford 2011.
3. Dr. B. Kuberudu and Dr. T. V. Ramana: Managerial Economics & Financial Analysis, Himalaya Publishing House 2011.
4. Vanitha Agarwal: Managerial Economics, Pearson Publications 2011.
5. Sanjay Dhameja: Financial Accounting for Managers, Pearson.
6. Maheswari: Financial Accounting, Vikas Publications.
7. S. A. Siddiqui & A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers, 2012

DESIGN OF MACHINE ELEMENTS

Course Objectives: To impart the knowledge of the design procedures and principles so as to enable the student, understand and design basic mechanical elementals that are subjected to various loads.

UNIT – I
Objective: To learn various factors to be considered in designing an element and to understand different theories of failures.
INTRODUCTION: General considerations in the design of Engineering Materials and their properties – Manufacturing consideration in design. Tolerances and fits –BIS codes of steels.
STRESSES IN MACHINE MEMBERS: Simple stresses – Combined stresses – Torsional and bending stresses - Various theories of failure – factors of safety – Design for strength and rigidity – preferred numbers. Static strength design based on fracture toughness.
STRENGTH OF MACHINE ELEMENTS : Stress concentration –Fatigue stress concentration factor-notch sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Goodman's line – Soderberg's line – Modified goodman's line.

UNIT – II
Objectives: The students are to be exposed to the design of riveted, welded joints and bolted joints.
Rivited and welded joints – Design of joints with initial stresses
Bolted joints – Design of bolts with pre-stresses – both of uniform strength.

UNIT – III
Objective: To learn various factors to be considered in designing shafts subjected to different loads. Further, design aspects of rigid and flexible couplings.
Shafts, keys and cotters:
SHAFTS : Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code. Design of Keys-stresses in keys-cottered joints-spigot and socket, sleeve and cotter.
COUPLINGS: Design of Rigid couplings: Muff, Split muff and Flange couplings□-Flexib couplings.
UNIT – IV
Objective: The students are to be exposed to learn various factors to be considered in designing different types of springs.
Mechanical Springs: Stresses and deflections of helical springs – Extension and DMM – I compression springs – Springs for fatigue loading – natural frequency of helical springs – Energy storage capacity – helical torsion springs – Co-axial springs, leaf springs.

UNIT – V

Objective: The objective is to make the students learn fundamentals of lubrication, various bearings and estimation of bearing life.

BEARINGS : Types of Journal bearings – Lubrication – Bearing Modulus – Full and partial bearings – Clearance ratio – Heat dissipation of bearings, bearing materials – journal bearing design – Ball and roller bearings – Static loading of ball & roller bearings, Bearing life.

UNIT – VI

Objective: The objective is to make the students use the design concepts to design various engine components.

ENGINE PARTS: Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends – Cranks and Crank shafts, strength and proportions of over hung and center cranks – Crank pins, Crank shafts. Pistons, Forces acting on piston – Construction Design and proportions of piston, Cylinder timers.

Course outcomes:

The students completing the course will be able to understand the concepts of various theories of failure, factors of safety, Design for strength and rigidity. Further the same will be used to design mechanical parts such as joints, shafts couplings, springs, bearings and other engine components.

TEXT BOOKS:

1. Dr P. Kannaiah Scitech Publishers
2. Design of Machine Elements/ T.J. Prabhu
3. Machine Design / Soundararaja Murthy and shanmugam
4. Machine design – Pandya & shah.

REFERENCES:

1. Design of Machine Elements / V.M. Faires
2. Machine design / Schaum Series.
3. Mech. Engg. Design / JE Shigley
4. Machine Design / Sarma and Agarwal
5. Machine Design / V.V. Bhandari
6. Machine Design Hand Book / V.V. Bandari

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VEHICLE TRANSPORT MANAGEMENT

Course Objectives: To impart the knowledge of organization and managing different kinds of vehicle transport systems. Should be able to develop an efficient transport management system considering infrastructure, public relations, route planning, schedules, and fare structure.

UNIT – I
Objective: The objective is to understand the history of transport management and the infrastructure requirements. The student will be able to understand the need of preventive maintenance.
Historical Back ground: Introduction, the growth of a network, trams, trolley buses, private car's subsidies.
The Infrastructure: Road- Approach Road. Highways National, State, District, traffic condition, relief of congestion, pedestrians, zebra lines, margins, shopping centres. Bus-stops. Shelters, Bus stations, Garages layout of premises, equipment, use of machinery, conveyance of staff, facilities for passengers. Maintenance -preventive, breakdown, overhauling -major, minor.

UNIT - II
Objective: The objective is to introduce the concepts of organization, administration and inter departmental liaison.
Organization and Management: Forms of ownership, principle of transport management - staff administration: industrial relation, administration, recruitment and training, welfare, health and safety.
Public relations divisions: Dissemination of information, handling complaints, traffic advisory. Committees- local contractors -inter departmental liaison advertisements, signs, notice and directions- general appearance of premises, specialized publicity.

UNIT - III
Objective: The student will be exposed how to prevent accidents by recording and estimating using different mechanisms.
Prevention of accidents: Emphasis of safe driving-annual, awards, bonus encouragement vehicle design platform, layout, location of steps, scheduled route hazards records elimination of accident prone devices.
Route planning: Source of traffic, town planning, turning points, stopping places, shelters survey of route preliminary schedule test runs elimination of hazards factors affecting. Frequency direction of traffic flow estimated traffic possibility single verses double deck.

UNIT - IV
Objective: The objective is to make the students schedule vehicle and crew timings and fare collection systems.
Timing, bus working and schedules : Time table layout uses of flat graph method of presentation preparation of vehicle and crew schedule preparation of the duty roster, co-operation with employers use of the vehicle running numbering- determination of vehicle efficiency, checking efficiency of crew, duty arrangements.

UNIT - V
Objectives: The students are to be exposed to derive fare structure by estimating the operating costs for various types of vehicles.
Fare collections systems: Principles of collection the way bill, bell punch system, Box system personal and common stock flat fare platform control.
The fare structure: Basis of fares historical background effects of competition and control calculating average zone system straight and tapered scale.

UNIT - VI
Objectives: The objective is to make the students understand various types of vehicles and to estimate the operating cost by considering factors like depreciation, obsolescence, life of vehicles and wages etc.,
Operating cost and types of vehicles: Classification costs, average speed running costs supplementary costs depreciation obsolescence, life of vehicles- sinking fund factor- wages and overheads 100 seats miles basis, average seating capacity vehicles size and spread overs, types of vehicle economic considerations authorization of trolley, bus services, statuary procedure taxes and hire cars.

Course outcomes:
The students completing the course will be able to understand the concepts of transport management, various types of roads, preventive breakdown and overhauling. Further the student shall be able to understand route planning, crew schedule and fare structure fixation.

TEXT BOOKS:

1. Bus Operation -L.D.Kitchen, Lliffe & Sons
2. Bus & Coach Operation -Rex W. Fautks, Butterworth Version Of 1987

REFERENCES:

1. Compendium Of Transport Terms Cirt, Pune
2. M.V. Act 1988 Central Law Agency, Allahabad
3. The Elements Of Transportation -R.J. Eaton
4. Goods Vehicle Operation -By C.S. Dubbar
5. Road Transport Law- L. Dkitchen
5. Road Transport Law – L.D. Kitchen
6. Compendium Of Transport Terms Cirt, Pune (Report
7. M.V. Act 1988, Pub Central Law Agency, Allahabad

HEAT TRANSFER
(Heat transfer data book allowed)

Course Objectives:

This course is intended to impart knowledge of principles of heat transfer and analyze the heat exchange process in various modes for the evaluation of rate of heat transfer and the temperature distribution in different configurations. □

UNIT – I

INTRODUCTION: Modes and mechanisms of heat transfer – basic laws of heat transfer –General discussion about applications of heat transfer.

CONDUCTION HEAT TRANSFER: Fourier rate equation – general heat conduction equation in cartesian, cylindrical and Spherical coordinates. Steady, unsteady and periodic heat transfer – initial and boundary conditions.

ONE DIMENSIONAL STEADY STATE CONDUCTION HEAT TRANSFER: Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – critical radius of insulation- Variable thermal conductivity – systems with heat sources or heat generation,

UNIT – II

extended surface (fins) heat Transfer – long fin, fin with insulated tip and short fin, application to error measurement of temperature.

ONE DIMENSIONAL TRANSIENT CONDUCTION HEAT TRANSFER: Systems with negligible internal resistance – significance of biot and fourier numbers - chart solutions of transient conduction systems

UNIT – III

CONVECTIVE HEAT TRANSFER: Classification of convective heat transfer – dimensional analysis as a tool for experimental investigation – Buckingham Pi Theorem for forced and free convection, application for developing semi – empirical non- dimensional correlation for convective heat transfer – Significance of non-dimensional numbers – concepts of continuity, momentum and Energy Equations.

UNIT –IV

FORCED CONVECTION

EXTERNAL FLOWS: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer -flat plates and cylinders.

INTERNAL FLOWS: Concepts about hydrodynamic and thermal entry lengths – division of internal flow based on this –use of empirical relations for horizontal pipe flow and annulus flow.

FREE CONVECTION: Development of hydrodynamic and thermal boundary layer along a vertical plate – use of empirical relations for vertical plates and pipes.

UNIT V

HEAT TRANSFER WITH PHASE CHANGE

BOILING: Pool boiling – regimes- calculations on nucleate boiling, critical heat flux and film boiling.

CONDENSATION: Film wise and drop wise condensation –nusselt's theory of condensation on a vertical plate - film condensation on vertical and horizontal cylinders using empirical correlations.

HEAT EXCHANGERS:

Classification of heat exchangers – overall heat transfer coefficient and fouling factor – concepts of LMTD and NTU methods – Problems.

UNIT VI
RADIATION HEAT TRANSFER:
Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchoff, Lambert, Stefan and Boltzmann– heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation networks.

TEXT BOOKS:
1.   Heat Transfer - HOLMAN/TMH
2.   Heat Transfer – P.K.Nag/ TMH
3.   Principles of Heat Transfer – Frank Kreith, RM Manglik & MS Bohn, Cengage learning publishers

REFERENCES:
1.   Heat and Mass Transfer – Arora and Domkundwar, Dhanpatrai & sons
2.   Fundamentals of Engg. Heat and Mass Transfer / R.C.SACHDEVA / New Age International
3.   Heat and Mass Transfer –Cengel- McGraw Hill.
4.   Heat and Mass Transfer – D.S.Kumar / S.K.Kataria & Sons

   Course outcomes:
   The student after undergoing this course is expected to know the principles of heat transfer and be able to apply to practical situations where in heat exchange takes place through various modes of heat transfer including phase change.

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FUELS AND COMBUSTION

Course Objectives: To impart the knowledge about the different kinds of fuels and principles of combustion, thermodynamics of combustion and flame propagation. The objective is to study and understand the combustion phenomena to increase combustion efficiency.

UNIT – I:

Objective: The objective is to introduce the use and the application of different fuel types and characteristics. The student will be able to understand various fuel handling and storage methods.

FUELS: Detailed classification – Conventional and Unconventional Solid, Liquid, gaseous fuels and nuclear fuels – Origin of Coal – Analysis of coal.

Coal – Carburisation, Gasification and liquification – Lignite, properties of coal, action of heat on coal, oxidation of coal, hydrogenation of coal, efficient use of solid fuels, manufactured fuels, agro fuels, solid fuel handling, properties related to combustion, handling and storage.

Unit-II

Objective: The objective is to expose the student about petroleum refining and conversion process in general and in India in particulars.

Origin and classification of Petroleum, refining and other conversion processes, composition of petroleum with respect to combustion, property and testing of petroleum products, various petroleum products, Nature of Indian Crudes & Petroleum refining in India, storage and handling of liquid fuels, liquid fuels combustion equipment.

Types of gaseous fuels, Natural gases, methane from coal mine, Producer gas, water gas, blast furnace gas, LPG.

UNIT – III

Objective: The objective is to make the students study and understand basic principles of combustion and chemical kinetics.

PRINCIPLES OF COMBUSTION: Chemical composition – Flue gas analysis – dew point of products – Stoichiometry Stoichiometry relations, theoretical air required for complete combustion, Chemical kinetics – Rate of reaction – Reaction order – Molecularity – Zeroth, first, second and third order reactions - complex reactions – chain reactions. Theories of reaction Kinetics – General oxidation behaviour of HC's.

UNIT – IV

Objective: The objective is to make the students study thermodynamics of combustion process and calculate adiabatic flame temperature.

THERMODYNAMICS OF COMBUSTION: Enthalpy of formation – Heating value of fuel – determination of heating value of fuels-Adiabatic flame Temperature –chemical equilibrium, Equilibrium composition of gaseous mixtures. Combustion analysis- problems.

UNIT – V

Objective: The objective is to study flame propagation, factors effecting the flame propagation of various kinds of fuels.

LAMINAR AND TURBULENT FLAMES PROPAGATION AND STRUCTURE: Flame stability – Burning velocity of fuels – Measurement of burning velocity – factors affecting the burning velocity.

Flame Propagation - Solid, Liquid & Gaseous Fuels Combustion - Flame Temperature - Theoretical, Adiabatic & Actual - Ignition Limits - Limits of Inflammability.

Unit-VI

Objective: The students are to be exposed to various combustion systems and design of burners for different kinds of fuels.

Combustion of fuel, droplets and sprays – Combustion systems – Pulverized fuel furnaces – fixed, Entrained and Fluidised Bed Systems. Burner Design: **B**asic features of solid, liquid and gaseous fuel burner, design consideration of different types of coal, oil and gas burners, recuperative and regenerative burners

Course outcomes:

The students completing the course will be able to understand the various kinds of fuels, their characteristics and origin. Further the student will be enriched with enough knowledge to understand the thermodynamics behind combustion, flame propagation and choice of combustion systems.

TEXT BOOKS:
1. Combustion Fundamentals / Roger A strehlow / Mc Graw Hill
2. Fuels and combustion / Sharma and Chander Mohan/ Tata McGraw Hill
3. Samir Sarkar, Fuels & Combustion, 2nd Edition, Orient Longman
4. Combustion Engineering and Fuel Technology / Shaha A.K./ Oxford and IBH.

REFERENCES:
1. Principles of Combustion / Kanneth K.Kuo/ Wiley and Sons.
2. Combustion / Sarkar / McGraw Hill.
3. An Introduction to Combustion / Stephen R. Turns/ McGraw Hill International Edition.
4. Combustion Engineering / Gary L. Berman & Kenneth W. Ragland/ McGraw Hill International Edition.

HEAT TRANSFER LAB

Objectives:

The laboratory course is aimed to provide the practical exposure to the students with regard to the determination of amount of heat exchange in various modes of heat transfer including condensation & boiling for several geometries.

1. Determination of overall heat transfer co-efficient of a composite slab
2. Determination of heat transfer rate through a lagged pipe.
3. Determination of heat transfer rate through a concentric sphere
4. Determination of thermal conductivity of a metal rod.
5. Determination of efficiency of a pin-fin
6. Determination of heat transfer coefficient in forced convection
7. Determination of heat transfer coefficient in natural convection.
8. Determination of effectiveness of parallel and counter flow heat exchangers.
9. Determination of emissivity of a given surface.
10. Determination of Stefan Boltzman constant.
11. Determination of heat transfer rate in drop and film wise condensation.
12. Determination of critical heat flux.
13. Demonstration of heat pipe.
14. Study of two – phase flow.

Outcomes: The student should be able to evaluate the amount of heat exchange for plane, cylindrical & spherical geometries and should be able to compare the performance of extended surfaces and heat exchangers

PRODUCTION TECHNOLOGY LAB

Course Objective: To impart hands-on practical exposure on manufacturing processes and equipment.

Minimum of 12 Exercises need to be performed

I. METAL CASTING:
1.   Pattern Design and making - for one casting drawing.
2.   Sand properties testing - for strength and permeability
3.   Mould preparation, Melting and Casting

II WELDING:
1.   Gas welding
2.   Gas cutting
3.   Manual metal arc welding - Lap & Butt Joints
4.   TIG/MIG Welding
5.   Resistance Spot Welding
6.   Brazing and soldering

III METAL FORMING AND POWDER METALLURGY:
1.   Blanking & Piercing operations and study of simple, compound and progressive dies.
2.   Deep drawing and extrusion operations.
3.   Bending and other operations
4.   Basic powder compaction and sintering

IV PROCESSING OF PLASTICS:
1.   Injection Moulding
2.   Blow Moulding

Course outcomes:

Attending the laboratory the students shall be able to

1. To apply some of the manufactures process directly in the industry for preparation of complicated jobs.
2. At the end of the lab learn preparation of various jobs using various manufacturing process
3. The student will be trained to implement similar features in preparation of jobs can be extended to implement in the preparation of complicated jobs.

INTELLECTUAL PROPERTY RIGHTS AND PATENTS

Unit I

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics - Types of Intellectual Property - Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement - Regulatory – Over use or Misuse of Intellectual Property Rights - Compliance and Liability Issues.

Unit II

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law- Semiconductor Chip Protection Act.

Unit III

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cooperation Treaty – New developments in Patent Law- Invention Developers and Promoters.

Unit IV

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law

Unit V

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law.

Unit VI

Introduction to Cyber Law – Information Technology Act - Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy - International aspects of Computer and Online Crime.

REFERENCE BOOKS:

1. Deborah E.Bouchoux: "Intellectual Property". Cengage learning , New Delhi
2. Kompal Bansal & Parishit Bansal "Fundamentals of IPR for Engineers", BS Publications (Press)
3. Cyber Law. Texts & Cases, South-Western's Special Topics Collections
4. Prabhuddha Ganguli: ' Intellectual Property Rights" Tata Mc-Graw – Hill, New Delhi
5. Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.
6. R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.
7. M.Ashok Kumar and Mohd.Iqbal Ali: "Intellectual Property Right"

Serials Pub.

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MACHINE TOOLS & METROLOGY

Course Objectives: The students completing this course are expected to understand the concept of various working principles of various machine tools and concepts of metal cutting. Further there are exposed to the importance of metrology.

UNIT – I
Objective: The fundamentals of metal cutting and forces involved will be given enough exposer to the student.
Elementary treatment of metal cutting theory – element of cutting process – geometry of single point tool angles, chip formation and types of chips – built up edge and its effects chip breakers, mechanics of orthogonal cutting –Merchant's force diagram, cutting forces, cutting speeds, feed, depth of cut, tool life, coolants, tool materials.

UNIT – II
Objective: the students are to be exposed the fundamental concepts of Engine Lathe and its various operations that can be performed.
Engine Lathe :– principle of working, specification of lathe – types of lathe – work holders tool holders – operations performed- box tools taper turning, thread turning – for lathes and attachments, turret and capstan lathes – collet chucks – other work holding – tool holding devices.
Principal features of automatic lathes – classification – single spindle and multi-spindle automatic lathes.

UNIT – III
Objective: the students are to be exposed the fundamental concepts of Shaping, Slotting, and
Planning, Drilling and boring machines and its various operations that can be performed
Shaping, slotting and planning machines**:** Principles of working – principal parts – specifications, operations performed, machining time calculations.
Drilling & Boring machines: Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring Machines – jig boring machine, deep hole Drilling Machine.

UNIT – IV
Objective: the students are to be exposed the fundamental concepts of Milling machines, grinding machines and its various operations that can be performed
Milling machine: Principles of working – specifications – classification of Milling Machines – machining operations, types of cutters and geometry.
Grinding: Theory of grinding – classification of grinding machines, different types of abrasives, bonds, specification and selection of a grinding wheel. Lapping, Honing & Broaching operations, comparison to grinding.

UNIT-V
Objective: The students are to be exposed to the fundamental concepts and systems of limits and tolerances and measurement instruments.
SYSTEMS OF LIMITS AND FITS: Introduction, nominal size, tolerance, limits, deviations, fits and their types-unilateral and bilateral tolerance system, hole and shaft basis systems-interchangeability.

Linear measurement: Length standards, end standards, slip gauges- calibration of the slip gauges, dial indicators, micrometers.

Measurement of angles and tapers: Different methods – bevel protractor, angle slip gauges-clinometer

Limit gauges: Taylor's principle – design of go and no go gauges; plug, ring, snap, gap, taper, profile and position gauges.

UNIT-VI

Objective: The students are to be exposed the fundamental concepts of optical measuring instruments and surface measurement instruments.

Optical measurement instruments: Tools maker's microscope and uses - collimators, optical projector, optical flats and their uses.

Surface roughness measurement: Differences between surface roughness and surface waviness.

Comparators: Types - mechanical, optical, electrical and electronic, pneumatic comparators and their uses.

Course outcomes: The students completing the course will be able to understand the various machines tools and their operating principles and various precision measuring procedures.

TEXT BOOKS
1.   Production Technology by R.K. Jain and S.C. Gupta.
2.   Workshop Technology – B.S.Raghu Vamshi – Vol II
3.   Engineering Metrology by Mahajan / Dhanpat Rai Publishers

REFERENCES
1.   Production Engineering, K.C Jain & A.K Chitaley, PHI Publishers
2.   Engineering Metrology by R.K.Jain / Khanna Publishers

INSTRUMENTATION & CONTROL SYSTEMS

Course Objectives:
The course focuses on imparting the principles of measurement which includes the working mechanism of various sensors and devices that are in use to measure the important physical variables of various mechatronic systems.

UNIT – I
Definition – Basic principles of measurement – measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. dynamic performance characteristics – sources of error, classification and elimination of error.

Measurement of Displacement: Theory and construction of various transducers to measure displacement – piezo electric, inductive, capacitance, resistance, ionization and photo electric transducers, calibration procedures.

UNIT – II
MEASUREMENT OF TEMPERATURE: Classification – ranges – various principles of measurement – expansion, electrical resistance – thermistor – thermocouple – pyrometers – temperature indicators.

MEASUREMENT OF PRESSURE: Units – classification – different principles used. manometers, piston, bourdon pressure gauges, bellows – diaphragm gauges. low pressure measurement – thermal conductivity gauges – ionization pressure gauges, mcleod pressure gauge.

UNIT – III
MEASUREMENT OF LEVEL: Direct method – indirect methods – capacitative, ultrasonic, magnetic, cryogenic fuel level indicators – bubler level indicators.

FLOW MEASUREMENT: Rotameter, magnetic, ultrasonic, turbine flow meter, hot – wire anemometer, laser doppler anemometer (LDA).

MEASUREMENT OF SPEED: Mechanical tachometers – electrical tachometers – stroboscope, noncontact type of tachometer

Measurement of Acceleration and Vibration: Different simple instruments – principles of seismic instruments – vibrometer and accelerometer using this principle.

UNIT – IV
STRESS STRAIN MEASUREMENTS: Various types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – usage for measuring torque, strain gauge rosettes.

UNIT – V
MEASUREMENT OF HUMIDITY – Moisture content of gases, sling psychrometer, absorption psychrometer, dew point meter.

MEASUREMENT OF FORCE, TORQUE AND POWER- Elastic force meters, load cells, torsion meters, dynamometers.

UNIT – VI

ELEMENTS OF CONTROL SYSTEMS : Introduction, importance – classification – open and closed systems, servomechanisms–examples with block diagrams–temperature, speed & position control systems.

TEXT BOOKS:
1.   Measurement Systems: Applications & design by D.S Kumar.
2.   Mechanical Measurements / BeckWith, Marangoni,Linehard, PHI / PE

REFERENCES:
1.   Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhanesh/ TMH
2.   Experimental Methods for Engineers / Holman.
3.   Mechanical and Industrial Measurements / R.K. Jain/ Khanna Publishers.
4.   Instrumentation, measurement & analysis by B.C.Nakra & K.K.Choudhary, TMH
    Course outcomes:

    After undergoing the course the student can select appropriate device for the measurement of parameters like temperature, pressure, speed, stress, humidity, flow velocity etc., and justify its use through characteristics and performance.

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AUTOMOTIVE ELECTRICAL AND AUTOTRONICS

Course Objectives: To impart the knowledge of various automotive electrical and electronic systems. To study and understand the functioning of different systems like ignition system, starter motors, electronic controls of carburetion, dash board units and other auto electrical Systems.

Unit-I

Objective: To make the student understand the working of storage battery and the principles involved in it. Further the factors affecting the performance of the battery will be studied.

Storage Battery: Principles of lead acid cells and their characteristics. construction and working of lead acid battery. types of batteries, testing of batteries, effect of temperature on capacity and voltage, battery capacity, voltage, efficiency, charging of batteries, sulphation and desulphation, maintenance and servicing. Fault diagnosis. New developments in electrical storage.

Unit-II

Objective: To make the student understand the ignition system and electronic components involved in automobiles.

Ignition System: Conventional ignition system and study of its components. Types of ignition systems, spark advance and retarding mechanisms. Types of spark plugs.

a) Electronic controls of carburetion, component of fuel injection systems, multipoint injection. Bosch L-variation electronic control diesel fuel injection.

b) Starter motor: Construction and working of series and shunt automotive starter motor, starter motor troubles and repairs.

Unit - III

Objective: To make the students understand the working of alternator and charging systems.

Charging system: Principle of generation of direct current. construction and working of alternator generating systems. Maintenance, servicing and trouble shooting. Bosch compact alternator.

Unit-IV

Objective: To make the students understand the working of fusing systems and wiring involved in auto electrical systems.

Wiring for auto electrical Systems: Earth return and insulated return systems, six volt and twelve volt systems, fusing of circuits, low and high voltage automotive cables, wiring diagram for typical automotive wiring systems, maintenance and servicing.

Unit-V

Objective: To make the students understand the dash board units and electrical accessories.

Dash board units and electrical accessories: Principle of automobile illumination, head lamp construction and wiring, horn, wind screen wiper signaling devices, fog lamps, auxiliary lighting , temperature gauge, oil pressure gauge, fuel gauge, speedometer, odometer.

Unit – VI

Objective: To enhance the students knowledge regarding Binary numbers and conversions.

Number system codes and data representation: Binary numbers, number base conversion, decimal, octal and hexa-decimal numbers, BCD codes, memory representation of positive and negative integers, conversion real numbers. Logic gates, arithmetic circuits and introduction to microprocessors: Study of basic and universal logic gates, study of X-OR and X-NOR gates. flip flop, S-R, S-J flip flop and counters and shift resistance, half adders and subtractions.

Course outcomes: The students completing the course will be able to understand the different automotive electrical systems, energy storages and ignition systems and the electronic components involved. The student will be in position to identify the fault diagnosis and preventive measures.

TEXTBOOKS

1. Automotive Electrical auxiliary systems -By N. R. Khatawale
2. Digital Logic and Computer Design by Mano, Prentice hall of India
3. Understanding Automotive Electronics- William B.Ribbens-ELSEVIER

REFERENCES

1. Automotive Electrical systems -By Young and Griffith, Butterworth
2. Basic automotive electrical systems -By C.P.Nakra, Dhanpat Rai.
3. Automotive mechanics -By William H. Grouse, TMH 5. Modem Electrical Equipments - By A. W. Judge,
4. Automotive Electrical Equipment -By P.l. Kohli, TMH

ALTERNATIVE ENERGY SOURCES FOR AUTOMOBILES

Course Objectives: To impart the necessity of finding alternative energy sources for automobiles. To understand merits and demerits, performance characteristics of various sources of fuels and their comparison.

Unit-I
Objective: The objective is to introduce the use and the application of different fuel types and characteristics. The student will be able to understand Solar photo-voltaic conversion and working principles.
Introduction: Need for non-conventional energy sources. Energy alternative : solar, photo-voltaic, Hydrogen, Bio mass. Electrical - their merits and demerits.
Solar photo-voltaic conversion, Collection and storage of solar energy, collection devices, flat plate collectors, concentrating type collectors, principles and working of photo-voltaic Conversion, Applications to automobiles.

Unit-II
Objective: The objective is to expose the student about energy from bio-mass performance characteristics.
Energy from Bio mass: Photosynthesis, photosynthetic oxygen production, energy plantation. Bio gas production from organic waste, description and types of Bio gas plants, Application and limitations - Merits and demerits performance characteristics and their comparison.

Unit-III
Objective: The objective is to expose the students to study and understand basic principles of hydrogen energy and thermo-chemical production.
Hydrogen Energy: Properties of Hydrogen, sources of Hydrogen, Thermodynamics of water splitting Production of Hydrogen, Electrolysis of water. Thermal decomposition of water. Thermo-chemical production, Biochemical production.

Unit – IV
Objective: To learn various factors to be considered in hydrogen fuel usage, and to study performance. Design and study of future possibilities of electric automobiles.
Hydrogen fuel, Storage and Transportation methods, Applications to engines modifications necessary, precautions and safety measures - Performance characteristics in Engine and their comparison.
Electric Automobiles: Design considerations, limitations. opportunities for improvement Batteries, problems. future possibilities , capacities, types , material requirement.

Unit – V

Objective: To learn various factors to be considered in hydrogen fuel usage, study of performance. Design and study of future possibilities of electric automobiles.

Applicability of electric cars, Driving requirements, cost of' electric car, comparative use of fuel and energy. Availability of energy for recharging. impacts on use of fuel and energy. Impact on urban air quality, impact on price, material requirement Traction motors and types.

Unit-VI

Objective: To study the use of gas turbines in automobiles and Design of turbochargers for automobiles.

Use of gas turbines in cars, arrangement, control merits and de-merits, Design of turbochargers for automobiles, their usefulness on the performance.

Course outcomes: The students completing the course will be able to understand the ever increasing quality of life. This phenomenon imposes high demand on conventional fossil fuels. Hence search for alternate fuels is a continuous phenomenon. The student will have an overview of various alternate fuels along with their merits and limitations.

Text Books:
1. G.D. Rai 'Non-conventional sources of energy Khamma Lab.
2. William Hamilton 'Electric Automobiles', PHI
3. Alternative sources and control system.Yes Dee publishing pvt Ltd

Reference Books:
1. S.P. Sukhatme 'Solar Energy', Tata McGraw Hill .
2. S. Rao & B.B. Larulekar 'Energy Technology', Khamma Lab
3. Frank Kreith & Jan F. Krieder' Principles of Solar Engineering' McGraw Hill.
4. J.A. Duffie&W.A. Beckman 'Solar Energy -thermal Process' McGrawHil1
5. E, D ;Totta, 'Solar Hydrogeff Energy-Systems'
6. T.N. Veziroglu. Alternative energy sources.
7. Mitsui E. Stal, Biological solar energy conversion

DEPARTMENTAL ELECTIVE-I
VEHICLE BODY ENGG. & SAFETY

Course objective: To impart the knowledge of the vehicle design procedures and safety measures to be considered in designing a vehicle. Further concepts of aerodynamic profile and to minimize noise and vibration are also introduced.

UNIT-1
INTRODUCTION: Classification of coachwork type: styling forms, coach and bus body style, layout of cars, buses and coach with different seating and loading capacity, commercial vehicles types, vans and pickups. Terms used in body building construction, angle of approach, angle of departure, ground clearance, cross bearers, floor longitudes, posts, seat rail, waist rail, cant rail, roof stick, roof longitude, rub rail, skirt rail, truss panel, wheel arch structure, wheel arch, post diagonals, gussets.

UNIT-II
VEHICLE BODY MATERIALS: Aluminium alloys, steel, alloy steel, plastics, metal matrix composites, structural timbers- properties, glass reinforced plastics and high strength composites, thermoplastics, ABS and styebes, load bearing plastics, semi rigid PUR foams and sandwich panel construction. Paint adhesive and their properties, corrosion and their prevention.

UNIT-III
AERODYNAMICS: Basics, vehicle drag and types, various types of forces and moments, effects of forces and moments, various body optimization techniques for minimum drag, principle of wind tunnel technology, flow visualization techniques, tests with scale models, aerodynamic study for heavy vehicles.

VEHICLE STABILITY: Introduction, longitudinal, lateral stability, vehicle on a curvilinear path, critical speed for toppling and skidding. Effect of operating factors on lateral stability, steering geometry and stabilization of steerable wheels, mass distribution and engine location on stability.

UNIT-IV
LOAD DISTRIBUTION: Types of body structures, vehicle body stress analysis, vehicle weight distribution, calculation of loading, symmetrical, longitudinal loads, side loads, stress analysis of bus structure under bending and torsion.

UNIT-V
INTERIOR ERGONOMICS: Introduction, seating dimensions, interior ergonomics, ergonomics system design, seat comfort suspension seats, split frame seating, back passion reducers, dash boards instruments, electronic displays, commercial vehicle cabin ergonomics, mechanical packages layout, goods vehicle layout. Visibility, regulations, drivers visibility, methods of improving visibility, window winding and seat adjustment mechanisms.

UNIT-VI
NOISE AND VIBRATION: Noise characteristics, sources of noise, noise level measurement techniques. Body structural vibrations, chassis bearing vibration, designing against fatigue, method of noise suppression.

SAFETY: Impact protection basics, physics of impact between deformable bodies, design for crash worthiness, occupant and cargo restraint, passive restraint systems, side impact analysis, bumper system energy absorbent foams, laws of mechanisms applied to safety.

Course outcome: After completing the course the student will be in a position to choose the correct material for various parts of the vehicle. Student will have enough knowledge to address the problems arising out of aerodynamic forces noise, vibration and the factors influencing the vehicle stability.

TEXT BOOKS:
1. Sydney F pages, "Body Engineering" Chapman & Hall Ltd, London, 1956.
2. "Giles J Pawlowski", vehicle body engineering Business books limited, 1989.
3. John Fenton, "Vehicle body layout and analysis", Mechanical Engg. Publication ltd, London.

REFERENCES:
1. Hand book on vehicle body desing-SAE publication.
2. Vehicle safety 2002, Cornwell press, Townbridge, UK, ISBN 1356-1448.
3. Redesign of bus bodies – part I & part II – CIRT Pune (report), 1983.
4. Ed W.H. Hucho, Aerodynamics of Road Vehicles, 4th Edition, Butter worth's 1987.
5. Scibor-Rylski A.J, Road vehicle Aerodynamics, Pentech press, London 2nd Edition 1984.
6. Rae W.H & Pope A, Low Speed Wind Tunnel Testing wiley & sons, USA 1984.

INTERACTIVE COMPUTER GRAPHICS
(DEPARTMENTAL ELECTIVE –I)

Course objectives:

This course allows the students to:

1. Understand the fundamental concepts and theory of computer graphics
2. Understand modeling, and interactive control of 3D computer graphics applications
3. The underlying parametric surface concepts be understood
4. Learn multimedia authoring tools.

UNIT-I

INTRODUCTION: Application areas of computer graphics, overview of graphic system, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices.

UNIT-II

OUTPUT PRIMITIVES: Points and lines, line drawing algorithms, mid-point circle algorithm, Filled area primitives: scan-line polygon fill algorithm, boundary-fill and flood-fill algorithm.

2-D GEOMETRICAL TRANSFORMATIONS: Translation, scaling, rotation, reflection and shear transformation matrix representations and homogeneous co-ordinates, composite transformations, transformations between coordinates

UNIT -III

2-D VIEWING: The viewing pipe-line, viewing coordinat4 reference frame, window to view-port co-ordinate transformations, viewing function, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland-Hodgeman polygon clipping algorithm

UNIT -IV

3-D OBJECT REPRESENTATION: spline representation, Hermite curve, Bezier curve and B-spline curve, Polygon surfaces, quadric surfaces, , Solid modeling Schalars – wire frame, CSG, B-rep. Bezier and B-spline surfaces, Basic illumination models, shading algorithms

UNIT -V

3-D GEOMETRIC TRANSFORMATIONS: Translation, rotation, scaling, reflection and shear transformation and composite transformations. Visible surface detection methods: Classification, back-face detection, depth-buffer, scan-line, depth sorting

UNIT-VI

COMPUTER ANIMATION: Design of animation sequence, general computer animation functions, raster animation, computer animation language, key frame system, motion specification

TEXT BOOKS:

1. " Computer Graphics C version" Donald Hearn and M. Pauline Baker, Pearson/PHI
2. "Computer Graphics Principles & practice", second edition in C, Foley, VanDam, Feiner and Hughes, Pearson Education

REFERENCES:
1.   "Computer Graphics Second edition", Zhigand xiang, Roy Plastock, Schaum's outlines, Tata Mc-Graw hill edition.
2.   Procedural elements for Computer Graphics, David F Rogers, Tata Mc Graw hill, 2nd edition.
3.   "Principles of Interactive Computer Graphics", Neuman and Sproul, TMH.
4.   Computer Graphics, Steven Harrington, TMH

Course outcomes:

Upon successful completion of the course, students will be able to:
1. Use the principles and commonly used paradigms and techniques of computer graphics
2. Write basic graphics application programs including animation
3. Design programs to display graphic images to given specifications
4. Possess in-depth knowledge of display systems, image synthesis, shape modeling, and interactive control of 3D computer graphics applications

ROBOTICS

(DEPARTMENTAL ELECTIVE –I)

Course Objectives:

1. To give students practice in applying their knowledge of mathematics, science, and Engineering and to expand this knowledge into the vast area of robotics.
2. The students will be exposed to the concepts of robot kinematics , Dynamics, Trajectory planning.
3. Mathematical approach to explain how the robotic arm motion can be described.
4. The students will understand the functioning of sensors and actuators.

UNIT-I
INTRODUCTION: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.
UNIT – II
COMPONENTS OF THE INDUSTRIAL ROBOTICS: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.
UNIT – III
MOTION ANALYSIS: Homogeneous transformations as applicable to rotation and translation – problems.
MANIPULATOR KINEMATICS: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.
UNIT – IV
Differential transformation and manipulators, Jacobians – problems
Dynamics: Lagrange – Euler and Newton – Euler formulations – Problems.
UNIT V
General considerations in path description and generation. Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages-description of paths with a robot programming language.
UNIT VI
ROBOT ACTUATORS AND FEED BACK COMPONENTS:
Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors.
Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.
ROBOT APPLICATIONS IN MANUFACTURING: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

TEXT BOOKS

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Robotics and Control / Mittal R K & Nagrath I J / TMH.

REFERENCES
1. Robotics / Fu K S/ McGraw Hill.
2. Robotic Engineering / Richard D. Klafter, Prentice Hall
3. Robot Analysis and Intelligence / Asada and Slow time / Wiley Inter-Science.
4. Introduction to Robotics / John J Craig / Pearson Edu.

Course outcomes:

Upon successful completion of this course you should be able to

1. Identify various robot configuration and components,
2. Select appropriate actuators and sensors for a robot based on specific application
3. Carry out kinematic and dynamic analysis for simple serial kinematic chains
4. Perform trajectory planning for a manipulator by avoiding obstacles.

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AUTOMATIVE AERODYNAMICS
(DEPARTMENTAL ELECTIVE-I)

Course objectives: The objective is to introduce the learner the concepts, principles of aerodynamics and principles of wind tunnel techniques to test the scale models for optimization of shape.

UNIT-I

Scope of automotive aerodynamics - historical development trends - Fundamental of fluid mechanics - Flow phenomenon related to vehicles - External & Internal flow problem - Resistance to vehicle motion - Performance - Fuel consumption and performance - Potential of vehicle aerodynamics.

UNIT-II

Aerodynamic Drag of Cars: Cars as a bluff body - Flow field around car - drag force - types of drag force - analysis of aerodynamic drag - drag coefficient of cars - strategies for aerodynamic development - low drag profiles.

UNIT-III

Effects of aerodynamics forces and moments various body optimisation techniques for minimum drag, principal of wind tunnel techniques, tests with scale models, aerodynamic study for heavy vehicles.

UNIT-IV

Shape Optimization of Cars: Front end modification - front and rear wind shield angle - Boat tailing - Hatch back, fast back and square back - Dust flow patterns at the rear - Effects of gap configuration - effect of fasteners.

UNIT-V

Vehicle Handling - The origin offerees and moments on a vechile - side wind problems - method to calculate forces and moments - vehicle dynamics under side winds - the effects of forces and moments - Characteristics offerees and moments.

UNIT-VI

Dirt accumulation on the vehicle - wind noise - drag reduction in commercial vehicles.
Wind Tunnels For Automotive Aerodynamic: Principle of wind tunnel technology - Limitation of simulation - Stress with scale models - fill scale wind tunnels - measurement techniques - Equipment and transducers - road testing methods - Numerical methods.

Course outcome: The students completing the course will be able to understand the concepts of aerodynamic profile, usage of wind tunnel and scaled models for optimal design of vehicle body profile.

Suggested Reading:

1.Hucho.W.H., *Aerodynamic of Road Vehicles,* Butterworths Co., Ltd., - 1997.

2.A. Pope, *Wind Tunnel Testing,* John Wiley & Sons - 2nd Edition, New York 1974.

3.*Automotive Aerodynamic:* Update SP-706 - SAE - 1987

4.*Vehicle Aerodynamics* - SP-1145 - SAE - 1996.
Road vehicle aerodynamic design an introduction r.h.barnark

PRODUCT DESIGN AND ASSEMBLY AUTOMATION

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Couse objective: To impart the importance of various automatic feeding devices and automation and design of manual assembly systems. Further project design using latest sophisticated technologies using Robots in assembly lines.

UNIT –I

AUTOMATIC FEEDING AND ORIENTING DEVICES: Vibrator feeders : Mechanics of vibratory conveying, estimating the mean conveying velocity, load sensitivity, solutions to load sensitivity, spiral elevators, balanced feeders.

UNIT – II

Orientation of typical oriental system, effect of active orienting devices on feed rate, analysis of orienting systems, performance of an orienting device, natural resting aspects, of parts for automatic handing, analysis of a typical orienting system, out-of-bowl tooling. Mechanical feeders. Reciprocating -tube hopper feeder; magazines:

UNIT-III

Assemble Automation: Development of the assemble process, choice of assemble method assemble advantages social effects of automation.

Automatic assembly transfer systems: Continuous transfer, intermittent transfer, indexing mechanisms, and operator - paced free – transfer machine.

UNIT-IV

Product design for high speed automatic assembly and robot assembly :Introduction, design of parts for: high speed, feeding and orienting, example, additional feeding difficulties, high speed automatic insertion, example, analysis of an assembly, general rules for product design for automation, design of parts for feeding and orienting, summary of design rules for high speed automatic assembly, product for robot assembly.

UNIT-V

Design of manual assembly: Design for assembly fits in the design process, general design guidelines for manual assembly, development of the systematic DFA methodology, assembly efficiency, classification system for manual handling, classification system for manual insertion and fastening, effect of part symmetry on handling time, effect of part thickness and size on handling time, effect of weight on handling time, parts requiring two hands for manipulation, effects of combinations of factors, effect of symmetry effect of chamfer design on insertion operations, estimation of insertion time.

UNIT-VI

Avoiding jams during assembly, reducing risk assembly problems, effects of holding down, manual assembly data base and design data sheets, application of the DFA methodology and general design guidelines.

Performance and economics of assembly systems: Indexing machines, free transfer machines, basis for economic comparisons of automation equipment, comparison of indexing and free - transfer machines' economics of robot assembly.

Feasibility study for assembly automation: Machine design factors to reduce machine downtime due to defective parts. Visibility study.

Course outcome: The students completing the course will be able to understand project design and mechanization of assembly lines. Further they will be having enough knowledge in robot assembly.

TEXT BOOKS
1. Geoffrey Boothroyd, "Assembly Automation and Product Design",
Marcel Dekker Inc., NY, 1992.

REFERENCES
1. Geoffrey Boothroyd, "Hand Book of Product Design" Marcel and Dekken, N.Y. 1990.
2. A Delbainbre "Computer Aided Assembly London, 1992.

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METROLOGY & MACHINE TOOLS LAB

Note: minimum of 6 experiments from each section

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

Section-I
METROLOGY LAB

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

Section-II
MACHINE TOOLS LAB
1. Introduction of general purpose machines -lathe, drilling machine, milling machine, shaper, planing machine, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.
2. Step turning and taper turning on lathe machine
3. Thread cutting and knurling on -lathe machine.
4. Drilling and tapping
5. Shaping and planning
6. Slotting
7. Milling
8. Cylindrical surface grinding
9. Grinding of tool angles.

Course Outcome: After completing the course the student will be able to operate various precession measuring instruments and working and operations of various machines tools.

AUTO SCANNING & VEHICLE TESTING LAB

OBJECTIVE: To impart to the learner the skills to analyze engine and to study its performance, wheel balancing and alignment machines. Further to scan the automobile in all aspects for correct diagnosis.

1. Computerized engine analyzer study and practice.
2. Computerized wheel balancing machine study and practice.
3. Computerized wheel alignment machine study and practice.
4. Exhaust emission test of petrol and diesel engine
5. Two wheeler chassis dynamometer study and practice
6. Study of wind tunnel -determining of coeff of drag for a given aerofoil .
7. Road worthiness test a) Acceleration b) Gradability c) Maximum speed d) Constant speed fuel consumption (High way drive) e) city drive fuel consumption tests.
8. Head light focusing test.
9. Visibility test .
10. Braking distance test .
11. Drawings of automobile bodies -light and heavy vehicles for different seating capacities .
12. Dimensional drawings of bus depots and service station workshop layouts.

Course outcomes: The students completing the course will be able to understand *automotive scan* tools and diagnostic equipment for fault diagnosis and troubleshooting any problem arises in automobile.

DEPARTMENTAL ELECTIVE-II

MICROPROCESSORS AND MICRO CONTROLLERS

Course Objectives: The objective is introducing the fundamental concepts of microprocessors and microcontrollers, their construction details and applications in the field of automobile engineering.

UNIT-I: 8086 ARCHITECTURE:
Functional Diagram, Register Organization, Addressing modes, Instructions, Functional schematic, Minimum and Maximum mode operations of 8086, 8086 Control signal interfacing, Timing Diagrams.

UNIT-II: ASSEMBLY LANGUAGE PROGRAMMMING OF 8086
Assembly Directives, Macro's, Simple Programs using Assembler, Implementation of FOR Loop, WHILE, REPEAT and IF-THEN-ELSE Features, String Manipulation, Procedures.

I/O INTERFACE : Parallel data transfer scream, Programmed I/O, Interrupt Driven I/O, 8255 PPI, Various modes of operations and interface of I/O devices to 8086, A/D, D/A Converter Interfacing, Stepper Motor Interfacing.

UNIT-III: INTERFACING WITH ADVANCED DEVICES.
8086 System bus structure, Memory and I/O Interfacing with 8086, Interfacing through various IC Peripheral Chips, 8257 (DMA Controller), 8259 (Interrupt Priority Control), Memory Interface using RAMS, EPROMS and EEPROMS.

UNIT-IV: COMMUNICATION INTERFACE
Serial Communication Standards, USART Interfacing RS-232, IEEE-488, 20mA Current Loop, Prototyping and Trouble shooting, Software Debugging tolls, MDS.

UNIT-V: INTRODUCTION TO MICRO CONTROLLERS
Overview of 8051 Micro Controller, Architecture, I/O ports and Memory Organization, Addressing modes and Instruction set of 8051, Simple Programs using Stack Pointer, Assembly language programming.

UNIT- VI: INTERFACING AND INDUSTRIAL APPLICATIONS
Applications of Micro Controllers, Interfacing 8051 to LED's, Push button, Relay's and Latch Connections, Keyboard Interfacing, Interfacing Seven Segment Display, ADC and DAC Interfacing.

Course outcome: After completing the course the students are able to know about the various microprocessors and microcontrollers that can be used to have optimal performance of various systems.

TEXT BOOKS:

1. Kenneth J Ayala, ― The 8051 Micro Controller Architecture, Programming and Applications☐, Thomson Publishers, 2nd Edition.
2. Kenneth J Ayala, ― The 8086 Micro Processors Architecture, Programming and Applications☐, Thomson Publishers, 2005.

REFERENCE BOOKS:
1. Ajay V. Deshmukh, ―Microcontrollers – theory applications, Tata McGraw-Hill Companies – 2005.
2. D.V.Hall, ―Micro Processor and Interfacing ―, Tata McGraw-Hill.
3. Ray and BulChandi, ― Advanced Micro Processors, Tata McGraw-Hill.

COMPUTATIONAL FLUID DYNAMICS
(DEPARTMENTAL ELECTIVE – II)

Course Objectives:
The course aims at providing required numerical and software techniques for solving various engineering problems involving fluid flow.

UNIT-I

ELEMENTARY DETAILS IN NUMERICAL TECHNIQUES: Number system and errors, representation of integers, fractions, floating point arithmetic, loss of significance and error propagation, condition and instability, computational methods for error estimation, convergence of sequences.

UNIT – II

APPLIED NUMERICAL METHODS: Solution of a system of simultaneous linear algebraic equations, iterative schemes of matrix inversion, direct methods for matrix inversion, direct methods for banded matrices.

REVIEW OF EQUATIONS GOVERNING FLUID FLOW AND HEAT TRANSFER: Introduction, conservation of mass, Newton's second law of motion, expanded forms of navier-stokes equations, conservation of energy principle, special forms of the navier-stokes equations.

UNIT - III

Steady flow, dimensionless form of momentum and energy equations, stokes equation, conservative body force fields, stream function - vorticity formulation.

Finite difference applications in heat conduction and convention – heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure.

UNIT - IV

Finite differences, discretization, consistency, stability, and fundamentals of fluid flow modeling: introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

UNIT - V

Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.

UNIT -VI

FINITE VOLUME METHOD: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

TEXT BOOKS:
1.   Numerical heat transfer and fluid flow / Suhas V. Patankar- Butter-worth Publishers
2.   Computational fluid dynamics - Basics with applications - John. D. Anderson / Mc Graw Hill.

REFERENCES:
1.   Computational Fluid Flow and Heat Transfer/ Niyogi, Pearson Publications
2.   Fundamentals of Computational Fluid Dynamics – Tapan K. Sengupta / Universities Press.

Course Outcomes:
After undergoing the course the student shall be able to apply various numerical tools like finite volume, finite difference etc for solving the different fluid flow problems.

OPERATIONS RESEARCH
(DEPARTMENTAL ELECTIVE-II)

Course Objectives:
To learn the importance of Operations Research in the design, planning, scheduling, manufacturing and business applications and to use the various techniques of Operations Research in solving such problems.

UNIT – I
Development – definition– characteristics and phases – types of operation research models – applications.
ALLOCATION: Linear programming problem formulation – graphical solution – simplex method – artificial variables techniques -two–phase method, big-M method – duality principle.

UNIT – II
TRANSPORTATION PROBLEM: Formulation – optimal solution, unbalanced transportation problem – degeneracy, assignment problem – formulation – optimal solution - variants of assignment problem- traveling salesman problem.
SEQUENCING – Introduction – flow –shop sequencing – *n* jobs through two machines – *n* jobs through three machines – job shop sequencing – two jobs through 'm' machines.

UNIT – III
REPLACEMENT: Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.

UNIT – IV
THEORY OF GAMES: Introduction – mini. max (max. mini) – criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points – 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method.
WAITING LINES: Introduction – single channel – poison arrivals – exponential service times – with infinite population and finite population models– multichannel – poison arrivals – exponential service times with infinite population single channel poison arrivals.

UNIT – V
INVENTORY : Introduction – single item – deterministic models – purchase inventory models with one price break and multiple price breaks – shortages are not allowed – stochastic models – demand may be discrete variable or continuous variable – instantaneous production. Instantaneous demand and continuous demand and no set up cost. ABC & VED Analysis.

UNIT – VI
DYNAMIC PROGRAMMING: Introduction – Bellman's principle of optimality – applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem.
SIMULATION: Definition – types of simulation models – phases of simulation– applications of simulation – inventory and queuing problems – advantages and disadvantages – simulation languages.

TEXT BOOK:

1.   Operations Research / S.D.Sharma-Kedarnath

REFERENCES:
1.   Introduction to O.R/Hiller & Libermann (TMH).
2.   Operations Research /A.M.Natarajan,P.Balasubramani, A. Tamilarasi/Pearson Education.
3.   Operations Research: Methods & Problems / Maurice Saseini, Arhur Yaspan & Lawrence Friedman
4.   Operations Research / R.Pannerselvam,PHI Publications.
5.   Operations Research / Wagner/ PHI Publications.
6.   Operation Research /J.K.Sharma/MacMilan.
7.   Operations Research/ Pai/ Oxford Publications
8.   Operations Research/S Kalavathy / Vikas Publishers
9.   Operations Research / DS Cheema/University Science Press
10.   Operations Research / Ravindran, Philips, Solberg / Wiley publishers

Course Outcomes:

After completion of the course, the student will be able to:

To solve the LP and DP problems

To solve the Transportation, assignment, game, inventory, replacement, sequencing, queuing problems.

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CONDITION MONITORING
(DEPARTMENTAL ELECTIVE – II)

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Course Objectives:

- This course is designed to introduce the benefits and opportunities of health Monitoring and covers a range of techniques
- The students will be exposed to a range of techniques from Vibration based methods, Thermography, Oil conditions, Debris and ultrasonic monitoring
- Using overall vibration, vibration limit zones, broadband vibration bandwidth, alert levels, typical severity guidelines, recording overall vibration, using overall vibration for fault finding, trending overall vibration.

Identifying Resonance, Hammer Test, Self Excitation, Exciter Testing. Reducing Resonance - Effects of Frequency, Stiffness, Mass, Damping, Isolation

UNIT-I

BASICS OF VIBRATION: Basic motion: amplitudes, period, frequency, basic parameters: displacement, velocity, acceleration, units (including dB scales) and conversions, Mass, spring and damper concept, Introduction to SDOF and MDOF systems, Natural frequencies and resonance, Forced response.

UNIT-II

VIBRATION MEASUREMENTS AND ANALYSIS: Transducers and mounting methods, data acquisition using instrumentation recorders/data loggers, time domain signal analysis, orbit analysis, Filters, Frequency domain analysis (Narrow band FFT analysis), Nyquist criteria, Sampling, aliasing, windowing and averaging.

VIBRATION MEASUREMENT AND ANALYSIS: Use of phase; bode, polar and water fall plots, constant percentage band width analysis (1/3 and 1/1 Octave analysis), envelope detection /spike energy analysis, cepstral analysis, advances in analysis (PC based and portable instruments for vibration analysis).

UNIT-III

Fault Diagnosis, Interpreting vibration measurements for common machine faults , imbalance, misalignment, mechanical looseness, bearing and gearing faults, faults in induction motors, resonances, some case studies, static and dynamic balancing, international standards for vibration condition monitoring.

UNIT-IV

THERMOGRAPHY: The basics of infrared thermography, differences in equipment and specific wave length limitations, application of ir to: electrical inspection, mechanical inspection, energy conservation, how to take good thermal images, hands-on demonstrations focusing on proper camera settings and image interpretation, analysis of thermal images and report generation, study of thermo graphy applications

UNIT-V

OIL AND WEAR DEBRIS ANALYSIS: Basics of oil analysis, monitoring condition of oil, lubricant analysis, physio – chemical properties, moisture, tan tbn, wear debris analysis, particle counting, spectroscopy, uses & limitations, ferrography wear particle analysis, concept of ferrography, principle particle classification, size, shape, composition, concentration,   analysis procedure, sampling & analytical ferrography equipments, severity rating.

UNIT-VI
ULTRASONIC MONITORING AND ANALYSIS: Ultrasonic monitoring (leak, crack and thickness) basics of ultrasonic monitoring , ultrasonic theory, test taking philosophy, ultrasonic theory, mathematics of ultrasound, equipment and transducers, inspection parameters and calibration, immersion theory, equipment quality control, flaw origins and inspection methods, UT Procedure familiarization, and study recommendations, application of ultrasound to: air leaks, steam trap testing, bearing lubrication, electrical inspection, case studies.

TEXT BOOKS:
1. The Vibration Analysis Handbook, J I Taylor (1994)
2. Machinery Vibration Condition Monitoring, Lynn, Butterworth(1989)

REFERENCE BOOKS:

1. Machinery Vibration: Measurement and Analysis. Victor Wowk(1991)
2. Mechanical fault diagnosis and condition monitoring, RA Collacott(1977)
3. The Vibration Monitoring Handbook (Coxmoor's Machine & Systems Condition Monitoring) (1998)

Course outcomes:
- Gaining invaluable insights into the benefits of Condition Monitoring
- Understanding the reasons for selecting particular maintenance strategies
- Understanding effective methodologies for implementing Condition Monitoring Techniques
- Identifying the optimum maintenance strategy for different types of equipment
- Gaining practical approaches to minimise the risk of plant and machinery breakdowns
- Awareness of International Standards covering asset manageme

VEHICLE DYNAMICS

Objectives: To import knowledge of various kinds of vibrations caused due to different aspects like road construction, engine unbalance and vibration measuring techniques.

Unit-I

Undamped free vibration: Single degree of freedom Systems, introduction, undamped free vibration -Natural frequency' of free vibration, Rayleigh's method, stiffness of spring elements, effects of spring mass, Energy method, Newton's method and D' Alembert's principle- problems.

Unit-II

Damped free vibration: Single degree of freedom systems, different types of damping, concept of critical damping and its importance, response study of viscous damped systems for cases of under damping and over damping, logarithmic decrement.

Unit-III

Forced vibration: Single degree of freedom systems, steady state solution with viscous damping due to harmonic force solution by complex algebra, concept of response, reciprocating and rotating unbalance, vibration isolation Transmissibility ratio, energy dissipated by damping equivalent. viscous damping. Structural damping, sharpness or resonance. base excitation.

Unit-IV

Systems with two degree of freedom: Introduction, principle modes and normal modes" co-ordinate coupling, generalised and principle co-ordinate, free vibrations in terms of natural conditions. Lagranges equation, semi-definite systems, forced oscillations. harmonic excitation.

Unit-V

Vehicle vibrations: Vehicle vibration with single degree of freedom free vibration, forced vibration, vibration due to road roughness, vibration due to engine unbalance, transmissibility of engine mounting vibration with two degree of freedom, free vibration, compensated suspension systems forced vibration, vibration due to road roughness.

Vibration measuring instruments -Accelerometers and vibrometers. whirling of shafts with and without air damping, discussion of speeds above and below critical speeds.

Unit-VI

Numerical methods for multi degree of freedom systems: Introduction, influence coefficients, Maxwell's reciprocal theorem, Dunkerley's equation, orthogonality principle, method of matrix iteration- method of determination of all the natural frequencies using sweeping matrix and orthogonality principle, Holzer's method for systems with free, fixed free and fixed ends.

Course outcome: After completing the course the student will be in a position to use various methods and techniques to minimize the vibrations caused during the operation and running of vehicles.

TEXT BOOKS
1. Mechanical Vibration -By G.K.Grovcr, Nernchand & Brothers
2. Vehicle dynamics, Theory and applications-reza N. Jazar-Springer International
3. Vibration Theory & Applications -By William I Thomson, Prentice Hall
4. Theory & Problems of Mechanical Vibration -By William W. Seto, McGrawHil1
5. Problems in Automobile Mechanics-By N.K.Giri, Khanna Pub.
6. Mechanics of Pneumatic Tyre -By S.K.Cfark, Prcl1ticc Hall
7. Mechanical Vibration Analysis -By PSrinivasan, TMH
8. Mechanical Vibration -By Church. Wife) international
     Prerequisites: Engineering mechanics, Mechanics of Solids, Kinematics of Machinery

CAD/CAM

Course Objectives:
The general objectives of the course are to enable the students to
1. Understand the basic fundamentals of computer aided design and manufacturing.
2. To learn 2D & 3D transformations of the basic entities like line, circle, ellipse etc
3. To understand the different geometric modeling techniques like solid modeling, surface modeling, feature based modeling etc. and to visualize how the components look like before its manufacturing or fabrication
4. To learn the part programming, importance of group technology, computer aided process planning, computer aided quality control
5. To learn the overall configuration and elements of computer integrated manufacturing systems.

UNIT – I
Computers in industrial manufacturing, product cycle, CAD / CAM Hardware, basic structure, CPU, memory types, input devices, display devices, hard copy devices, storage devices.
COMPUTER GRAPHICS: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNIT – II
GEOMETRIC MODELING: Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.
DRAFTING AND MODELING SYSTEMS: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling.

UNIT – III
PART PROGRAMMING FOR NC MACHINES: NC, NC modes, NC elements, CNC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming. Direct Numerical Control, Adaptive Control.

UNIT – IV
GROUP TECHNOLOGY: Part family, coding and classification, production flow analysis, types and advantages.
Computer aided processes planning – importance, types.

UNIT – V
COMPUTER AIDED QUALITY CONTROL: Terminology used in quality control, use of computers in Quality control. Inspection methods- contact and noncontact types, computer aided testing, integration of CAQC with CAD/CAM.

UNIT – VI
COMPUTER INTEGRATED MANUFACTURING SYSTEMS: Types of manufacturing systems, machine tools and related equipment, material handling systems, material requrirement planning, computer control systems, human labor in manufacturing systems, CIMS benefits.

TEXT BOOKS:
1.   CAD / CAM / E Zimmers & M.Groover/Pearson Education
2.   Automation, Production systems & Computer integrated Manufacturing/ Groover/P.E

REFERENCES:
1.   CAD / CAM Theory and Practice / Ibrahim Zeid / TMH
2.   Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson
3.   Computer Numerical Control Concepts and programming / Warren S Seames / Thomson.
4.   Product manufacturing and cost estimation using CAD/CAE/ Kuang Hua Chang, Elsevier Publishers

Course Outcome:
At the end of the course the students shall be able to:
1. Describe the mathematical basis in the technique of representation of geometric entities including points, lines, and parametric curves, surfaces and solid, and the technique of transformation of geometric entities using transformation matrix
2. Describe the use of GT and CAPP for the product development
3. Identify the various elements and their activities in the Computer Integrated Manufacturing Systems.

FINITE ELEMENT METHODS

Course Objectives:
1. To learn basic principles of finite element analysis procedure
2. To learn the theory and characteristics of finite elements that represent engineering structures
3. To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses performed by others
4. Learn to model complex geometry problems and solution techniques.

UNIT-I
Introduction to finite element method, stress and equilibrium, strain – displacement relations, stress – strain relations, plane stress and plane strain conditions, variational and weighted residual methods, concept of potential energy, one dimensional problems.

UNIT – II
Discretization of domain, element shapes, discretization procedures, assembly of stiffness matrix, band width, node numbering, mesh generation, interpolation functions, local and global coordinates, convergence requirements, treatment of boundary conditions.

UNIT – III
Analysis of Trusses: Finite element modeling, coordinates and shape functions, assembly of global stiffness matrix and load vector, finite element equations, treatment of boundary conditions, stress, strain and support reaction calculations. Analysis of Beams: Element stiffness matrix for Hermite beam element, derivation of load vector for concentrated and UDL, simple problems on beams.

UNIT – IV
Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions, formulation of axisymmetric problems.

UNIT-V
Higher order and isoparametric elements: One dimensional quadratic and cubic elements in natural coordinates, two dimensional four noded isoparametric elements and numerical integration.

UNIT – VI
Steady state heat transfer analysis : one dimensional analysis of a fin and two dimensional analysis of thin plate, analysis of a uniform shaft subjected to torsion. Dynamic Analysis: Formulation of finite element model, element consistent and lumped mass matrices, evaluation of eigen values and eigen vectors, free vibration analysis.

TEXT BOOKS:
1.   Introduction to Finite Elements in Engineering / Chandraputla, Ashok and Belegundu / Prentice – Hall.
2.   The Finite Element Methods in Engineering / SS Rao / Pergamon.

REFERENCES:
1. Finite Element Method with applications in Engineering / YM Desai, Eldho & Shah /Pearson publishers
2. An introduction to Finite Element Method / JN Reddy / McGrawHill
3. The Finite Element Method for Engineers – Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smith and Ted G. Byrom / John Wiley & sons (ASIA) Pte Ltd.
4. Finite Element Analysis: Theory and Application with Ansys, Saeed Moaveniu, Pearson Education

Course outcomes:

Upon successful completion of this course you should be able to

1. Understand the concepts behind variational methods and weighted residual methods in FEM
2. Identify the application and characteristics of FEA elements such as bars, beams, plane and isoparametric elements, and 3-D element .
3. Develop element characteristic equation procedure and generation of global stiffness equation will be applied.
4. Able to apply Suitable boundary conditions to a global structural equation, and reduce it to a solvable form.
5. Able to identify how the finite element method expands beyond the structural domain, for problems involving dynamics, heat transfer, and fluid flow.

OPEN ELECTIVE
AUTOMOTIVE POLLUTION AND CONTROL

Course objective: The students are exposed to pollution control laws, causes of pollution and measures to be taken to reduce the exhaust gas pollutants.

UNIT I

Laws and regulations: Historical background, regulatory test procedures (European cycles). Exhaust gas pollutants (European rail road limits), particulate pollutants, European statutory values, inspection of vehicles in circulation (influence of actual traffic conditions and influence of vehicle maintenance) Analysis of pollutants: Carbon and Nitrogen compounds-(CO.CO2 Nox), Ammonia and Amines, Hydrocarbons. Volatile compounds, evaporative losses, analysis of particulates.

UNIT-II

Pollutants from SI engines, Mechanism & formation of HC, Co and NOx in SI engines. Engines and operating variables affecting pollution in SI engines.
Pollution for CI engines, Mechanism & formation of HC, Co and NOx , and root in CI engines. Factor affecting emissions in CI engines.

UNIT-III

Lean burns & stratified charge engines. Multipoint fuel injection and gasoline direct injection methods. Common rail fuel injection in diesel engines. Post combustion treatments: Introduction, exhaust gas recirculation, exhaust gas composition before treatment, catalytic convertors, oxidation and three way types thermal reactors, installation of catalysts in exhaust lines treatment in diesel engines, particulate traps for diesel engines, particulates trap regeneration.

UNIT-IV

Economic challenges: Introduction, cost of improvement to SI engines, cost of injection systems, cost of improvement in Diesel engines, economic consequences of introducing the catalyst, additional costs incurred by diesel traps, cost of periodic inspection of pollution control system and evaporative control system.

UNIT-V

Instrumentation for pollution measurements: NDIR- analysers, thermal conductivity and flame ionization detectors, analysers for NOx, gas chromatograph. Orsat apparatus, smoke meters-spot sampling and continuous indication types like Bosch, Hartridge. Particulate measuring systems, dilution tunnels- full and partial flow.

UNIT VI

SI and CI engines fuel requirements. Knock in SI and CI engines. Knock rating of SI and CI Engines fuels. Alternative fuel like Hydrogen, Natural gas, LPG, vegetable oil and biodiesel, their production, properties, storage and performance as engines fuels.

Course outcome: The students completing this course will be in a position to derive various measures to be taken to reduce the exhaust gas pollutants coming out of automobiles to meet the laws and regulations in practice.

TEXT BOOKS
1. Bosch – Gawline fuel injection – Bosch Publications

2. Bosch – Diesel fuel injection – Bosch Publications

REFERENCES
1. Automobiles and Pollution – PaulDegobert(SAE)
2. Diesel engine operation manual – V.L. Maleev, CBS Pub
3. I.C. Engines – E.F. Obert, Harper & Row
4. Engine emission – Springer and Patterson, Plenum Press
5. Heins Aeisth – Internal Combustion Engines – SAE Publications.

ADVANCED MATERIALS
(OPEN ELECTIVE)

Course Objectives

The objective for this course is to understand the mechanics of different materials. This understanding will include concepts such as anisotropic material behavior, constituent properties and manufacturing processes of different composites. Suitability of smart and nano materials for engineering applications.

UNIT-I
INTRODUCTION TO COMPOSITE MATERIALS: Introduction, classification: polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon–carbon composites, fiber- reinforced composites and nature-made composites, and applications .
REINFORCEMENTS: Fibres- glass, silica, kevlar, carbon, boron, silicon carbide, and born carbide fibres.

UNIT-II
polymer composites, thermoplastics, thermosetting plastics, manufacturing of PMC, MMC & CCC and their applications.

UNIT-III
MANUFACTURING METHODS: Autoclave, tape production, moulding methods, filament winding, man layup, pultrusion, RTM.

UNIT-IV
MACROMECHANICAL ANALYSIS OF A LAMINA: Introduction, generalized hooke's law, reduction of hooke's law in three dimensions to two dimensions, relationship of compliance and stiffness matrix to engineering elastic constants of an orthotropic lamina, laminate-laminate code.

UNIT-V
FUNCTIONALLY GRADED MATERIALS: Types of functionally graded materials-classification-different systems-preparation-properties and applications of functionally graded materials.
SHAPE MEMORY ALLOYS: Introduction-shape memory effect-classification of shape memory alloys-composition-properties and applications of shape memory alloys.

UNIT-VI
NANO MATERIALS: Introduction-properties at nano scales-advantages & disadvantages-applications in comparison with bulk materials (nano – structure, wires, tubes, composites). state of art nano advanced- topic delivered by student.

TEXT BOOKS:
1. Nano material by A.K. Bandyopadyay, New age Publishers
2. Material science and Technology- Cahan
3. Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press

REFERENCES:
1. R. M. Jones, Mechanics of Composite Materials, Mc Graw Hill Company, New York, 1975.
2. L. R. Calcote, Analysis of Laminated Composite Structures, Van Nostrand Rainfold.
3. B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, Wiley-Interscience, New York, 1980
4. Mechanics of Composite Materials, Second Edition (Mechanical Engineering), Autar K.Kaw, Publisher: CRC

Course outcomes

Students who successfully complete this course will demonstrate the following:

- Properties of constituents, classification of composites and their suitability for the structural applications
- Manufacturing processes
- Smart materials and their applications
- Nano materials in comparison with bulk materials

INDUSTRIAL HYDRAULICS & PNEUMATICS
(OPEN ELECTIVE)

Course objective

1. Understand the underlying principles of Industrial Hydraulics & Pneumatic System
2. Analyze circuits and Enumerate the functions & characteristics of circuit elements
3. Attend to troubleshooting in fluid power systems
4. identify and describe the basic operation of Hydraulic / Pneumatic systems, the various equipment
   used in their operation

UNIT – I
Fundamentals of Fluid Power Systems-Introduction-types advantages, disadvantages & applications-fluid characteristics-terminologies used in fluid power-hydraulic symbols-hydraulic systems and components-sources-pumping theory-gear, vane & piston pumps.

UNIT-II
Fluid Power Actuators: Introduction-hydraulic actuators-hydraulic cylinders-types, construction, specifications and special types. hydraulic motors- working principle-selection criteria for various types-hydraulic motors in circuits- formulae-numerical problems

UNIT-III
Hydraulic elements in the design of circuits- Introduction-control elements-direction control valve-check valve-pressure control valve-relief valve-throttle valve-temperature & pressure compensation-locations of flow control valve

UNIT-IV
Accumulators & intensifiers-types, size &function of accumulators-application & circuits of accumulators- intensifiers-circuit & applications.
Design & drawing of hydraulic circuits-Introduction-case study & specifications-method of drawing a hydraulic circuit-hydraulic cylinder-quick return of a hydraulic cylinder

UNIT-V
Pneumatic systems-Introduction-symbols used-concepts & components- comparision-types & specifications of compressors-arrangement of a complete pneumatic system-compressed air behaviour- understanding pneumatic circuits-direction control valves
Electro pneumatics- Introduction-Pilot operated solenoid valve-electrical connections to solenoids-electro pneumatic circuit switches-relays-solenoids-P.E converter-concept of latching

UNIT-VI
Applications-servo systems-introduction-closed loop, hydro-mechanical and electro hydraulic – conventional and proportional valves-characteristics of proportional and servo valves- PLC applications in fluid power – selected pneumatic / electro pneumatic circuit problems – failure and trouble shooting in fluid power systems.

TEXT BOOKS:

1. Introduction to Hydraulics and Pneumatics by S. Ilango and V. Soundararajan, PHI , New Delhi
2. Applied hydraulics and pneumatics-T. Sunder Selwyn & R. Jayendiran, Anuradha Publications.

REFERENCE BOOKS:
1. Oil Hydraulic Systems, S.R .Majumdar, McGrawHill Companies
2. Pneumatic Systems: Principles and Maintenance, Majumdar, McGrawHill

Course outcome:
Upon successful completion of this course student should be able to

1. understand the general concepts associated with Hydraulic and Pneumatic equipment as found in industry today.
2. The course describes the various types of Hydraulic / Pneumatic equipment as well as the different
   types of Seals used in such equipment
3. Understand advantage of fluid power, it provides examples of applications
4. Understand the operation of hydraulics & pnuematics circuits and components typically used in industry

<p style="text-align:center;">AUTOMOTIVE CHASSIS & SUSPENSION</p>

Course objective: To impart the necessity, requirements and construction of chassis and frames and other automobile components like bakes, breaking systems, suspensions systems.

Unit-I
Introduction to Chassis System: Introduction: Requirements of an automobile with types of automobiles, layout of an automobile with reference to power plant, power required for propulsion, various resistances to motion of the automobile.
Frames: Types of frames, materials, calculation of stresses on sections, constructional details, loading points, testing of frames. Wheels and tyres: Types of wheels, construction. Structure and function of tyres.

UNTI-II
Steering systems: types of steering gears, front axle. Under steer and over steer, wheel alignment, power steering, steering geometry, wheel balancing, centre point steering, steerability.

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

Unit-IV
Suspension: Types of suspension, leaf springs, materials, independent suspension, torsion bar, air bellows or pneumatic, suspension, hydraulic suspension, constructional details of telescopic shock absorbers, types, vibrations and riding comfort, role axis of spring suspension.

UNIT-V
Front Wheel Mounting, Rear Wheel Mounting, engine mounting, various types of springs used in suspension system. Requirements and various types, Material.
Testing: Testing procedures, types of tests and chassis components, equipment for lab and road tests, preparation of test reports.

 UNIT-VI
Two and three wheelers: Classification of two and three wheelers, construction details, construction details of frames and forks, suspension systems and shock absorbers, different arrangement of cylinders. Carburetion system and operation.
Course outcome: The students completing the course will be able to understand various automobile components and their construction details. And preventive and remedial measures can be attended by the student with enough knowledge.

TEXTBOOKS
   1. Automotive chassis and body -P. L. Kohli, TMH
   2. Automobile engineering – Sudhir kumar – university science press

REFERENCES
1. Introduction to automobile engineering -N.R. Khatawate. Khanna pub.
2. Automotive mechanics -Joseph I heintner. Affiliated East West Press
3. Problems in Automobile Engineering -N.K.Giri, Khanna Pub
4. Automotive Chassis -P.M. Heldt, Chilton & Co.

5. Automobile Engineering -T.R. Banga & Nathu Singh, Khanna

IV Year –I SEMESTER

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AUTOMOBILE ENGINEERING LAB & INSTRUMENTATION
LAB

Objective: To impart practical knowledge on automobile working, Servicing and maintenance of selected components, and to calibrate the measuring devices.

Note: Any six experiments from each section
Section-I
AUTOMOBILE ENGINEERING LAB

1. Dismantling and assembly of LMV components as following :
a) Gear box b) clutch assembly c) Propeller shaft d) differential gear box
e) rear axle t) suspension system g) steering mechanism.
2. Dismantling and assembly of door frames, door locks and window locks
3. Study of driver's seat layout in anyone LMV and anyone HMV.
4. Testing, servicing and charging of batteries
5. Servicing of generator, alternator and starter motor with dismantling, testing, inspection and assembly.
6.Servicing of ignition systems
7.Drawing of general electrical wiring diagrams of various vehicles { two and four wheelers)
8. Calibration of micrometer, measurement of plain plug, measurement of plain ring gauge, taper gauge
9.Measurement of taper using sine bar and other instruments.
10. Measurement of base circle diameter and tooth thickness of spur and helical gears
11.Use of slip gauges, measurement of screw threads using screw thread micrometer, use of comparators, experiments involving profile projectors.

Note: Driving practice of a geared two wheeler and anyone LMV for a minimum of 10 hours duration need to be provided.
Section-II
INSTRUMENTATION LAB

1. Calibration of Pressure Gauges
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge for temperature measurement.
5. Calibration of thermocouple for temperature measurement.
6. Calibration of capacitive transducer for angular displacement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurement.
9. Study and calibration of a rotometer for flow measurement.
10. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and calibration of Mcleod gauge for low pressure.

Course outcome: After completing the course the learner will be in a position to servicing the generators and batteries and ignition systems and is expected to wellverse with various calibrated the devices.

CAD/CAM LAB

Course objective: To impart the skill to use various softwares available for design and drafting of mechanical components that are been used in automobiles. The students are exposed to latest trends in manufacturing technologies.

1.   **DRAFTING:** Development of part drawings for various components in the form of orthographic andisometric. representation of dimensioning and tolerances scanning and plotting. study of script, DXE and IGES files.

2.   **PART MODELING:** Generation of various 3D models through protrusion, revolve, shell sweep. creation of various features. study of parent child relation. feature based and boolean based modeling surface and assembly modeling. study of various standard translators. design simple components.

3. a).   Determination of deflection and stresses in 2D and 3D trusses and beams.

     b).   Determination of deflections component and principal and Von-mises stresses in   plane stress, plane strain and Axisymmetric components.

      c).   Determination of stresses in 3D and shell structures (at least one example in each case)

     d).   Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.

     e).   Steady state heat transfer Analysis of plane and Axisymmetric components.

4. a).   Development of process sheets for various components based on tooling Machines.

     b).   Development of manufacturing and tool management systems.

     c).   Study of various post processors used in NC Machines.

     d).   Development of NC code for free form and sculptured surfaces using CAM packages.

     e).   Machining of simple components on NC lathe and Mill by transferring NC Code / from a CAM package. Through RS 232.

     f)   Quality Control and inspection.

Course outcome: After completing the course learner will be in a position to make use of latest modeling ,desiging softwares and is expected to wellverse with CNC programming and machining skills.

        Packages to be provided to cater to drafting, modeling & analysis from the following:

        Auto CAD, Micro Station, CATIA, Pro-E, I-DEAS, ANSYS, NISA, CAEFEM, Gibbs CAM, Master CAM etc.

AUTOMOTIVE CONTROL SYSTEMS

Course objectives: The objective of the course is to impart necessary skills required to model an engine and control systems. To make the learner understand over all diagnosis of automotive engines, vehicle, road and driver modelling

UNIT-I
Engine management systems: effective work, inflammation of A/F mixtures, flame propagation, energy conversion, emissions of I/C engines, fuel management, injection time calculation, air mass per cycle, intake manifold dynamics.

UNIT-II
Diesel engine modelling: four stroke cycle diesel engine, charge exchange, air fuel raito, mass balance, fuel injection, fuel evaporation, cylinder dynamics, fitting of model parameters.

UNIT-III
Engine control systems: Lambda control, stoichiometric operation of SI engines, engine model for lambda control, lambda control circuit, adaptive lambda control, idle speed control, knocking at SI engines, knock sensors, adaptive knock control, cylinder balancing.

UNIT-IV
Diagnosis of automotive engines: introduction to diagnosis, faults modelling, principles of model based diagnosis, modelling the air intake system, model identification, the diagnosis system, residual generation, residual, evaluation, implementation, validation of the diagnosis system, misfire detection.

UNIT-V
Vehicle modelling: introduction, co-ordinate system, vehicle body side slip angle observer, determination of the road gradient, vehicle control system: ABS control systems. Road and driver models: road models, requirements of the road models, definitions of the course path, road surfaces and wind strength, PID driver model, Hybrid driver model.

UNIT VI
Introduction to mechatronics: Sensors – elements of mechatronics systems-displacement sensors, position sensors, proximity sensors, velocity sensors, motion sensors, torque sensors, acceleration sensors, temperature sensors. Hydraulic and pneumatic actuating systems-design of mechatronics systems.

Course outcomes: After completing the course the student will be in a position to understand various control systems involved in vehicle modelling.

TEXT BOOKS
1. Automotive control systems, Uwe Kiencle, Lars Nielsen, Springer,2005
2. Automotive Control systems, A, galip Ulsoy, Huei Peng, Melih Cakmakci, Cambridge University press, 2012.
3. Mechatroincs, integrated mechanical electronics systems,K.P.Ramachandran,et,al;WILEY India private limited.
4. Electronic Engine controls, Steve V.Hatch-Cengage Learning

REFERENCES
1. Mechatronics principles and applications, Onwubolu, ELSEVIER
2. Modern automotive technology, James E. Duffy, Goodheart – willcox Publ, 2003.

VEHICLE MAINTENANCE

Course objectives: The students are exposed to maintain records and schedules, overhauling of engine components and various systems of a vehicle.

UNIT-I
Maintenance records and schedule: importance of maintenance, scheduled and unscheduled maintenance. Preparation of check lists, Chassis lubrication. Cost effectiveness. Pre-trip. Inspection forms, log books, trip sheets, other maintenance record form.

UNIT-II
Maintenance, Repair: Dismantling of engine components, cleaning methods, Visual inspection and dimensional check of various engine components.
Overhauling of engines: Minor and major tune up reconditioning, repairing methods of engine components, assembly procedure. Special tools used for maintenance, repair and overhauling.

UNIT-III
Maintenance, repair and overhauling of chassis drive line components and suspensions systems: clutch – mechanical, automatic type gear box. Final reduction , Propeller shaft. Suspension systems: front and rear suspension systems, Rigid and independent types, Brakes system – hydraulic, servo, apr. air bleeding. Steering system, wheel alignment – tyres.

UNIT-IV
Maintenance, repair and servicing of electrical systems: Battery – testing methods. Starter motor. Charging system- DC generator, AC generator, Regulator, Ignition systems- coil ignition, transistor assisted ignition, capacitor discharge ignition. Electric horn, wiper, Flasher, electric fuel pump, gauges. Lighting system, head lights focussing. Wiring system.

UNIT-V
Maintenance, repair and servicing of cooling system, lubrication system: cooling system – types, water pumps, radiator, and thermostat valve, anti-corrosion and anti-freezing solutions.
Lubricating system – Oil analysis, oil topping up, oil change, oil filters, oil relief valve.

UNIT-VI
Maintenance, repair and servicing of fuel system and body: fuel system-petrol, diesel fuel feed system components. Body repair tools, minor body panel beating, tinkering, soldering, polishing, painting. Door locks mechanism. Window glass actuating mechanism.

Course outcome: the students completing this course are expected to maintain various records and scheduled and unscheduled maintenance. They are also expected to maintain, repair and service of various systems of a vehicle.

TEXT BOOKS
1. JOHN Doke, "Fleet management", McGraw Hill Co, 1984.
2. An Introductory Guide to Motor Vehicle Maintenance: Light Vehicles by Phil Knott, Adam Roylance; EMS Publishing, London.

REFERENCES

1. APRACTICAL Approach to Motor Vehicle Engineering and Maintenance by Allan Bonnick, Derek Newbold, Elsevier Ltd.
2. Vehicle Maintenance: Vehicle fitting Units Levels 1 & 2: Vehicle Fitting Units 1&2 (Vehicle Maintenance and Repair Series) Roy Brooks, Jack Hrist, John Whipp, Thomson, Singapore.2001
3. John. W.Vale.J.R."Modern Auto Body and finder repair".
4. Venk.Spicer."Automotive Maintenance and Troubleshooting".

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DEPARTMENTAL ELECTIVE-III
AUTOMOTIVE SAFETY

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Course objective: To impart the knowledge of the safety concepts, comfort and convenience system, driver assistance system and other requirements of automotive safety.

UNIT-I

INTRODUTION:

Design of the body for safety, energy equation, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumble zone, safety sandwich construction.

UNIT-II

SAFETY AND FATIGUE ASPECTS

Design of body, forces in roll over, head on impact, plastics collapse and analysis, fatigue and vibration, test on box sections, structural vibration.

UNIT-III

SAFETY CONCEPT

Active safety: driving safety, conditional safety, perceptibility safety, operating safety- crash safety passive safety: exterior safety, interior, safety, deformation behaviour of vehicle body, speed and acceleration characteristics of passenger compartment on impact.

Safety equipment: Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, bumpers design for safety.

UNIT-IV

COLLISION WARNING AND AVOIDANCE

Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system object detection system with braking system interactions.

UNIT-V

COMFORT AND CONVENIENCE SYSTEM

Steering and mirror adjustment, central locking system, garage door opening system, tyre pressure control system, rain sensor system, environment information system.

UNIT-VI

DRIVER ASSISTANCE SYSTEMS:

Introduction, driver support systems- driver information, vehicle support system, - vehicle status monitoring.

TELEMATICS: Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition, driver assistance system.

Course Outcome: After completing the course the student will be in a position to understand the various safety measures to be taken while designing an automobile.

TEXT BOOKS

1. Bosch – "Automotive Handbook" – 5th edition – SAE publication – 2000.
2. Junsz Pawlowski, "Vehicle Body Engineering", Business book limited, 1989.
3. Ronald K Jurgen, "Navigation and Intelligent Transportation Systems – Progress in Technology", Automotive Electronics Series, SAE. USA,1998.

REFERENCES

1. Rudolf Limpert, "Brake Design and Safety", SAE International, Second Edition, 1999.

2. Ronald.K.Jurgen – "Automotive Electronics Handbook" – Second edition – Mc Graw – Hill Inc.

2. Ronald.K.Jurgen – "Automotive Electronics Handbook" – Second edition – Mc Graw – Hill Inc.

AUTOMOTIVE MANUFACTURING
(DEPARTMENTAL ELECTIVE – III)

Course Objectives: To impart the knowledge of latest trends in manufacturing, automated flow lines, material handling systems and Flexible assemble lines.

UNIT-I
INTRODUCTION: Types and strategies of automation, pneumatic and hydraulic components, circuits, automation in machine tools, mechanical feeding and tool changing and machine tool control.
UNIT – II
AUTOMATED FLOW LINES: Methods of part transport, transfer mechanism, buffer storage, control function, design and fabrication considerations.
UNIT – III
ANALYSIS OF AUTOMATED FLOW LINES: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.
ASSEMBLY SYSTEM AND LINE BALANCING: Assembly process and systems, assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.
UNIT – IV
AUTOMATED MATERIAL HANDLING: Types of equipment, functions, analysis and design of material handling systems, conveyor systems, automated guided vehicle systems.
AUTOMATED STORAGE SYSTEMS: Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.
UNIT – V
ADAPTIVE CONTROL SYSTEMS: Introduction, adaptive control with optimization, adaptive control with constraints, application of a.c. in machining operations. Use of various parameters such as cutting force, temperatures, vibration and acoustic emission.
UNIT – VI
Automated inspection: Fundamentals, types of inspection methods and equipment, CMM, machine vision.
Course outcome: After completing the course the student will be able to know about the automated flow lines, automated assembly and other automated that are being used in automobile manufacturing industries.

TEXT BOOKS
1. Automation, Production Systems and Computer Integrated Manufacturing: M.P. Groover./ PE/PHI
2. Manufacturing process and systems : Ostwals Munoz

REFERENCES
1. Computer Control of Manufacturing Systems by Yoram Coren.
2. CAD / CAM/ CIM by Radhakrishnan.
3. Automation by W. Buekinsham.
4. Mechanical assemblies – Daniek E. Whitney

AUTO AIR CONTIDITIONING
(DEPARTMENTAL ELECTIVE-III)

Course objective: To impart the knowledge of the auto air conditioning concepts and various systems and also load analysis, air distribution calculations.

UNIT I
AIR CONDITIONING FUNDAMENTALS: Basic air conditioning system, Air conditioning principles, air conditioning types, temperature and pressure fundamentals, types of compressors and refrigerants.

UNIT II
AIR CONDITIONING SYSTEMS: Classification, layouts, central I unitary air conditioning systems, components like compressors, evaporators, condensers, expansions devices, fan blowers.
Heating systems, automotive heaters, types, heater systems, air conditioning protection, engine protection.

UNIT-III
LOAD ANALYSIS: Outside & inside design consideration, factors forming the load on refrigeration & air conditioning systems, cooling & heating loads calculations, load calculations for automobiles, effect of air conditioning load on engines performance.

UNIT –IV
AIR DISTRIBUTION SYSTEMS: Distribution duct system, sixing, supply I return ducts, type of grills, diffusers, ventilation, air noise level, layout of duct systems for automobiles and their impact on load calculations.

UNIT-V
Air routing & temperature control-Objectives, evaporator air flow, through the re-circulating unit, automatic temperature control, duct system, controlling flow, vacuum reserve, testing the air control of air handling systems.

UNIT-VI
AIR CONDITIONING SERVICES: Air conditioner maintenance & service- causes of air conditioner failure, leak testing guide, discharging the system, evacuating the system, charging the system, servicing heater system, removing & replacing components, trouble shooting of air conditioning system, compressor service, methods of dehydration, charging & testing.
Air conditioning control: Common control such as thermostats, humidistat, control dampers, pressure cut outs, relays.

Course outcome: After completing the course, student will be in a position to understand various systems fault diagnosis and troubleshooting of auto air conditioning.

TEXT BOOKS
1. Mark Schnubel, "Automotive Heating & Air Conditioning", Thomson Delmar Learning, 3rd edition, NY.
2. William H. Crouse & Donald L. Anglin, "Automotive Air Conditioning, Mc GrawHill. Inc., 1990.
3. ASHRAE Handbook – 1985 Fundamentals.

REFERENCES
1. Boyace H. Dwuggins, "Automotive Air – Conditioning".
2. SamSungarman, "HVAC Fundamentals, Fairmont Press, ISBNO-88173-489.
3. Paul Weisler, "Automotive Air Conditioning, Reston PublishingCo.Inc.1990.

4. Paul Lung, "Automotive Air Conditioning, C.B, S. Publisher & Distributor, Delhi.

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EXPERIMENTAL STRESS ANALYSIS
(DEPARTMENTAL ELECTIVE – III)

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Course objectives:

Objective of the course is to measure strain through various experimental methods like strain gauges, photo elasticity techniques, brittle coatings, moiré methods and birefrigerent coatings to understand the relation between the mechanics theory and experimental stress analysis to learn usage of the experimental techniques on the practical problems

UNIT – I

Introduction: Stress, strain, Plane stress and plane strain conditions, Compatibility conditions. Problems using plane stress and plane strain conditions, stress functions, mohrs circle for stress strain, Three-dimensional stress strain relations.

UNIT – II

Strain Measurement and Recordings: Various types of strain gauges, Electrical Resistance strain gauges, semiconductor strain gauges, strain gauge circuits. Introduction, static recording and data logging, dynamic recording at very low frequencies, dynamic recording at intermediate frequencies, dynamic recording at high frequencies, dynamic recording at very high frequencies, telemetry systems.

UNIT – III

Photo elasticity: Photo elasticity – Polariscope – Plane and circularly polarized light, Bright and dark field setups, Photo elastic materials – Isochromatic fringes – Isoclinics

Three dimensional Photo elasticity : Introduction, locking in model deformation, materials for three-dimensional photo elasticity, machining cementing and slicing three-dimensional models, slicing the model and interpretation of the resulting fringe patterns, effective stresses, the shear-difference method in three dimensions, applications of the Frozen-stress method, the scattered-light method.

UNIT – IV

Brittle coatings: Introduction, coating stresses, failure theories, brittle coating crack patterns, crack detection, ceramic based brittle coatings, resin based brittle coatings, test procedures for brittle coatings analysis, calibration procedures, analysis of brittle coating data.

UNIT – V

Moire Methods: Introduction, mechanism of formation of Moire fringes, the geometrical approach to Moire-Fringe analysis, the displacement field approach to Moire-Fringe analysis, out of plane displacement measurements, out of plane slope measurements, sharpening and multiplication of Moire-Fringes, experimental procedure and techniques.

UNIT – VI

Birefringent Coatings

Introduction, Coating stresses and strains, coating sensitivity, coating materials, application of coatings, effects of coating thickness, Fringe-order determinations in coatings, stress separation methods.

TEXT BOOKS

1. Theory of Elasticity by Timoshenke and Goodier Jr
2. Experimental stress analysis by Dally and Riley,Mc Graw-Hill

REFERENCES

1. A treatise on Mathematical theory of Elasticity by LOVE .A.H
2. Photo Elasticity by Frocht
3. Experimental stress analysis, Video course by K.Ramesh / NPTEL

Course Outcomes:

The intended learning outcomes are that on completion of this course the student should be able to:

1. Student should be able to chose the appropriate method for measuring strain
2. Students should be able to apply optical techniques for measurement of strain & stress
3. Analyze the results obtained from coating techniques and corroborated with theoretical results.
4. Correlate experimental and analytically derived results.

DEPARTMENTAL ELECTIVE-IV
MANAGEMENT SCIENCE

Course objective: The objective is to expose the student to the concepts of management science, material management, and strategic management. Further the student will be given enough exposure to the contemporary management practices.

Unit I:

Introduction to Management: Concepts of Management and organization- Nature and Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management.

Unit II:

Operations Management: Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study -Basic procedure involved in Method Study and Work Measurement-Statistical Quality Control: $\overline{X}$ chart, R chart, *c* chart, *p* chart, (simple Problems), Acceptance Sampling, Deming's contribution to quality.

Unit III:

A) Materials Management: Objectives, Need for Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Stores Records - Supply Chain Management

B) Marketing: Functions of Marketing, Marketing Mix, Marketing Strategies based on Product Life Cycle., Channels of distribution.

Unit IV:

Human Resources Management (HRM): Concepts of HRM, HRD and Personnel Management and Industrial Relations (PMIR), HRM vs. PMIR, Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating.

Unit V:

Strategic Management: Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, SWOT Analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives.

Unit VI:

***Contemporary Management Practices*:** Basic concepts of Just-In-Time (JIT) System, Total Quality Management (TQM), Six sigma and Capability Maturity Model (CMM) Levels, Value Chain Analysis, Enterprise Resource Planning (ERP), Performance Management, Business Process outsourcing (BPO), Business Process Re-engineering and Bench Marking, Balanced Score Card.

Course outcome: The students after completing the course will be able to understand the concepts of management sciences, material sciences and are expected to make use of strategic management and operations management concepts.

TEXT BOOK
1. Aryasri: *Management Science*, TMH, New Delhi.

REFERENCES

1. Kotler Philip & Keller Kevin Lane: Marketing Mangement 12/e, PHI, 2007
2. Koontz & Weihrich: *Essentials of Management*, 6/e, TMH, 2007
3. Thomas N.Duening & John M.Ivancevich *Management—Principles and Guidelines,* Biztantra,2007.
4. Kanishka Bedi, *Production and Operations Management*, Oxford University Press, 2007.
5. Memoria & S.V.Ganker, *Personnel Management*, Himalaya, 25/e, 2007
6. Schermerhorn: *Management*, Wiley, 2007.
7. Parnell: Strategic Management, Biztantra,2007.
8. L.S.Srinath: PERT/CPM,Affiliated East-West Press, 2007.

PRINCIPLES OF ENTREPRENEURSHIP
(DEPARTMENTAL ELECTIVE-IV)

Course objectives*: The objective is to expose the students to the concepts of entrepreneurship and role of entrepreneurship in economic development. Further the student will be given enough exposure to the managerial practices to increase the overall productivity.

Unit-I
Introduction to Entrepreneurship Definition of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vs Entrepreneur. The Entrepreneurial decision process. Role of Entrepreneurship in Economic Development, Ethics and Social responsibility of Entrepreneurs. Opportunities for Entrepreneurs in India and abroad. Woman as Entrepreneur.

Unit- II
Creating and Starting the Venture Sources of new Ideas, Methods of generating ideas, creating problem solving, product planning and development process.
The Business Plan: Nature and scope of Business plan , Writing Business Plan, Evaluating Business plans, Using and implementing business plans. Marketing plan, financial plan and the organizational plan, Launching formalities.

Unit- III
Financing and Managing the new venture Sources of capital, Record keeping, recruitment, motivating and leading teams, financial controls . Marketing and sales controls. E-commerce and Entrepreneurship, Internet advertising.

Unit- IV
New venture Expansion Strategies and Issues Features and evaluation of joint ventures, acquisitions, merges, franchising. Public issues, rights issues, bonus issues and stock splits. Institutional support to Entrepreneurship. Role of Directorate of Industries.

Unit- V
Production and Marketing Management Thrust of production management, Selection of production Techniques, plant utilization and maintenance, Designing the work place, Inventory control, material handling and quality control. Marketing functions, market segmentation, market research and channels of distribution, Sales promotion and product pricing.

Unit -VI
Labour legislation, Salient Provision under Indian Factories Act, Industrial Disputes Act, Employees State Insurance Act, Workmen's Compensation Act and payment of Bonus Act.
This course replaces the course offered in earlier years as 'Entrepreneurship& Management'.

Course outcome: After completing the course, the learner will be in a position to manage an enterprise right from starting the venture to implementation of strategic managerial practices to increase the productivity.

TEXT BOOKS:

1. Robert Hisrich, & Michael Peters: Entrepreneurship, TMH, 5th Edition.
2. Dollinger: Entrepreneurship,4/e, Pearson, 2004.

REFERENCE BOOKS:

1. Vasant Desal: Dynamics of Entrepreneurial Development and management, Himalaya Publishing House, 2004.
2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.
3. Robert J.Calvin: Entrepreneurial Management, TMH, 2004.
4. Gurmeet Naroola: The Entrepreneurial Connection, TMH, 2001.
5. Bolton & Thompson : Entrepeneurs- Talent, Temperament, Technique, Butterworth Heinemann, 2001.
6. Agarwal :Indian Economy , Wishwa Prakashan 2005.
7. Dutt & Sundaram : Indian Economy. S. Chand, 2005.
8. Srivastava: Industrial Relations & Labour Laws, Vikas, 2005.
9. Aruna Kaulgud: Entrepreneurship Management by. Vikas publishing house, 2003.
10. Thomas W. Zimmerer & Norman M. Scarborough: Essential of Entrepreneurship and small business management, PHI, 4/e, 2005.
11. Mary Coulter: Entrepreneurship in Action, PHI, 2/e, 2005.
12. Kaplan: Patterns of Entrepreneurship, Willey, 2005.
13. ND Kapoor: Industrial Law, Sultan Chand & Sons, 2005.

Couse object: The students are exposed to principals of simulation using computers and validation of models with more emphasis on SI engine and CI engine process.

UNIT-I
INTRODUCTION: Simulation principles − simulation exercises using computers, validation of models.
COMBUSTION PROCESS: Reactive process, heat of reaction, adiabatic flame temperature, isentropic changes of stage, temperature change due to fuel vaporization.

UNIT-II
SIMULATION OF SI ENGINE PROCESSES:
SI engine simulation with air as working medium: Ideal otto cycle, deviation with ideal and actual cycle.
SI engine simulation with adiabatic combustion: Temperature drop due to fuel vaporization, full throttle, part throttle and supercharged operations, problems.

UNIT-III
SI engines simulation with progressive combustion, gas exchange process, evaluation of performance parameters.
Simulation of two strokes SI engine processes.

UNIT-IV
SIMULATION OF CI ENGINE PROCESS:
CI engines simulation with air as working medium: deviation with ideal and actual cycle.
CI engines simulation with adiabatic combustion : Naturally aspirated and super charged operations, problems.

UNIT-V
CI engines simulation with progressive combustion, combustion modelling, zero dimensional combustion models, heat release and heat transfer models.
CI engines simulation with gas exchange process. Evaluation of performance parameters.

UNIT-VI
Introduction to CFD simulation of IC engine flow mixture formation and combustion

Course outcome: students completing this course are expected to understand the principals involved in simulation and adopt the same to simulate an IC engine with different working media.

TEXT BOOKS
1. Computer simulation of SI engine process, V.Ganesan, Orient Longman Ltd.,
2. Computer simulation of CI engine process, V.Ganesan, Orient Longman Ltd.,

REFERENCES
1. Introduction to modelling and control of Internal Combustion Engine Systems, Lino Guzzella, Christopher H.Onder,Springer,2010.
2. Computer Optimization of Internal Combustion Engines, Y.Shi,et,al;Springer,2011.
3. 3D − CFD Simulation of IC Engine Flow, Mixture Formation and Combustion with AVL FIRE, Gunter P.Merker,Springer,2010.

MODERN VEHICLE TECHNOLOGY
(DEPARTMENTAL ELECTIVE-IV)

Course objectives: The students are exposed to modern trends in automobile industry and the use of combination of various energy sources. Further the students are exposed to latest trends in suspension system, emission and noise control systems.

UNIT-I

Trends in Automotive Power Plants: Hybrid Vehicles - Stratified charged / lean burn engines - Hydrogen Engines-Electric vehicles-Magnetic track vehicles solar powered vehicle Combined power source vehicle, types of hybrid drives, Toyota hybrid system.

UNIT-II

Suspension: Interconnected air and liquid suspensions, Hydrolastic suspension system, Hydragas suspension.

UNIT-III

Breaking systems and safety: Modern rear wheel brake, indirect floating calliper disc brake, self energising disc brake, brake limiting device, anti-slide system, Ford Escort and Orion anti lock system. Closed loop suspension; Regenerative braking; Passenger comfort.

UNIT-IV

Emission and Noise Pollution Control: Introduction, Engine emissions, types of catalytic conversion, open loop and closed loop operation to the oxidizing catalytic converter, Evaporative emissions, Internal and External Noise, Identification of Noise sources, Noise Control Techniques.

UNIT-V

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.

UNIT-VI

Fuel Injection Systems: SPFI, MPFI, DI, Pilot Injection, Unit Injection. CRDI; Two Wheeler Technology: DTS- i, DTS - Fi, DTS - Si; Four Wheeler Technology: WT, Camless Engine, GDI.

Course outcome: The students completing the course are expected to make use of the latest technologies to develop more efficient vehicles to meet the customer demands.

REFERENCES

1. K.K. Ramalingam, "Automobile Engineering", Scitech Publications Pvt. Ltd., 2005
2. Dr. N.K. Giri, "Automobile Mechanic", Khanna Publishers, 2006
3. Crouse/Anglin "Automotive Mechanics"
4. K.Newton, W.Steeds "The Motor Vechicle"
5. Heinz Heisler " Advanced Vehicle Technology" ELSEVIER

IV Year –II SEMESTER

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PROJECT WORK

Objectives:

The aim of the course is to make the student perform a comprehensive project work that involves either or all of the following: optimum design of a mechanical component or an assembly, thermal analysis, computer aided design & analysis, cost effective manufacturing process, material selection, testing procedures or fabrication of components and prepare a detailed technical thesis report. The completed task should also take into account the significance of real time applications, energy management and the environmental affects.

Outcomes:

After completing the project work the student should learn the technical procedure of planning, scheduling and realizing an engineering product and further acquire the skills of technical report writing and data collection.

Course content:

The student should work in groups to achieve the aforementioned objectives and the outcomes.