ANNA UNIVERSITY:: CHENNAI 600 025

UNIVERSITY DEPARTMENTS

R - 2012

B.E. – AUTOMOBILE ENGINEERING

I – VIII SEMESTERS CURRICULA AND SYLLABI

SEMESTER I

Sl. No.	Code No.	Course Title	L	T	P	C
Theory						
1	HS8151	Technical English I	3	1	0	4
2	MA8151	Mathematics – I	3	1	0	4
3	PH8151	Engineering Physics	3	0	0	3
4	CY8151	Engineering Chemistry	3	0	0	3
5	GE8151	Computing Techniques	3	0	0	3
6	GE8152	Engineering Graphics	2	0	3	4
Practical						
7	PH8161	Physics Laboratory	0	0	2	1
8	CY8161	Chemistry Laboratory	0	0	2	1
9	GE8161	Computer Practices Laboratory	0	0	3	2
10	GE8162	Engineering Practices Laboratory	0	0	3	2
		TOTAL	**17**	**2**	**13**	**27**

SEMESTER II

Sl. No.	Code No.	Course Title	L	T	P	C
Theory						
1	HS8251	Technical English - II	3	1	0	4
2	MA8251	Mathematics – II	3	1	0	4
3	PH8251	Materials Science	3	0	0	3
4	GE8251	Engineering Mechanics	3	1	0	4
5	AU8201	Theory of Fuels and Lubricants	3	0	0	3
6	PR8252	Manufacturing Processes	3	0	0	3
Practical						
7	AU8211	Conventional Machining Process Laboratory	0	0	3	2
8	PR8263	Computer Aided Part and Modeling Laboratory	0	0	3	2
		TOTAL	**18**	**3**	**6**	**25**

SEMESTER III

Sl. No.	Code No.	Course Title	L	T	P	C
THEORY						
1	MA8353	Numerical Methods	3	1	0	4
2	AE8351	Solid Mechanics	3	0	0	3
3	AU8301	Automotive Petrol Engines	3	0	0	3
4	AU8302	Measurement System for Automobiles	3	0	0	3
5	AU8351	Thermodynamics and Thermal Engineering	3	1	0	4
6	EI8305	Electrical and Electronics Engineering	3	0	0	3
PRACTICAL						
7	AU8311	Mechanical Science Laboratory	0	0	3	2
8	EI 8361	Electrical and Electronic Engineering Laboratory	0	0	3	2
		TOTAL	**18**	**2**	**6**	**24**

SEMESTER IV

Sl. No.	Code No.	Course Title	L	T	P	C
THEORY						
1	GE8351	Environmental Science and Engineering	3	0	0	3
2	AE8451	Engineering Fluid Mechanics	3	0	0	3
3	AU8401	Automotive Chassis	3	0	0	3
4	AU8402	Automotive Diesel Engines	3	0	0	3
5	PR8451	Kinematics & Dynamics of Machines	3	1	0	4
PRACTICAL						
6	AU8411	Automotive Chassis Components Laboratory	0	0	3	2
7	AU8412	Automotive Engine Components Laboratory	0	0	3	2
8	AU8413	Fuels and Lubricants Laboratory	0	0	3	2
		TOTAL	**15**	**1**	**9**	**22**

SEMESTER V

Sl. No.	Code No.	Course Title	L	T	P	C
THEORY						
1	AU8501	Automotive Components Design	3	0	0	3
2	AU8502	Automotive Electrical and Electronics Systems	3	0	0	3
3	AU8503	Automotive Transmission	3	0	0	3
4	AU8504	Two and Three Wheeler Technology	3	0	0	3
5	E1	Elective – I	3	0	0	3
6	E2	Elective – II	3	0	0	3
PRACTICAL						
7	AU8511	Automotive Electrical and Electronics Laboratory	0	0	3	2
8	AU8512	Design and Simulation of Automotive Engine Components Laboratory	1	0	2	2
		TOTAL	**19**	**0**	**5**	**22**

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SEMESTER VI

Sl. No.	Code No.	Course Title	L	T	P	C
Theory						
1	AU8601	Automotive Pollution and Control	3	0	0	3
	AU8602	Vehicle Body Engineering	3	0	0	3
2	AU8603	Vehicle Control System	3	0	0	3
3	PR8602	Management Science	3	0	0	3
4	E3	Elective – III	3	0	0	3
5	E4	Elective – IV	3	0	0	3
Practical						
6	HS8561	Employability Skills	0	0	2	1
7	AU8611	Creative and Innovative Project	0	0	3	2
8	AU8612	Engine Testing and Emission Measurement Laboratory	0	0	3	2
		TOTAL	**18**	**0**	**8**	**23**

SEMESTER VII

Sl. No.	Code No.	Course Title	L	T	P	C
Theory						
1	AU8701	Simulation of IC Engines	3	0	0	3
2	AU8702	Vehicle Dynamics	3	0	0	3
3	AU8703	Vehicle Maintenance	3	0	0	3
4	E5	Elective – V	3	0	0	3
5	E6	Elective – VI	3	0	0	3
6	E7	Elective – VII	3	0	0	3
Practical						
7	AU8711	Computer Aided Chassis Design Laboratory	1	0	2	2
8	AU8712	Industrial Training*	0	0	3	2
9	AU8713	Vehicle Maintenance and Re-Conditioning Laboratory	0	0	3	2
		TOTAL	**19**	**0**	**8**	**24**

* - Four weeks Industrial Training during Vacation

SEMESTER VIII

Sl. No.	Code No.	Course Title	L	T	P	C
Theory						
1	E8	Elective – VIII	3	0	0	3
2	E9	Elective – IX	3	0	0	3
Practical						
3	AU8811	Project Work	0	0	12	6
		Total Credits				**12**

TOTAL CREDITS: 27 + 25 + 24 + 22 + 22 + 23 + 24 + 12 = 179

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LIST OF ELECTIVES FOR B. E. AUTOMOBILE ENGINEERING

S.No	Code No.	Course Title	L	T	P	C
1.	AU8001	Advance Theory of IC Engines	3	0	0	3
2.	AU8002	Advance Vehicle Technology	3	0	0	3
3.	AU8003	Alternative Fuels and Energy System	3	0	0	3
4.	AU8004	Automotive Aerodynamics	3	0	0	3
5.	AU8005	Automotive Test Instrumentation	3	0	0	3
6.	AU8006	Combustion Thermodynamics and Heat Transfer	3	0	0	3
7.	AU8007	Computational Fluid Mechanics	3	0	0	3
8.	AU8008	Fleet Management	3	0	0	3
9.	AU8009	Hybrid and Electric Vehicles	3	0	0	3
10.	AU8010	Hydraulic and Pneumatic Systems	3	0	0	3
11.	AU8011	Noise, Vibration and Harshness	3	0	0	3
12.	AU8012	Polymer Components in Automotive Applications	3	0	0	3
13.	AU8013	Principles of Control System	3	0	0	3
14.	AU8014	Renewable sources of energy	3	0	0	3
15.	AU8015	Special Types of Vehicles	3	0	0	3
16.	AU8016	Vehicle Air-Conditioning	3	0	0	3
17.	AU8017	Virtual Instrumentation in Automobile Engineering	3	0	0	3
18.	AU8071	Finite Element Techniques	3	0	0	3
19.	AU8651	Manufacturing of Automotive Components	3	0	0	3
20.	GE8071	Fundamentals of Nano Science	3	0	0	3
21.	GE8751	Engineering Ethics And Human Values	3	0	0	3
22.	MG8654	Total Quality Management	3	0	0	3
23.	ML8071	Automotive Materials	3	0	0	3
24.	PR8072	Energy management	3	0	0	3
25.	PR8075	Robotic Engineering	3	0	0	3
26.	PR8551	Quantitative techniques in management	3	0	0	3
27.	PR8651	Quality control and reliability	3	0	0	3
28.	GE8072	Disaster Management	3	0	0	3
29.	GE8073	Human Rights	3	0	0	3

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HS8151	TECHNICAL ENGLISH I (Common to all branches of B.E. / B.Tech. Programmes in I Semester)	L T P C 3 1 0 4

OBJECTIVES:

- To enable all students of engineering and technology develop their basic communication skills in English.
- To give special emphasis to the development of speaking skills amongst the students of engineering and technology students.
- To ensure that students use the electronic media such as interne and supplement the learning materials used in the classroom.
- To inculcate the habit of reading for pleasure.

UNIT I

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one's place, important festivals etc. – Introducing oneself, one's family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one's leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

UNIT II

Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking & answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Lab descriptions (general/specific description of laboratory experiments) - Definitions - Recommendations; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association; E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

UNIT III

Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause & effect / compare & contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

UNIT IV

Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations & acronyms; E-

materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

UNIT V

Listening - Listening to different accents, Listening to Speeches / Presentations, Listening to broadcast & telecast from Radio & TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar & Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents, - Interpreting posters

TOTAL : 60 PERIODS

OUTCOMES:

Learners should be able to

- Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Read different genres of texts adopting various reading strategies.
- Listen/view and comprehend different spoken discourses/excerpts in different accents

TEXT BOOKS:

1. Mindscapes: English for Technologists and Engineers, Orient Black Swan, 2012.
2. S.P. Dhanavel, English and Communication skills for students of science and Engineering. Orient Black Swan, Chennai,2011

REFERENCES:

1. Pickett, Nell Ann, Ann A.Laster and Katherine E.Staples. Technical English: Writing, Reading and Speaking. New York: Longman, 2001.
2. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge, 2011.
3. Morgan, David and Nicholas Regan. Take-Off: Technical English for Engineering. Reading: Garnet Publishing Limited, 2008.
4. Thorn, Michael and Alan Badrick. An Introduction to Technical English. Harlow: Prentice Hall Europe, 1993.
5. Rizvi, M.Ashraf. Effective Technical Communication. New Delhi: Tata McGraw-Hill Publishing Company, 2007.

EXTENSIVE READERS

1. Murthy, Sudha, Wise & Otherwise. New Delhi: Penguin Books India, 2006.
2. Gates, Bill and Collins Hemingway. Business @ the Speed of Thought: Succeeding in the Digital Economy. New York: Warner Business Books, 2000.

WEBSITE RESOURCES

1. www.uefap.com
2. www.eslcafe.com
3. www.listen-to-english.com
4. www.owl.english.purdue.edu
5. www.chompchomp.com

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MA8151 **MATHEMATICS – I** **L T P C**
3 1 0 4

(Common to all branches of B.E. / B.Tech. Programmes in I Semester)

OBJECTIVES:

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I MATRICES **9+3**

Eigen values and Eigenvectors of a real matrix – Characteristic equation – Properties of eigen values and eigenvectors – Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II INFINITE SERIES **9+3**

Sequences – Convergence of series – General properties – Series of positive terms – Tests of convergence (Comparison test, Integral test, Comparison of ratios and D'Alembert's ratio test) – Alternating series – Series of positive and negative terms Absolute and conditional convergence – Power Series – Convergence of exponential, logarithmic and Binomial Series.

UNIT III FUNCTIONS OF SEVERAL VARIABLES **9+3**

Limits and Continuity – Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Errors and approximations – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT IV IMPROPER INTEGRALS **9+3**

Improper integrals of the first and second kind and their convergence – Evaluation of integrals involving a parameter by Leibnitz rule – Beta and Gamma functions – Properties – Evaluation of integrals using Beta and Gamma functions – Error functions.

UNIT V MULTIPLE INTEGRALS **9+3**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of Solids – Change of variables in double and triple integrals – Area of a curved surface.

TOTAL : 60 PERIODS

OUTCOMES:

This course equips students to have basic knowledge and understanding in one field of materials, integral and differential calculus

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition, 2007.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.

REFERENCES:

1. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
2. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Greenberg M.D., "Advanced Engineering Mathematics", Pearson Education, New Delhi, 2nd Edition, 5th Reprint, 2009.
4. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.

PH8151 **ENGINEERING PHYSICS** **L T P C**
3 0 0 3

(Common to all branches of B.E. / B.Tech. Programmes in I Semester)

OBJECTIVE:

- To introduce the basic physics concepts relevant to different branches of Engineering and Technology.

UNIT I PROPERTIES OF MATTER **9**

Elasticity - Poisson's ratio and relationship between moduli (qualitative) - Stress-strain diagram - factors affecting elasticity - bending of beams - cantilever - bending moment - theory and experiment of Young's modulus determination - Uniform and non-uniform bending - I shaped girders - twisting couple - hollow cylinder - shaft - torsion pendulum - determination of rigidity modulus- moment of inertia of a body (regular and irregular).

UNIT II ACOUSTICS AND ULTRASONICS **9**

Classification of sound - loudness and intensity - Weber-Fechner Law - standard intensity and intensity level - decibel - reverberation - reverberation time - rate of growth and decay of sound intensity - derivation of Sabine's formula - absorption coefficient and its determination - factors affecting acoustics of buildings : focussing, interference, echo, Echelon effect, resonance - noise and their remedies. Ultrasonics - production - magnetostriction and piezoelectric methods - detection of ultrasound - acoustic grating - industrial applications - NDT - Ultrasonic method: scan modes and practice.

UNIT III THERMAL PHYSICS **9**

Thermal expansion - thermal stress - expansion joints - bimetallic strips - thermal conductivity - conductions in solids - Forbe's and Lees' disc methods - Rectilinear flow of heat through a rod - flow of heat through a compound materials - radical flow of heat through a spherical shell - thermal insulation of buildings – Laws of blackbody radiation: Kirchoffs law, Stephens law, Wiens law, Raleigh-Jean law and Planks law (derivation). Laws of thermodynamics - Otto and diesel engines and their efficiency - entropy - entropy of Carnot's cycle - reverse Carnot's cycle - refrigerator.

UNIT IV APPLIED OPTICS **9**

Interference - Michelson interferometer: construction, working, determination of wave length and thickness - anti-reflection coating - air wedge and its application - Lasers - Einstein's coefficients - CO2, Nd:YAG and semiconductor lasers - homo junction and hetro junction - construction and working - applications - Optical fibres - classification (index & mode based) - principle and propagation of light in optical fibres - acceptance angle and numerical aperture - fibre optic communication system - active and passive sensors.

UNIT V SOLID STATE PHYSICS **9**

Nature of bonding - growth of single crystals (qualitative) - crystal systems - crystal planes and directions - expressions for interplanar distance - coordination number and packing factor for simple structures: SC, BCC, FCC and HCP - structure and significance of NaCl, ZnS, diamond and graphite - crystal imperfections: point defects, dislocations and stacking faults - unit cell, Bravais space lattices - miller indices.

TOTAL : 45 PERIODS

OUTCOMES:

- The students will have knowledge on the basics of physics related to properties of matter, optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

TEXT BOOKS:

1. Gaur R.K., and Gupta, S.L., Engineering Physics, Dhanpat Raj Publications,2003.
2. Palanisamy, P.K., Engineering Physics, Scitech Publications (P) Ltd, 2006.
3. Arumugam, M., Engineering Physics, Anuradha Publications, 2000.

REFERENCES:

1. Sankar, B.N., Pillai.S.O., Engineering Physics, New Age International (P) Ltd., 2007.
2. Rajendran.V Engineering Physics, Tata McGraw-Hill, 2009.

CY8151 ENGINEERING CHEMISTRY **L T P C 3 0 0 3**

(Common to all branches of B.E. / B.Tech. Programmes in I Semester)

OBJECTIVES:

- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To acquaint the students with the basics of nano materials, their properties and applications.

UNIT I CHEMICAL THERMODYNAMICS **9**

Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation – variation of chemical potential with temperature and pressure.

UNIT II POLYMER CHEMISTRY **9**

Introduction: Classification of polymers – Natural and Synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerisation. Types and mechanism of polymerisation: Addition (Free Radical, cationic, anionic and living); condensation and copolymerisation. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerisation: Bulk, emulsion, solution and suspension.

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UNIT III KINETICS AND CATALYSIS 9

Introduction – reaction velocity, factors affecting reaction velocity, rate constant, order of reaction, molecularity, pseudo molecular reactions, zero, first, second and third order reactions, reactions of fractional orders, determination of order of reactions. Catalysis: Auto catalysis - Enzyme Catalysis: Michaelis-Menton equation; factors affecting enzyme catalysis. Heterogeneous Catalysis: Types of adsorption isotherms: Langmuir–Hinselwood and Rideal–Eley Mechanism.

UNIT IV PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry: Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert-Beer Law. Photoprocesses - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitisation. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. Width and intensities of spectral lines. Spectrophotometric estimation of iron. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram) and applications.

UNIT V NANOCHEMISTRY 9

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: Nanocluster, nanorod, nanotube and nanowire. Synthesis: Precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation; Properties and Applications. Risk discussion and Future perspectives.

TOTAL : 45 PERIODS

OUTCOMES:

- The knowledge gained on polymer chemistry, thermodynamics. spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning

TEXT BOOKS

1. P. Kannan and A. Ravikrishnan, "Engineering Chemistry", Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2009.
2. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India, 2011

REFERENCE BOOKS

1. P.W. Atkins and de Paula Julio, "Physical Chemistry", Oxford University Press, 8th Ed., (Indian Student Edition) (2009).
2. K. K. Rohatgi-Mukherjee, "Fundamental of Photochemistry" New Age International (P) Ltd., New Delhi, 1986.
3. G.A. Ozin and A.C. Arsenault, "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.
4. V.R.Gowariker, N.V.Viswanathan and Jayadev Sreedhar, "Polymer Science", New Age International P (Ltd.,), Chennai, 2006

GE8151 COMPUTING TECHNIQUES **L T P C**
3 0 0 3

OBJECTIVES:

The students should be made to:

- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

UNIT I INTRODUCTION **8**

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

UNIT II C PROGRAMMING BASICS **10**

Problem formulation – Problem Solving - Introduction to ' C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

UNIT III ARRAYS AND STRINGS **9**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

UNIT IV FUNCTIONS AND POINTERS **9**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

UNIT V STRUCTURES AND UNIONS **9**

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Design C Programs for problems.
- Write and execute C programs for simple applications.

TEXTBOOKS

1. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009
2. Ashok N. Kamthane, "Computer programming", Pearson Education, 2007.
3. Yashavant P. Kanetkar. " Let Us C", BPB Publications, 2011.

REFERENCES

1. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006
2. Byron S Gottfried, " Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
3. R.G. Dromey, "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007

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GE8152	ENGINEERING GRAPHICS	L T P C
		2 0 3 4

(Common to all branches of B.E. / B.Tech. Programmes in I Semester)

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION) **1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HAND SKETCHING **14**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES **14**

Orthographic projection- principles-Principal planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS **14**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES **14**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS **15**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method and vanishing point method.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY) **3**

Introduction to drafting packages and demonstration of their use.

TOTAL: 75 PERIODS

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OUTCOMES:

On Completion of the course the student will be able to

- perform free hand sketching of basic geometrical constructions and multiple views of objects.
- do orthographic projection of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- prepare isometric and perspective sections of simple solids.
- demonstrate computer aided drafting.

TEXT BOOK:

1. N.D.Bhatt and V.M.Panchal, "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010

REFERENCES:

1. K.R.Gopalakrishna, "Engineering Drawing" (Vol I&II combined) Subhas Stores, Bangalore, 2007
2. Luzzader, Warren.J., and Duff,John M.,," Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2005
3. M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson, 2nd Edition, 2009
4. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International (P) Limited ,2008.
5. K. V.Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi,2008.

PUBLICATION OF BUREAU OF INDIAN STANDARDS:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

SPECIAL POINTS APPLICABLE TO UNIVERSITY EXAMINATIONS ON ENGINEERING GRAPHICS:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

PH8161	PHYSICS LABORATORY	L T P C 0 0 2 1

(Common to all branches of B.E. / B.Tech. Programmes in I Semester)

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

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LIST OF EXPERIMENTS:

1.	Torsional pendulum	Determination of rigidity modulus of wire and moment of inertia of disc
2.	Non – uniform bending	Determination of young's modulus
3.	Lee's disc	Determination of thermal conductivity of a bad conductor
4.	Potentiometer	Determination of thermo EMF of thermocouple
5.	Air wedge	Determination of thickness of a thin sheet of paper
6.	i. Optical fibre	Determination of Numerical Aperture and acceptance angle
	ii. Compact disc	Determination of width of the groove using laser
7.	Acoustic grating	Determination of velocity of ultrasonic waves in liquids
8.	Post office box	Determination of Band gap of a semiconductor
9.	Spectrometer	Determination of wavelength using grating
10.	Viscosity of liquids	Determination of co-efficient of viscosity of a liquid by Poiseuille's flow

TOTAL : 30 PERIODS

OUTCOMES:

- The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

CY8161 **CHEMISTRY LABORATORY** **L T P C**
0 0 2 1

(Common to all branches of B.E. / B.Tech. Programmes in I Semester)

OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by vacometry.

LIST OF EXPERIMENTS:

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1,10-phenanthroline / thiocyanate method).

10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of poly vinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics – ester hydrolysis.
13. Corrosion experiment – weight loss method.
14. Determination of CMC.
15. Phase change in a solid.

TOTAL: 30 PERIODS

OUTCOMES:

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters

REFERENCE BOOKS

1. A text of quantitative inorganic analysis, A. L. Vogel , ELBS London. 1995.
2. Experiments in physical chemistry, D.P. Shoemarker and C.W. Gardad, McGraw Hill, London, 2001.
3. American Public Health Association.

GE8161 COMPUTER PRACTICES LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVES:

The student should be made to:

- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

LIST OF EXPERIMENTS:

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

GE8162	ENGINEERING PRACTIES LABORATORY (Common to all Branches of B.E. / B.Tech. Programmes)	L T P C 0 0 3 2

OBJECTIVE

To provide exposure to the students with hands-on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP – A (CIVIL & ELECTRICAL)

1. CIVIL ENGINEERING PRACTICE **12**

Plumbing

Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.

Laying pipe connection to the suction side of a pump – inlet.

Laying pipe connection to the delivery side of a pump – out let.

Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.

Wood Work

Sawing, planning and making common joints: T-Joint, Mortise and Tennon joint, Dovetail joint.

Study

Study of joints in door panels, wooden furniture

Study of common industrial trusses using models.

2. ELECTRICAL ENGINEERING PRACTICE **9**

- Basic household wiring using switches, fuse, indicator – lamp etc.,
- Preparation of wiring diagrams
- Stair case light wiring
- Tube – light wiring
- Study of iron-box, fan with regulator, emergency lamp

GROUP – B (MECHANICAL AND ELECTRONICS) **15**

3. MECHANICAL ENGINEERING PRACTICE

WELDING

- Arc welding of butt joints, lap joints, tee joints
- Gas welding Practice.
- Basic Machining
- Simple turning, drilling and tapping operations.
- Machine assembly Practice.
- Study and assembling the following:
- Centrifugal pump, mixies and air conditioners.
- Demonstration on
  - (a) Smithy operations like the production of hexagonal bolt.
  - (b) Foundry operation like mould preparation for grooved pulley.

4. ELECTRONIC ENGINEERING PRACTICE **9**

Soldering simple electronic circuits and checking continuity.

Assembling electronic components on a small PCB and testing.
Study of Telephone, FM radio, low-voltage power supplies.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to fabricate carpentry components and pipe connections including plumbing works.
- Ability to use welding equipments to join the structures
- Ability to fabricate electrical and electronics circuits

HS8251 TECHNICAL ENGLISH II **L T P C**
3 1 0 4

(Common to all branches of B.E. / B.Tech. Programmes in II Semester)

OBJECTIVES:

- To make the students acquire listening and speaking skills meant for both formal and informal contexts
- To help them develop their reading skills by exposing them to different types of reading strategies
- To equip them with writing skills needed for academic as well as workplace situations
- To make them acquire language skills at their own pace by using e-materials and language lab component

UNIT I

Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on something, weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using 'emoticons' as symbols in email messages; Grammar - Regular & irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

UNIT II

Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his success, thanking one's friend / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercise on Grammar and vocabulary, Extensive reading activity (reading stories / novels from links), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.

UNIT III

Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret etc.); Reading - Speed reading – reading passages with the time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading the articles from the journals - Format for the journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); E-materials - Interactive exercise on Grammar & vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU materials – Attending a meeting and writing minutes.

UNIT IV

Listening - Listening to a telephone conversation, Viewing a model interview (face-to-face, telephonic and video conferencing) and observing the practices; Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping the interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on Grammar & Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

UNIT V

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading Writing - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises - Pictures for discussion; Language Lab - Different models of group discussion

TOTAL: 60 PERIODS

OUTCOMES:

Learners should be able to

- Speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
- Write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- Read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
- Listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

TEXT BOOKS:

1. Mindscapes: English for Technologists and Engineers, Orient Black Swan, 2012.
2. S.P. Dhanavel, English and Communication skills for students of science and Engineering. Orient Black Swan, Chennai,2011

REFERENCE BOOKS:

1. Laws, Anne. Presentations. Hyderabad: Orient BlackSwan, 2000.
2. Lewis, Hedwig. Body Language: A Guide for Professionals. New Delhi: Sage Publications, 1998.
3. Naterop, Jean B. and Rod Revell. Telephoning in English. Cambridge: Cambridge University Press, 1987.
4. Rutherford, Andrea J. Basic Communication Skills for Technology. New Delhi: Pearson Education, 2001.
5. Ur, Penny. Teaching Listening Comprehension. Cambridge: Cambridge University Press, 1984.

EXTENSIVE READERS

1. Abdul Kalam, A P J. Ignited Minds: Unleashing the Power within India. New Delhi: Penguin Books India, 2002.
2. Parameswaran, Uma. C.V.Raman: A Biography. New Delhi: Penguin Books India, 2011.

WEB RESOURCES

1. www.esl-lab.com
2. www.englishgrammar.org
3. www.englishclub.com
4. www.mindtools.com
5. www.esl.about.com

MA8251	MATHEMATICS – II (Common to all branches of B.E. / B.Tech. Programmes in II Semester)	L T P C 3 1 0 4

OBJECTIVES:

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I DIFFERENTIAL EQUATIONS 9+3

Method of variation of parameters – Method of undetermined coefficients – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

UNIT II VECTOR CALCULUS 9+3

Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral and volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

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UNIT III ANALYTIC FUNCTION **9+3**

Analytic functions – Necessary and sufficient conditions for analyticity - Properties –Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $w = z + c, az, \frac{1}{z}, z^2$ - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION **9+3**

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT V LAPLACE TRANSFORMS **9+3**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems –Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem — Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL : 60 PERIODS

OUTCOMES:

- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition, 2007.
2. Ramana, B.V. "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi, 2010.

REFERENCES:

1. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, New Delhi, 2007.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
4. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.

PH8251 **MATERIALS SCIENCE** **L T P C**

(Common to Manufacturing, Industrial, Mining, Mechanical, Aeronautical, Automobile and Production Engineering) **3 0 0 3**

OBJECTIVE:

To introduce the essential principles of materials science for mechanical and related engineering applications.

UNIT I MECHANICAL PROPERTIES **9**

Introduction to mechanical properties - tensile test - plastic deformation mechanisms - slip and twinning - role of dislocations in slip - strengthening methods - strain hardening - refinement of the grain size - solid solution strengthening - precipitation hardening - creep resistance - creep curves - mechanisms of creep - creep-resistant materials - fracture - the Griffith criterion - critical stress intensity factor and its determination - fatigue failure - fatigue tests - methods of increasing fatigue life - hardness - Rockwell and Brinell hardness - Knoop and Vickers microhardness.

UNIT II PHASE DIAGRAMS **9**

Solid solutions - Hume Rothery's rules - free energy of solid solution - intermediate phases - The phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the level rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions - microstructural change during cooling.

UNIT III FERROUS ALLOYS AND HEAT TREATMENT **9**

The iron-carbon equilibrium diagram - phases, invariant reactions - microstructue of slowly cooled steels - eutectoid steel, hypo and hypereutectoid steels - effect of alloying elements on the Fe-C system - diffusion in solids - Fick's law - phase transformations - pearlitic transformations - T-T-T-diagram for eutectoid steel - baintic and martensitic transformations - tempering of martensite - heat treatment of steels - annealing - normalizing - quenching and tempering - case hardening - induction, flame and laser hardening - carburizing, cyaniding, carbonitriding and nitriding.

UNIT IV ELECTRONIC MATERIALS **9**

Classification of solids - energy bands - concept of Fermi level - conductor, semiconductor, insulator - Semiconductors: intrinsic, extrinsic - carrier concentration expression (qualitative) - compound semiconductors (qualitative) - dielectric materials - polarization mechanisms - dielectric breakdown - magnetic materials - ferromagnetic materials & hysterisis - ferrites - superconducting materials, properties, types and applications.

UNIT V NEW MATERIALS AND APPLICATIONS **9**

Introduction to Ceramics and its applications - Ceramic Fibres - Fibre reinforced Plastics – Fibre reinforced Metal – Metallic glasses – Shape memory alloys – Copper base alloys – Nickel – Titanium alloys – Relaxor- Ferroelectric materials – Electro and magneto rheological fluids - Sensors and Actuators – polymer semiconductos – photoconducting polymers – liquid crystals - Bio-sensors - Scintillation detectors (Position sensitive) –Bio materials – hydroxyapatite – PMMA – Silicone.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply the different materials, their processing, and heat treatments in suitable application in mechanical engineering fields.

TEXT BOOK:

1. Raghavan, V., Materials Science and Engineering, Prentice Hall of India, 2007.
2. Palanisamy, P.K., Applied Materials Science, Scitech, 2003.
3. Raghavan, V., Physical Metallurgy, Prentice Hall of India, 2002.

REFERENCE BOOKS:

1. Calister, W.D., Materials Science and Engineering an Introduction, John Wiley, 2003.
2. Rajendarn V and Marikani A, Materials Science, Tata McGraw Hill, 2006

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GE8251	ENGINEERING MECHANICS	L T P C 3 1 0 4

OBJECTIVE:

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering

UNIT I BASICS AND STATICS OF PARTICLES 9 + 3

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces — Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

UNIT II EQUILIBRIUM OF RIGID BODIES 9 + 3

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS 9 + 3

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula –Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES 9 + 3

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Work Energy Equation – Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 9 + 3

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction –wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL: 60 PERIODS

OUTCOMES:

- ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
- ability to analyse the forces in any structures.
- ability to solve rigid body subjected to dynamic forces.

TEXT BOOKS:

1. Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004)
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2010).

REFERENCES:

1. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education (2010).
2. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education (2006)
3. J.L.Meriam and L.G.Kraige, " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2,Third Edition, John Wiley & Sons,(1993)
4. Rajasekaran, S and Sankarasubramanian, G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., (2005).
5. Bhavikatti, S.S and Rajashekarappa, K.G. "Engineering Mechanics", New Age International (P) Limited Publishers, (1998).
6. Kumar, K.L. "Engineering Mechanics", 3rd Revised Edition, Tata Mcgraw – Hill Publishing Company, New Delhi (2008)

AU8201 THEORY OF FUELS AND LUBRICANTS **L T P C 3 0 0 3**

OBJECTIVES

To understand the properties of fuels and lubricants for the design and operation of the I.C engines.

UNIT I MANUFACTURE OF FUELS AND LUBRICANTS **9**

Structure of petroleum, refining process, fuels, thermal cracking, catalytic cracking, polymerization, alkylation, isomerisation, blending, products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants.

UNIT II THEORY OF LUBRICATION **9**

Engine friction: introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system.

UNIT III LUBRICANTS **9**

Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, additives and additive mechanism, synthetic lubricants, classification of lubricating oils, properties of lubricating oils, tests on lubricants. Grease, classification, properties, test used in grease.

UNIT IV PROPERTIES AND TESTING OF FUELS **9**

Thermo-chemistry of fuels, properties and testing of fuels, relative density, calorific value, flash point, fire point, distillation, vapour pressure, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point, carbon residue, copper strip corrosion etc.

UNIT V COMBUSTION & FUEL RATING **9**

SI Engines – flame propagation and mechanism of combustion, normal combustion, knocking, octane rating, fuel requirements. CI Engine, mechanism of combustion, diesel knock, cetane rating, fuel requirements. Additive - mechanism, requirements of an additive, petrol fuel additives and diesel fuel additives – specifications of fuels.

TOTAL : 45 PERIODS

OUTCOMES:

- At the end of the course, the student can understand the importance, manufacturing methods, testing methods, combustion methodology of automotive fuels and lubricants.

Attested

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TEXT BOOKS:

1. Ganesan.V., "Internal Combustion Engineering", Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. M.L. Mathur, R.P.Sharma "A course in internal combustion engines", Dhanpatrai publication, 2003.
3. Obert.E.F "Internal Combustion Engineering and Air Pollution", International book Co., 1988.

REFERENCES

1. Brame, J.S.S. and King, J.G. – Fuels – Solids, Liquids, Gaseous.
2. Francis, W – Fuels and Fuel Technology, Vol. I & II
3. Hobson, G.D. & Pohl.W- Modern Petroleum Technology
4. A.R.Lansdown – Lubrication – A practical guide to lubricant selection – Pergamon press – 1982.
5. Raymond.C.Gunther – Lubrication – Chilton Book Co., - 1971.

PR8252	MANUFACTURING PROCESSES	L T P C 3 0 0 3

OBJECTIVE:

To learn the basic processes available to make a part/product. Will help the students to select the best manufacturing process based on quality/time/cost/mechanical properties.

UNIT I CASTING PROCESSES **9**

Comparison of Manufacturing Processes - Pattern – mould, die – Pattern allowances – materials – types – sand – sand moulding – single box – 2 and 3 box moulding – die casting – investment casting – shell moulding – centrifugal casting – continuous casting – core – runner – riser – gate – chaplet – squeeze casting.

UNIT II WELDING PROCESSES **9**

Soldering, brazing and welding – fusion welding gas welding – flame types – process – arc welding – electrode – filler material – flux – edge preparation – joints – position – welding symbol – GMAW – GTAW – resistance welding – spot, seam, butt and projection – stud welding – friction welding – submerged arc welding – electrosleg welding.

UNIT III METEL FORMING PROCESSES **9**

Hot and cold forming – forging – rolling – extrusion – spinning – sheet metal operations – Powder metallurgy – steps – sintering – merits – demerits and applications. Types of dies – Progressive and combination dies – tube bending.

UNIT IV MACHINING PROCESSES **9**

Machine and Machine tool – Lathe types – various operations – Shaper – Planer - Quick return mechanism – drilling – types and operations – milling – types – cutters – operations – gear cutting in milling – grinding – types – grinding wheel – loading – turning & balancing of wheels - CNC machines.

UNIT V PLASTIC MATERIAL PROCESSES **9**

Injection – Blow and rotational moulding – Thermoforming Process - Reinforced plastics and composite materials – Manufacturing of honey comb structure – shaping of ceramics – Transfer moulding – MMC – CMC.

TOTAL : 45 PERIODS

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OUTCOMES:

- The students will be in a position to select and employ a particular non traditional machining process as well as a rapid prototyping technique based upon the application in industries.

TEXT BOOKS:

1. Serope Kalpakjian, Steven R. Schmid "Manufacturing Engineering and Technology", Addison Wesley, 2001
2. P.C. Sharma, "A Text Book of Production Technology", S.Chand and Co. Ltd., New Delhi, 1996.

REFERENCE BOOKS:

1. B.H.Amstead, "Manufacturing Processes", Phillip F.Ostwald, L.Begemon, John Wiley and Sons, 8th Edition, 1998.
2. De Garmo, "Materials and Processes in Manufacturing", Prentice Hall of India, 8th Edition, 1998.
3. T.R. Banga, R.L. Agarwal and T.Manghrani, "Foundry Engineering", Khanna Publishers, New Delhi – 1995.
4. P.N.Rao, "Manufacturing Technology – foundry Forging and Welding", Tata McGraw Hill Publishing Co., New Delhi – 1988.

AU8211	CONVENTIONAL MACHINING PROCESSES LABORATORY	L T P C 0 0 3 2

OBJECTIVE:

- To get hands on experience in the conventional machines.
- To prepare the process planning sheets for all the operations and then follow the sequences during the machining processes.

LIST OF EXPERIMENTS:

1. Study of all the conventions machines – identification of parts / Mechanisms and Position of tool and work piece.
2. Facing, plain turning /Step Turning operations in Lathe.
3. Taper Turning/ Threading, Knurling operations in Lathe.
4. Multi start Threading/ Burnishing operations in Lathe.
5. Machining to make a cube using shaper.
6. Machining to make a V-Block in shaper.
7. Counter sinking, Counter Boring, Tapping operation in a drilling machine.
8. Surfacing/Pocket Milling in a vertical milling machine.
9. Polygonal shape milling in a horizontal milling machine.
10. Flat surface grinding and cylindrical grinding operations.
11. Machining an internal spline in a slotting machine.
12. To machine the given part drawing using Lathe and milling machines.

TOTAL : 45 PERIODS

OUTCOMES:

The Students can able to use different machining process and use this in industry for component production

PR8263	COMPUTER AIDED PART MODELLING LABORATORY	L T P C 0 0 3 2

OBJECTIVE:

- To impart practical knowledge in modeling.
- To get hands on experience in drafting of automotive / typical industrial components, etc.

LIST OF EXPERIMENTS:

1. Practice on Drafting software using Measuring Commands; Basic Draw Commands; Display Commands GRID, SNAP, CIRCLE, LINE, ARC, LIMITS, ZOOM, PAN
2. Practice on using Editing Commands; Creating Layers; CHANGE, ERASE, EXTEND, TRIM, GRIDS, LAYER. Construction Commands ARRAY, COPY, MIRROR, MOVE, OFFSET, FILLET, CHAMFER, OSNAP
3. Placing lettering on a drawing; Crosshatching a drawing TEXT, BHATCH
4. 2D drafting of automobile components like engine crank shaft, connecting rod etc.
5. 2D drafting of machine components.
6. 2D drafting of machine shop drawing.
7. 2D drafting of pin joints, cotter joints and bearings.

TOTAL : 45 PERIODS

OUTCOMES

- Students can able to understand uses of computer aided drafting
- Students can able to understand any given drawing of a component and draw the different views of components

MA8353	NUMERICAL METHODS	L T P C 3 1 0 4

OBJECTIVES:

- To provide the mathematical foundations of numerical techniques for solving linear system, eigen value problems, interpolation, numerical differentiation and integration and the errors associated with them;
- To demonstrate the utility of numerical techniques of ordinary and partial differential equations in solving engineering problems where analytical solutions are not readily available.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

Solution of algebraic and transcendental equations - Fixed point iteration method –Newton-Raphson method- Solution of linear system of equations – Gauss Elimination method – Pivoting - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method - Eigenvalues of a matrix by Power method and by Jacobi's method.

UNIT II INTERPOLATION AND APPROXIMATION 9+3

Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae – Least square method - Linear curve fitting.

UNIT III NUMERICAL DIFFERENTATION AND INTEGRATION 9+3

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method – Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+3

Single step-methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Multi-step methods - Milne's and Adams-Bashforth predictor-corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9+3

Finite difference methods for solving two-point linear boundary value problems. Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit (Crank-Nicholson) methods - One dimensional wave equation by explicit method.

TOTAL: 60 PERIODS

OUTCOMES:

- The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

TEXT BOOKS:

1. Grewal, B.S. and Grewal,J.S., "Numerical methods in Engineering and Science", Khanna Publishers, New Delhi, 9th Edition, 2007.
2. Sankara Rao, K. "Numerical methods for Scientists and Engineers', Prentice Hall of India Private Ltd., New Delhi, 3rd Edition,2007.

REFERENCES:

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education Asia, New Delhi, 1st Edition, 2007.
2. Gerald, C.F. and Wheatley, P.O., "Applied Numerical Analysis", Pearson Education Asia, New Delhi, 6th Edition, 2006.
3. Laurene V. Fausett, "Applied Numerical Analysis using MATLAB", Pearson Education, New Delhi, 1st print, 2nd Edition, 2009.

AE8351 SOLID MECHANICS L T P C
3 0 0 3

OBJECTIVE:

- To introduce various behavior of structural components under various loading conditions.

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UNIT I INTRODUCTION **8**

Definition of stress, strain and their relations – Relations between material constants – Axial loading - Statically determinate and indeterminate problems in tension & compression – Plane truss analysis – method of joints – method of sections – 3-D trusses – Thermal stresses – Impact loading.

UNIT II STRESSES IN BEAMS **10**

Shear force & bending moment diagrams: Bending and shear stress variation in beams of symmetric sections, a typical spar section: Beams of uniform strength - beams of two materials.

UNIT III DEFLECTION OF BEAMS **10**

Double integration method – Macaulay's method – moment area method – conjugate beam method – principle of superposition – Maxwell's reciprocal theorem.

UNIT IV TORSION – SPRINGS – COLUMNS **10**

Torsion of solid and hollow circular shafts – shear stress variation – open and closed-coiled helical springs – stresses in helical springs – classification of columns – Euler buckling – columns with different end conditions.

UNIT V BIAXIAL STRESSES **7**

Stresses in thin-walled pressure vessels – combined loading of circular shaft with bending, torsion and axial loadings – Mohr's circle and its construction – determination of principal stresses.

TOTAL: 45 PERIODS

OUTCOMES:

- Solve the problems related to the structural components under various loading conditions

TEXT BOOKS:

1. William Nash, 'Strength of Materials', Tata McGraw Hill, 2004
2. Timoshenko and Young "Strength of Materials" Vol. I & II

REFERENCES:

1. Dym,C.L., and Shames,I.H., 'Solid Mechanics', McGraw Hill, Kogakusha, Tokyo, 1973.
2. Stephen Timoshenko, 'Strength of Materials', Vol I & II, CBS Publishers and Distributors, Third Edition.
3. Timoshenko,S. and Young,D.H., 'Elements of Strength of Materials', T.Van Nostrand Co. Inc., Princeton, N.J., 1977.

AU8301 AUTOMOTIVE PETROL ENGINES **L T P C**
3 0 0 3

OBJECTIVE:

To impart the knowledge on basic concepts on Automotive SI Engines and its various sub components along with its functions.

UNIT I ENGINE CONSTRUCTION AND OPERATION **10**

4 stroke engine - Constructional details, working principle. Otto cycle, Actual indicator diagram, Fuel air cycle. Cylinder layout and configurations. Firing order and its significance. Engine balancing. Materials for engine components.

UNIT II FUEL AND IGNITION SYSTEM 10

Carburetor – requirements, working principle, types, different circuits – Compensation – Maximum power devices – Petrol injection in SI engines, Magneto coil and battery coil spark ignition system. Advance mechanism. Electronic ignition System – CDI.

UNIT III COOLING AND LUBRICATION SYSTEM 8

Need for cooling. Types of cooling system – air cooling and Liquid cooled systems. Forced circulation system, pressure cooling system, Evaporative cooling system – Need for Lubrication system. Mist lubrication system, wet & dry sump lubrication, Properties of lubricants, properties of coolant – Recent Technologies.

UNIT IV COMBUSTION AND COMBUSTION CHAMBERS 9

Combustion in SI engine – Stages of combustion – Flame propagation – Rate of pressure rise – Abnormal combustion – pre ignition and knock in SI engines – effect of engine variables on knock – Combustion chambers for SI engine – Different types – Factors controlling combustion chamber design.

UNIT V TWO STROKE ENGINES 8

Two stroke engine – types, terminologies, definitions, construction and operation. Comparison of four stroke and two stroke engine operation. Theoretical scavenging processes. Merits and demerits, scavenging efficiency, Scavenging pumps, Rotary valve engine.

TOTAL : 45 PERIODS

OUTCOMES:

- Understand the working principles and constructional details of automotive SI Engines
- Understand the different sub systems of S.I Engine like,Fuel and ignition system, lubricating system, cooling system etc.

TEXT BOOKS:

1. Ramalingam. K. K., Internal Combustion Engines, Scitech publications, Chennai, 2003
2. Ganesan.V., Internal Combustion Engines, Tata McGraw Hill Publishing Co., New York, 1994.

REFERENCES:

1. Heldt.P.M. High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1975.
2. Obert E.F., Internal Combustion Engines Analysis and Practice, International Text Books: Co., Scranton, Pennsylvania, 1988.
3. William.H.Crouse, Automotive Engines, McGraw Hill Publishers, 1985.
4. Ellinger, H.E., Automotive Engines, Prentice Hall Publishers, 1992.

AU8302 MEASUREMENT SYSTEM FOR AUTOMOBILES L T P C
3 0 0 3

OBJECTIVES:

- To impart the knowledge on basics of measurements and sensors
- To impart the knowledge on automotive measurements and instruments

UNIT I INTRODUCTION TO MEASUREMENTS AND SENSORS 9

Sensors: Functions- Classifications- Main technical requirement and trends

Units and standards- Calibration methods- Classification of errors- Error analysis- Limiting error- Probable error- Propagation of error- Odds and uncertainty- principle of transduction- Classification.

Static characteristics- mathematical model of transducers- Zero, First and Second order transducers- Dynamic characteristics of first and second order transducers for standard test inputs.

UNIT II VARIABLE RESISTANCE AND INDUCTANCE SENSORS 9

Principle of operation- Construction details- Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezoresistive sensors Inductive potentiometer- Variable reluctance transducers:- EI pick up and LVDT

UNIT III VARIABLE AND OTHER SPECIAL SENSORS 9

Variable air gap type, variable area type and variable permittivity type- capacitor microphone

Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor- digital transducers-Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.

UNIT IV AUTOMOTIVE PRESSURE AND FORCE/TORQUE SENSOR 9

Pressure Sensor:

Typical automotive applications- Thick film pressure sensor- Semiconductor pressure sensor- Integrated silicon intake-manifold pressure sensor-Integrated silicon combustion-pressure sensor- Piezo electric sensor-High pressure sensor with metal diaphragm.

Force/Torque Sensor:

Typical automotive applications- Magneto elastic bearing-pin sensor- Magneto elastic tension/compressive-force sensor according to the cross-ductor principle – Basic principle of torque measurement –Stress and Angle measuring torque sensor

UNIT V AUTOMOTIVE POSITION AND RPM/VELOCITY SENSORS 9

Position Sensors:- Typical automotive applications- Wiper potentiometers- Short-circuiting ring sensor- Half-differential sensor- Eddy-current pedal-travel sensor- Integrated Hall IC's - Hall acceleration sensor- Knock sensors-RPM and Velocity Sensors: - Inductive rotational speed sensor- Hall effect sensor

Temperature Sensors:- Typical automotive applications -Sintered-Ceramic resistors-Thin film resistors-Thick film resistors- Monocrystalline silicon semiconductor resistor- Thermopile sensors

Flow Sensors:- Ultrasonic flow sensors-Pitot tube air-flow sensor- Hot wire air-mass flow meter- Micro mechanical hot-film air-mass flow meter- Lambda sensor -Imaging sensor-Rain Sensor

Introduction to MEMs

TOTAL: 45 PERIODS

OUTCOME:

- Students gained the basic knowledge on measurements and sensor.
- Familiarized in application of automotive sensors.

TEXT BOOKS:

1. Doeblin E.O, "Measurement Systems : Applications and Design", 5th Edition, Tat McGraw-Hill Publishing Co,2007
2. Robert Brandy, " Automotive Electronics and Computer System", Prentice Hall,2001
3. William Kimberley," Bosch Automotive Handbook", 6th Edition, Robert Bosch GmbH,2004.

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Anna University, Chennai-600 025.

REFERENCES:

1. Bentley J.P ," Principles of Measurement Systems", 4th Edition, Addision Wesley Longman Ltd., U.K, 2004
2. Patranabis.D, " Sensors and Transducers", 2nd Edition, Prentice Hall India Ltd,2003
3. Murthy D.V.S, "Transducers and Instrumentation", Prentice Hall of India, 2007
4. Neubert H.K.P.," Instrument Transducers- An Introduction to their Performance and Design" , Oxford University Press, Cambridge,2003

AU8351 THERMODYNAMICS AND THERMAL ENGINEERING

L	T	P	C
3	1	0	4

OBJECTIVE:

To introduce fundamental concepts in thermodynamics, heat transfer, propulsion and refrigeration and air conditioning.

UNIT I BASIC THERMODYNAMICS **14**

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

UNIT II AIR STANDARD CYCLES AND COMPRESSORS **12**

Otto, Diesel, Dual combustion and Brayton cycles. Air standard efficiency. Mean effective pressure. Compressors, Classifications of compressors, Single stage and multi stage, Effect of intercooler in multi stage compressor, Perfect and imperfect intercooler, work done by the compressor, Reciprocating, Rotary, Axial, Vane compressors.

UNIT III STEAM AND JET PROPULSION **12**

Properties of steam, Dryness fraction, Quality of steam by steam tables and Mollier chart – Rankine cycle, Work done, Steam rate – Steam Nozzles, Types of nozzles, Friction in nozzles - Simple jet propulsion system – Thrust rocket motor – Specific impulse.

UNIT IV REFRIGERATION AND AIR-CONDITIONING **10**

Principles of refrigeration, Vapour compression – Vapour absorption types, comparison - Co-efficient of performance (COP), Properties of refrigerants – Basic Principle, Summer, winter and Year round Air conditioning.

UNIT V HEAT AND MASS TRANSFER **12**

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

TOTAL : 60 PERIODS

OUTCOMES:

- It helps the students to have a clear idea of application of thermodynamics and heat transfer. The student would be able to identify the applications of these techniques in their engineering fields.

TEXT BOOKS:

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

REFERENCES:

1. Ramalingam K.K. "Thermodynamics", Sci-Tech Publications, 2006
2. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 2007.
3. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 1987
4. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
5. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
6. Mathur& Sharma Steam Tables, Jain Publishers, NewDelhi.

EI8305 ELECTRICAL AND ELECTRONICS ENGINEERING L T P C 3 0 0 3

OBJECTIVE:

- To impart the knowledge on basic concepts of electrical circuits and electrical machines.
- To impart the knowledge on basic concepts of electronic components, devices and circuits

UNIT I BASIC CONCEPTS AND DC CIRCUITS 9

Ohm's law - Electrical resistance - Series /Parallel resistive circuits - Star/Delta transformations - Kirchoff's law - Node and Mesh analysis - Thevenin's and Norton's theorem.

UNIT II A.C.CIRCUITS 9

RMS and average value of periodic waves - Form factor - Phase and Phase difference - Simple RC.RL and RLC circuits - series and parallel resonance - power and power factor - introduction to three phase systems – power measurement in 3 phase system.

UNIT III D.C. MACHINES 10

Construction details of DC machines - principle of operation of DC generator - EMF equation - principle of DC motor - Back EMF - Voltage and torque equation - Principle of transformer - construction and type - EMF equation - Tests on transformer - Equivalent circuit - Induction motor - Construction and basic principle of operation - Starting and Running torques.

UNIT IV ELECTRONIC COMPONENTS AND DEVICES 9

Operating principle and characteristics of Simple PN Junction Diodes, Zener diode, Bipolar Junction transistor - Field Effect Transistors – UJT – SCR.

UNIT V ANALOG CIRCUITS 8

Rectifier and Power Supply Circuits, clipper, clamper using diodes, Operational Amplifiers (Ideal) - properties and typical circuits like differentiator, integrator, summer, comparator.

TOTAL : 45 PERIODS

OUTCOMES:

- The students will be able to construct analog and digital circuits with electrical and electronics component. They will be familier with the use of electrical and electronic measuring systems

Attested

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REFERENCES:

1. Theraja, B.L., " A Text Books of Electrical Technology ", S.S.Chand and Co., New Delhi, 1998.
2. Edminister J.A., " Theory and Problems on Electric circuits ", McGraw Hill International Edition, 1994.
3. Kosow, I.L., " Electrical Machinery and Transformers ", 4th Edition, Prentice Hall of India, 1991.
4. Nagrath I.J. and Kothari D.P., "Theory and Problems of Basic Electrical Engineering", Prentice Hall of India, 1998.
5. Millman.J. and Grabel.S., Integrated Electronics, Tata McGraw Hill, 1995.
6. Horowits.P. and Hill.W., The Art of Electronics, McGraw Hill, 1995.

AU8311 MECHANICAL SCIENCE LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVE :

To train the students in testing and quantifying the mechanical properties of Engineering Materials, Engines.

LIST OF EXPERIMENTS:

Material Testing Lab

- Tension Test
- Torsion Test
- Testing of springs
- Impact test i) Izod, ii) Charpy
- Hardness test i) Vickers, ii) Brinell, iii) Rockwell, iv) Shore
- Deflection of Beams
- Dye Penetrant Test
- Tensile testing of polymers.
- Flex Fatigue test for Elastomers.
- Injection moulding machine operation.

IC Engines Lab

- Performance test on a 4 stroke engine
- Viscosity determination of the given fluid
- Moment of inertia of connecting rod
- Determination of Effectiveness of a parallel and counter flow heat exchangers.
- Valve timing of a 4 stroke engine and port timing of a 2 stroke engine.
- Determination of Flash point and Fire point of the given oil.

TOTAL : 45 PERIODS

OUTCOMES:

- The students can gain knowledge on some basic testing procedure of the engine and its fuel to calculate some of the mechanical properties like Viscosity, Moment of Inertia etc. The students can get practical knowledge on testing the engine and calculating its performance in the field.

EI8361	ELECTRICAL AND ELECTRONIC ENGINEERING LABORATORY	L T P C 0 0 3 2

OBJECTIVE:

- To train the students in performing various tests on electrical drives, sensors and circuits.

LIST OF EXPERIMENTS:

1. Load test on separately excited DC shunt generator
2. Load test on DC shunt moor
3. Load test on S Transformer
4. Load test on Induction motor
5. Regulation of 3 Alternator
6. Study of CRO
7. Logic gates
8. Operational amplifiers
9. Time constant of RC circuit
10. Characteristics of LVDT
11. Calibration of Rotometer
12. RTD and Thermistor
13. Flapper Nozzle system

TOTAL : 45 PERIODS

OUTCOMES:

- The students will gain practical experience in designing robots in Mechatronics approach

GE8351	ENVIRONMENTAL SCIENCE AND ENGINEERING	L T P C 3 0 0 3

OBJECTIVES

To the study of nature and the facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY **14**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL : 45 PERIODS

OUTCOMES:

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2006).

REFERENCE BOOKS

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2 Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia',Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD,New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)

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DIRECTOR
Centre For Academic Courses
Anna University, Chennai-600 025.

AE8451	ENGINEERING FLUID MECHANICS	L T P C 3 0 0 3

OBJECTIVE:

- To introduce the basic concepts of fluid statics.
- To make the student understand the basic laws governing fluid motion and its application.
- To give an introduction on fluid machines and aerodynamics.

UNIT I BASIC CONCEPTS **9**

Classification of fluids and their properties – Measurement of pressure and viscosity - Fluid statics and force on submerged bodies – Stability of floating bodies.

UNIT II EQUATIONS OF FLUID FLOW **10**

Kinematics – Motion of a fluid particle – Fluid deformation – Navier Stokes equation and Euler's equation – Basic laws of fluid motion in integral form and differential form - Linear momentum equation

UNIT III INCOMPRESSIBLE INVISCID FLOW **8**

Bernoulli's equations – Applications — Flow measurement – Orifice plate – Venturi meter – Stream function and velocity potential – Laplace equation

UNIT IV INCOMPRESSIBLE VISCOUS FLOW **8**

Fully developed laminar flow between parallel plates – Laminar and turbulent flow through pipes – Velocity profiles – Energy considerations in pipe flow – Calculation of head loss Pipe flow problems – Hydraulic and energy grade lines – Moody's diagram

UNIT V DIMENSIONAL ANALYSIS AND FLUID MACHINERY **10**

Dimensional analysis – The Buckingham-Pi theorem – Significant dimensionless groups – Flow similarity and model studies - Impact of jets - Introduction and classification of fluid machines – Turbines and pumps.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can critically analyse the performance of pumps and turbines.

TEXT BOOKS:

1. White.F.M,. Fluid Mechanics
2. Robert W Fox & Alan T McDonald, 'Introduction to fluid Mechanics', John Wiley and Sons, 1995
3. Kuethe, A.M. and Chow, C.Y., Foundations of Aerodynamics, First Indian Reprint, John Wiley & Sons, 2010.

REFERENCES:

1. Yuan S W, 'Foundations of fluid Mechanics', Prentice-Hall, 1987
2. Rathakrishnan, E, 'Fundamentals of Fluid Mechanics', Prentice-Hall, 2007
3. Graebel, W.P. 'Engineering Fluid Mechanics' Taylor and Francis, 2001

AU8401	AUTOMOTIVE CHASSIS	L T P C 3 0 0 3

OBJECTIVE:

Study of the Constructional details and Theory of important drive line, Structural, Steering, Braking and Suspension Systems of Automobiles. Problem–Solving in Steering Mechanism, Propeller Shaft, Braking and Suspension Systems are to be done.

UNIT I LAYOUT, FRAME, FRONT AXLE AND STEERING SYSTEM 9

Basic construction of chassis, Types of Chassis layout, with reference to Power Plant location and drive, various, types of frames, Loads acting on vehicle frame, Types of Front Axles and Stub Axles, Front Wheel Geometry. Condition for True Rolling Motion. Ackerman's and Davi's Steering Mechanisms, Steering Linkages, Different Types of Steering Gear boxes, Slip Angle, Over–Steer and Under–Steer, Reversible and Irreversible Steering, Electrical Power–Assisted Steering. Problems in steering system.

UNIT II DRIVE LINE, FINAL DRIVE AND DIFFERENTIAL 9

Driving Thrust and its effects, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints, Final drive, different types of final drive, Worm and Worm wheel, straight bevel gear,spiral bevel gear and hypoid gear final drive. Differential principle. Constructional details of differential unit, Differential housings, Non–Slip differential, Differential locks.

UNIT III REAR AXLES, WHEELS, RIMS AND TYRES 9

Construction of rear axles, Types of Loads acting on rear axles, Full –Floating, Three–Quarter Floating and Semi–Floating Axles, Twist beam rear axle, Types, Multi axles vehicles. Wheels and Rims, Types of Tyres and their constructional details. Measurement of wheel and axle load.

UNIT IV SUSPENSION SYSTEM 9

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

UNIT V BRAKING SYSTEM 9

Need for Braking system, Stopping Distance, Time and Braking Efficiency, Effect of Weight Transfer during Braking, Classification of brakes , Braking Torque, drum brake and disc Brake Theory, Types and Construction of Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power–Assisted Braking System, Servo Brakes, Retarders. Problems in braking system.

TOTAL : 45 PERIODS

OUTCOMES:

- The students will understand the constructional, working principle of various sub system of an automobile.

TEXT BOOKS

1. Newton Steeds and Garret, "Motor Vehicles" 13th Edition,Butterworth, London, 2005.
2. Heinz Hazler, "Modern Vehicle Technology", Butterworth, London, 2005.

REFERENCES

1. Heldt P.M., "Automotive Chassis" Chilton Co., New York.
2. N.K. Giri, "Automotive Mechanics" Khanna Publishers, New Delhi, 2005.
3. Milliken & Milliken, "Race Car Vehicle Dynamics", SAE

AU8402	AUTOMOTIVE DIESEL ENGINES	L T P C 3 0 0 3

OBJECTIVES:

To impart knowledge on basic concepts of automotive diesel engines, combustion process involved in diesel engines and the various subsystems used along with their functions in detail.

UNIT I DIESEL ENGINE BASIC THEORY 9

Diesel engine classification, construction and operation. Two stroke and four stroke diesel engines. Diesel cycle – Fuel - air and actual cycle analysis problems. Diesel fuel properties. Ignition quality of diesel. Cetane number and cetane Index. Laboratory tests for diesel fuel. Standards and specifications.

UNIT II FUEL INJECTION SYSTEM 9

Requirements – solid injection. Function of components – conventional fuel injection system, common rail direct injection - Jerk and distributor type pumps. Pressure waves, Injection lag. Unit injector. Types of injection nozzle, Nozzle tests. Electronic fuel injection. Spray characteristics. Injection timing. Pump calibration. Split and Multiple injection. Mechanical and pneumatic governors.

UNIT III AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS 10

Air intake systems – Importance of air motion – Swirl, Squish and Tumble. Swirl ratio. Fuel air mixing. Stages of combustion. Delay period – factors affecting combustion. Knock in CI engines. Comparison of knock in CI & SI engines. Direct and indirect injection combustion chambers. Air cell chamber. Combustion chamber design – M-Combustion chamber. Combustion chambers for HCCI engines.

UNIT IV SUPERCHARGING AND TURBOCHARGING 8

Necessity and limitation of supercharging. Thermodynamic cycle with super charging. Types of supercharging and turbocharging – Relative merits. Intercooler. Matching of turbocharger. Modification of an engine for supercharging. Effect of supercharging on engine performance. Variable geometry and variable nozzle turbocharger. E-Turbocharger. Problems.

UNIT V DIESEL ENGINE TESTING AND PERFORMANCE 9

Automotive and stationary diesel engine testing and related standards – Engine power and efficiencies – performance characteristics. Variables affecting engine performance – Heat balance – Methods to improve engine performance - Introduction to Stratified charge engine, LHR engines, HCCI Engine. Problems.

TOTAL: 45 PERIODS

OUTCOMES:

- The students can understand the construction and basic principle of operation of various types of engines and its various fuel induction systems. Also the students can have the basic knowledge on theory of combustion and its types, different types of combustion chamber, air motion etc. Also the students will get the knowledge on the design advances in IC engines; Electronic fuel injection system will also be introduced to the students. At the end of the course the students will have command over automotive engine operation and its fuel injection system.

TEXT BOOKS:

1. V. Ganesan, Internal Combustion Engines, Tata-McGraw Hill Publishing Co., New Delhi, 1994.
2. M.L. Mathur and R.P.Sharma, Internal Combustion Engine, Dhanpat Rai Publications (P) Ltd, New Delhi 110002

REFERENCES:

1. K. K. Ramalingm, internal Combustion Engines, Scitech publications, Chennai, 2003.
2. Heldt, P.M., High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1985.
3. Obert, E.F., Internal Combustion Engine analysis and Practice, International Text Book Co., Scranton, Pennsylvania, 1988.
4. Maleev, V.M., Diesel Engine Operation and Maintenance, McGraw Hill, 1974.
5. Heinz advanced engine tech

PR8451 KINEMATICS AND DYNAMICS OF MACHINES **L T P C**
3 1 0 4

OBJECTIVES:

To understand the basic concepts of mechanisms and machinery

UNIT I MECHANISMS **14**

Definition – Machine and Structure – Kinematic link, pair and chain – classification of Kinematic pairs – Constraint & motion – Degrees of freedom - Slider crank – single and double – Crank rocker mechanisms – Inversions, applications – Introduction to Kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration of simple mechanisms.

UNIT II FRICTION **12**

Types of friction – friction in screw and nut – screw jack – pivot, collar and thrust bearings – plate and cone clutch – belt (flat & vee) and rope drives – creep in belts – open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tensions – condition for maximum power transmission.

UNIT III GEARING AND CAMS **12**

Gear – Types and profile – nomenclature of spur & helical gears – laws of gearing – interference – requirement of minimum number of teeth in gears – gear trains – simple, compound and reverted gear trains – determination of speed and torque in epicyclic gear trains – cams different types of followers – Cam – Types of cams and followers – Cam design for different follower motions.

UNIT IV BALANCING **11**

Static and dynamic balancing – single and several masses in different planes – primary and secondary balancing of reciprocating masses – Balancing of single and multi cylinder engines – Governors and Gyroscopic effects.

UNIT V VIBRATION **11**

Free, forced and damped vibrations of single degree of freedom systems – force transmitted to supports – vibration Isolation – vibration absorption – torsional vibration of shafts – single and multirotor systems – geared shafts – critical speed of shafts.

TOTAL : 60 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can critically analyse the performance of pumps and turbines.

TEXT BOOK

1. Bansal Dr.R.K. " Theory of Machines" Laxmi Publications (P) Ltd., New Delhi 2001
2. Rattan S.S."Theory of machines" Tata McGraw Hill publishing Co., New Delhi, 2002.

REFERENCES

1. Rao J.S.and Dukkipati R.V. "Mechanism and Machine Theory" Second Edition, Wiley Eastern Limited, 1992.
2. Malhotra D.R. and Gupta H.C "The Theory of machines" Satya Prakasam, Tech. India Publications, 1989
3. Gosh A and Mallick A.K. "Theory of Machines and Mechanisms" affiliated east west press, 1989
4. Shigley J.E. and Uicker J.J. Theory of Machines and Mechanisms" McGraw Hill, 1986.

AU8411 AUTOMOTIVE CHASSIS COMPONENTS LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVE:

- To familiarize and train the students on the constructional arrangements of different automotive chassis components.

LIST OF EXPERIMENTS:

1. Study the layout of chassis system
2. Study the layout of steering systems with different Steering gearboxes
3. Dismantling, study and Assembling of Transfer case
4. Dismantling, study and Assembling of Constant Velocity Joint(Front Axles)
5. Dismantling, study and Assembling of Clutch.
6. Dismantling, study and Assembling of sliding mesh gear box
7. Dismantling, study and Assembling of Constant mesh gear box
8. Dismantling, study and Assembling of Syncro mesh gear box
9. Dismantling, study and Assembling of Differential.
10. Study the Layout of Rear Axle.
11. Study the Layout of Braking system.
12. Study of different types of suspension system.
13. Study the Automatic transmission system.

TOTAL : 45 PERIODS

OUTCOMES:

- At the end of course the students will get familiarized on the constructional arrangements of different chassis systems.

AU8412 AUTOMOTIVE ENGINE COMPONENTS LABORATORY **L T P C**
0 0 3 2

OBJECTIVE:

- To familiarize and train the students on the constructional arrangements of different engine system.

Study of the following engines and its components:

1. Single Cylinder Four Stroke Diesel Engine
2. Two wheeler Two stroke Petrol engines
3. Two wheeler Four Stroke Petrol Engine
4. Three wheeler Engine
5. Multi cylinder inline diesel engine
6. Multi cylinder inline Petrol engine
7. Multi cylinder V type diesel Engine
8. MPFI engine
9. CRDI engine

TOTAL : 45 PERIODS

OUTCOME:

At the end of course the students familiarize on the constructional arrangements of different engine components.

AU8413 FUELS AND LUBRICANTS LABORATORY **L T P C**
0 0 3 2

OBJECTIVES:

- To study the characteristics of the fuels and Lubricants used in automobile

LIST OF EXPERIMENTS:

1. Temperature dependence of viscosity of lubrication oil by Redwood Viscometer.
2. Viscosity Index of lubricating oil by Saybolt Viscometer
3. Flash and Fire points of fuels.
4. Flash and Fire points of lubricants.
5. Cloud and pour point of fuels.
6. ASME distillation test of fuels (gasoline / diesel).
7. Carbon residue test of lubrication oil.
8. Calorific value of liquid fuel.
9. Calorific value of gaseous fuel.
10. Ash content test of fuel.
11. Penetration test of grease.
12. Finding the Cetane index
13. Copper strip corrosion
14 Density test

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to characteristic and chase the fuels and Lubricantes for the automobiles.

LIST OF EQUIPMENTS

1.	Redwood Viscometer	- 1 No.
2.	Saybolt Viscometer	- 1 No.
3.	Flash and Fire point apparatus	- 1 No.
4.	Cloud and pour point apparatus	- 1 No
5.	Distillation test apparatus	- 1 No
6.	Carbon residue apparatus	- 1 No
7.	Bomb Calorimeter	- 1 No.
8.	Ash content test apparatus	- 1 No.

AU8501 AUTOMOTIVE COMPONENTS DESIGN

L	T	P	C
3	0	0	3

OBJECTIVE:

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components

UNIT I INTRODUCTION **12**

Classification of design – Engineering materials and their physical properties as applied to design – Selection of materials – Factors of safety in design – Endurance limit of materials – Determination of endurance limit for ductile materials – Notch sensitivity – Principle of design optimization – Future trends – CAD Euler's formula – Rankine's formula – Tetmajer's formula – Johnson formula – Design of push rods and eccentricity loaded columns – Reduction of stress concentration.

UNIT II DESIGN OF SHAFTS AND SPRINGS **9**

Introduction – Material and design stresses – Design of axles – Design of shafts on the basis of strength – Design of shaft on the basis of rigidity – Design of hollow shafts – Design of close coiled helical spring subjected to axial loading – Torsion of helical springs.

UNIT III GEAR DESIGN **8**

Design considerations – strength of gear teeth – Lewis equation – Terminology of gears – Dynamic tooth load – Design of spur gears – helical gears – herringbone gears – bevel gears and worm gears. .

UNIT IV FLYWHEELS **7**

Determination of the mass of a flywheel for a given co-efficient of speed fluctuation. Engine flywheels stresses of rim of flywheels. Design of hubs and arms of flywheel – Turning moment diagram.

UNIT V DESIGN OF BEARINGS **9**

Design of journal bearings - Ball and Roller bearings – Types of Roller bearings – Bearing life – Static load capacity – Dynamic load capacity – Bearing material – Boundary lubrication – Oil flow and temperature rise.

TOTAL : 45 PERIODS

OUTCOMES:

- At the end of course the students familiarize on the design procedure of different automotive components

TEXTBOOKS:

1. Jain,R.K., Machine Design, Khanna Publishers, 1992.
2. Sundararaja Murthy,T.V., Machine Design, Khanna Publishers, New Delhi, 1991.
3. Bhandari,V.B., Design of Machine elements, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1990.

REFERENCES:

1. Hall Allen,S. & Others, Machine Design, Schaum Publisher Co., 1982.
2. Sigley, Machine Design, McGraw Hill, 1981.
3. Design Data Book, PSG College of Technology, Coimbatore, 1992.

AT8502 AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS L T P C
3 0 0 3

OBJECTIVES

- Knowledge in vehicle electrical and electronics components for engine operation.
- Enhancing the knowledge of revsor and microprocessor applications in vehicle control systems.
- Gaining information's on modern safety system in vehicle braking.

UNIT I BATTERIES AND STARTING SYSTEM 10

Different types of Batteries – principle, rating, testing and charging. Starter motors characteristics, capacity requirements. Drive mechanisms. Starter switches.

UNIT I CHARGING SYSTEM LIGHTING AND ACCESSORIES 9

DC Generators and Alternators their characteristics. Control unit – cut out, electronic regulators. Vehicle interior lighting system. Vehicle exterior lighting system. Wiring requirements. Lighting design. Dashboard instruments. Horn, trafficator.

UNIT III ELECTRONIC IGNITION AND INJECTION SYSTEM 9

Spark plugs. Advance mechanisms. Different types of ignition systems. Electronic fuel injection systems.

UNIT IV SENSORS AND MICROPROCESSORS IN AUTOMOBILES 9

Basic sensor arrangements. Types of sensors – oxygen sensor, hot wire anaemometer sensor, vehicle speed sensor, detonation sensor, accelerometer sensor, crank position sensor. Microprocessor and microcomputer controlled devices in automobiles such voice warning system, travel information system, keyless entry system, automatic transmission system, electronic steering system.

UNIT V SAFETY SYSTEMS 8

Antilock braking system, air bag restraint system, voice warning system, seat belt system, road navigation system, anti theft system.

TOTAL : 45 PERIODS

OUTCOMES:

- The student will have to know about all theoretical information and about electrical components used in a vehicle.

REFERENCES:

1. Judge. A.W., modern Electrical Equipment of Automobiles, Chapman & Hall, London, 1992
2. Young.A.P., & Griffiths.L., Automobile Electrical Equipment, English Language Book Society & New Press, 1990
3. Spreadbury. F.G., Electrical Ignition Equipment, Constable & Co Ltd., London, 1962
4. Robert N Brady Automotive computers and Digital Instrumentation. A Reston Book, Prentice Hill, Eagle Wood Cliffs, New Jersey, 1988.

AU8503	AUTOMOTIVE TRANSMISSION	L T P C 3 0 0 3

OBJECTIVES:

- To know about the various transmission and drive line units of automobiles.

UNIT I CLUTCH AND GEAR BOX 9

Requirement of transmission system, Different types of clutches, principle & Construction of Single plate coil spring and Diaphragm spring clutches., Need and Objectives of Gear box. Construction and operation of Sliding mesh, Constant mesh and Synchromesh gearboxes. – Determination of gear ratios for vehicles. Performance characteristics in different speeds. Problems on performance of automobile such as Resistance to motion, Tractive effort, Engine speed & Power and acceleration.

UNIT II HYDRODYNAMIC TRANSMISSION 9

Fluid coupling-Principle-Constructional details. Torque capacity. Performance characteristics. Reduction of drag torque in fluid coupling. Torque converter-Principle-constructional details, performance characteristics. Multistage torque converters and Polyphase torque converters.

UNIT III EPICYCLIC GEARBOXES USED IN AUTOMATIC TRANSMISSION 9

Principle of Planetary gear trains - Wilson Gear box, Cotal electromagnetic transmission-Hydraulic control system for Automatic Transmission.

UNIT IV AUTOMATIC TRANSMISSION APPLICATIONS 9

Need for automatic transmission, Four speed longitudinally mounted automatic transmission - Chevrolet "Turboglide" Transmission, Continuously Variable Transmission (CVT) – Types – Operations of a typical CVT.

UNIT V HYDROSTATIC AND ELECTRIC DRIVE 9

Hydrostatic drive; Various types of hydrostatic systems – Principles of Hydrostatic drive system. Advantages and limitations. Comparison of hydrostatic drive with hydrodynamic drive, construction and working of typical Janny hydrostatic drive. Electric drive-types- Principle of early and modified Ward Leonard Control system-Advantages & limitations.

TOTAL : 45 PERIODS

OUTCOMES

- The students will understand the constructional, working principle of various types of manual and automotive transmission of an automobile.

TEXT BOOKS:

1. Heldt,P.M., Torque converters, Chilton Book Co., 1962.
2. Newton and Steeds, Motor vehicles, Illiffe Publishers, 1985.

REFERENCES:

1. SAE Transactions 900550 & 930910.
2. Hydrostatic transmissions for vehicle applications, I Mech E Conference, 1981-88.
3. Crouse,W.H., Anglin,D.L., Automotive Transmission and Power Trains construction, McGraw Hill, 1976.
4. Heinz Heisler, Advance vehicle Technology, Butterworth-Heinemann.

AU8504	TWO AND THREE WHEELER TECHNOLOGY	L T P C 3 0 0 3

OBJECTIVE:

- The aim of this course is to make the students to know and understand the constructional details operating characteristics and vehicle design aspects

UNIT I THE POWER UNIT **9**

Two stroke and four stroke SI & CI engine Construction and Working, merits and demerits, Symmetrical and unsymmetrical valve & port timing diagrams. Scavenging process.

UNIT II FUEL AND IGNITION SYSTEMS **9**

Fuel system – Different circuits in two wheeler fuel systems, fuel injection system. Lubrication system, Ignition systems - Magneto coil and battery coil spark ignition system, Electronic ignition System, Starting system - Kick starter system – Self starter system. Recent technologies.

UNIT III CHASSIS AND SUB-SYSTEMS **9**

Main frame for two and three wheelers, its types, Chassis and different drive systems for two wheelers, Single, multiple plates and centrifugal clutches, Gear box and its and various gear controls in two wheelers. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar, Freewheeling devices

UNIT IV BRAKES AND WHEELS **8**

Drum brakes & Disc brakes Construction and Working and its Types, Front and Rear brake links lay-outs. Brake actuation mechanism. Spoked wheel, cast wheel, Disc wheel & its merits and demerits. Tyres and tubes Construction & its Types. Steering geometry.

UNIT V TWO & THREE WHEELERS – CASE STUDY **10**

Case study of Sports bike, Motor cycles, Scooters and Mopeds - Auto rickshaws, Pick up van, Delivery van and Trailer. Servicing and maintenance. Recent developments.

TOTAL : 45 PERIODS

OUTCOMES:

- The students can able to understand the various subsystem of two and three wheeler and also know how it is different from light motors and heavy motor vehicles.

TEXT BOOK:

1. Irving,P.E., Motor cycle Engineering, Temple Press Book, London, 1992.

REFERENCES:

1. The Cycle Motor Manual, Temple Press Ltd., London, 1990.
2. K. K. Ramalingam, Two Wheelers, Scitech publications, Chennai,
3. Encyclopedia of Motor cycling, 20 volumes, Marshall Cavensih, New York and London, 1989.
4. Bryaut,R.V., Vespa Maintenance and Repair series.
5. Raymond Broad, Lambretta – A practical guide to maintenance and repair, 1987.

Attested

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AU8511	AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY	L T P C 0 0 3 2

OBJECTIVES:

- To train the students in performing various tests on electrical drives, sensors and circuits.

LIST OF EXPERIMENTS:

1. Testing and checking of battery
2. Testing and checking of starting systems
3. Testing and checking of charging systems
4. Testing and checking of ignition systems
5. Study of automotive lighting system
6. Adjustment of head lights beam
7. Testing and checking of body controller systems
8. Logic gates, Adders, Flip flops
9. SCR and IC Timers
10. Interface circuit like amplifier, filter, Multiplexer and Demultiplexer
11. Interfacing seven segment displays
12. Basic microprocessor and microcontroller programming like arithmetic and Logic operation, code conversion, waveform generation, look up table etc
13. Interfacing ADC and DAC for Data Acquisition and Control Application
14. Interfacing Sensors for Measurements of position, displacement, velocity, force, temperature, proximity/range etc
15. Display, Keyboard, Stepper Motor and DC Motor interface using microcontroller.
16. EPROM Programming
17. Study of Virtual Instrumentation
18. Mini Project

TOTAL : 45 PERIODS

OUTCOMES:

- The students can able to understand the various principle electrical and electronic components.

AU8512	DESIGN AND SIMULATION OF AUTOMOTIVE ENGINE COMPONENTS LABORATORY	L T P C 1 0 2 2

OBJECTIVE

To make the students understand the design concept and principles of various engine components, their materials and manufacturing techniques. These concepts and principles and familiarized for design of components

1. Design of piston, piston pin, piston rings and drawing of these components.
2. Designing of connecting rod small end and big end, shank design, design of big and cap bolts and drawing of the connecting rod assembly.
3. Design of crankshaft, balancing weight calculations, development of short long crankarms, front end and rear end details, drawing of the crankshaft assembly.
4. Design and drawing of flywheel, ring gear design, drawing of the flywheel including the development of ring gear teeth.

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5. Design and drawing of the inlet and exhaust valves
6. Design of cam and shaft, cam profile generation. Drawing of cam and camshaft.
7. Design of combustion chamber.
8. Design and drawing of engine complete assembly involved with cylinder block, cylinder head, crankcase, valve ports, water jackets.

Computer aided design of the above components
(use of these packages are recommended - Pro E, CATIA and other CAD packages)

TOTAL : 15 L + 30 P

OUTCOMES;

At the end of this course the student should be able to

- Can understand the design concept and principles of various engine components.
- Understand the concepts and principles are familiarized for design of components**.**

TEXT BOOK:

1. Heldt, P.M., "High speed Combustion Engine", Chilton Books Co., 1952.

REFERENCES:

1. Giles. J.G., Engine Design", Illiffe Books Ltd., London, 1962
2. Newton, K. and Steeds, W., "The motor Vehicle", The English Language Book Society and Butterworth, London, 1972
3. Khovak"Motor Vehicle Engines", MIR Publishers
4. Kolchin,A. and Demidov, V., "Design of Automotive Engines".

AU8601 AUTOMOTIVE POLLUTION AND CONTROL L T P C 3 0 0 3

OBJECTIVES:

- The main objective of this course is to impart knowledge in automotive pollution control. The detailed concept of formation and control techniques of pollutants like UBHC, CO, NO_x, particulate matter and smoke for both SI and CI engine will be taught to the students. The instruments for measurement of pollutants and emission standards will also be introduced to the students. At the end of the course the students will have command over automotive pollution and control.

UNIT I INTRODUCTION 6

Pollutants – sources – formation – effects of pollution on environment - human – transient operational effects on pollution – Regulated – Unregulated emissions - Emission Standards.

UNIT II EMISSIONS IN SI ENGINE 11

Chemistry of SI engine combustion – HC and CO formation in SI engines – NO formation in SI engines – Smoke emissions from SI engines – Effect of operating variables on emission formation.

UNIT III EMISSIONS IN CI ENGINE 10

Basics of diesel combustion – Smoke emission and its types in diesel engines – NOx emission and its types from diesel engines – Particulate emission in diesel engines. Odor, sulfur and Aldehyde emissions from diesel engines – effect of operating variables on emission formation.

UNIT IV CONTROL TECHNIQUES FOR REDUCTION OF EMISSION 9

Design modifications – Optimization of operating factors – Fuel modification – Evaporative emission control - Exhaust gas recirculation – SCR – Fumigation – Secondary Air injection – PCV system – Particulate Trap – CCS – Exhaust treatment in SI engines –Thermal reactors – Catalytic converters – Catalysts – Use of unleaded petrol.

UNIT V TEST PROCEDURE, INSTRUMENTATION & EMISSION MEASUREMENT 9

Test procedures CVS1, CVS3 – Test cycles – IDC – ECE Test cycle – FTP Test cycle - NDIR analyzer – Flame ionization detectors – Chemiluminescent analyzer – Dilution tunnel - Gas chromatograph – Smoke meters –SHED test.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon the completion of the course, the student will understand the fundamentals of formation of automobile pollutions in SI and CI Engines, various control techniques, test procedures etc.

TEXT BOOKS:

1. Springer and Patterson, Engine Emission, Plenum Press, 1990.
2. B.P.Pundir, " IC Engines Combustion and Emissions" Narosa Publishers, 2010

REFERENCES:

1. Ramalingam. K.K., Internal Combustion Engines, Scitech Publications, Chennai, 2003.
2. Ganesan,V., Internal Combustion Engines, Tata McGraw Hill Co., 1994.
3. SAE Transactions, Vehicle emission, 1982 (3 volumes).
4. Obert,E.F., Internal Combustion Engines, 1982.
5. Taylor,C.F., Internal Combustion Engines, MIT Press, 1972.
6. Heywood,J.B., Internal Combustion Engine Fundamentals, McGraw Hill Book Co., 1995.
7. Automobiles and Pollution SAE Transaction, 1995.

AU8602 VEHICLE BODY ENGINEERING L T P C 3 0 0 3

OBJECTIVES:

- The main objective of this course is to impart knowledge in the construction of vehicle, aerodynamic, concept, paneling of passenger car body trim. At the end of the course the student will be well versed in the design and construction of external body of the vehicles.

UNIT I CAR BODY DETAILS 10

Types of Car body - Saloon, convertibles, Limousine, Estate Van, Racing and Sports car – Visibility- regulations, driver's visibility, improvement in visibility and tests for visibility. Driver seat design -Car body construction-Various panels in car bodies. Safety aspect of car body.

UNIT II BUS BODY DETAILS 9

Types of bus body: based on capacity, distance traveled and based on construction.– Bus body lay out for various types, Types of metal sections used – Regulations – Constructional details: Conventional and integral. driver seat design- Safety aspect of bus body.

UNIT III COMMERCIAL VEHICLE DETAILS **8**

Types of commercial vehicle bodies - Light commercial vehicle body. Construction details of commercial vehicle body - Flat platform body, Trailer, Tipper body and Tanker body – Dimensions of driver's seat in relation to controls – Drivers cab design - Regulations.

UNIT IV VEHICLE AERODYNAMICS **9**

Objectives, Vehicle drag and types. Various types of forces and moments. Effects of forces and moments. Side wind effects on forces and moments. Various body optimization techniques for minimum drag. Wind tunnels – Principle of operation, Types. Wind tunnel testing such as: Flow visualization techniques, Airflow management test – measurement of various forces and moments by using wind tunnel.

UNIT V BODY MATERIALS, TRIM, MECHANISMS AND BODY REPAIR **9**

Types of materials used in body construction-Steel sheet, timber, plastics, GRP, properties of materials. Body trim items-body mechanisms.Hand tools-power tools-panel repair-repairing sheet metal-repairing plastics-body fillers-passenger compartment service- corrosion: Anticorrosion methods, Modern painting process procedure-paint problems

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of the course, students will

- Know about different aspects of car body and bus body, types, commercial vehicle.
- Role of various aerodynamic forces and moments, measuring instruments
- Know about the material used in body building, tools used, body repairs.

TEXTBOOKS:

1. Powloski, J., Vehicle Body Engineering, Business Books Ltd., 1998.
2. James E Duffy, Body Repair Technology for 4-Wheelers,Cengage Learning,2009.

REFERENCES:

1. Giles, G.J., Body construction and design, Illiffe Books Butterworth & Co., 1991.
2. John Fenton, Vehicle Body layout and analysis, Mechanical Engg. Publication Ltd., London, 1992.
3. Braithwaite, J.B., Vehicle Body building and drawing, Heinemann Educational Books Ltd., London, 1997.
4. Dieler Anselm., The passenger car body, SAE International, 2000

AU8603	VEHICLE CONTROL SYSTEM	L T P C
		3 0 0 3

OBJECTIVES:

- The course is designed to know about automotive system dynamics, different controllers and tuning of different controllers.

UNIT I INTRODUCTION TO VEHICLE CONTROL SYSTEM **9**

Steps in vehicle control system design- Influence of vehicle system design on vehicle control- examples w.r.to vehicle sub system - Degree of freedom for vehicle control- Calculation of the Control degree of freedom- Effect of feedback on Control degree of freedom- selection of controlled, manipulated, measured disturbance variables- classification of the variables in various automotive systems like engines, suspension, braking, air conditioning – General types of vehicle controller configurations- Feedback, Inferential, Feed-Forward, Ratio control

UNIT II DYNAMIC BEHAVIOUR AND HARDWARE OF VEHICLE CONTROL SYSTEMS **9**

Transfer function and state-space models- Dynamic behavior of first order and second order vehicle system- Standard vehicle system inputs- Dynamic responses characteristics of more complicated vehicle system- Development of empirical models from vehicle system data

Hardware elements like vehicle plant, measuring instruments, transducers, transmission lines, controller, final control elements, recording elements- Use of digital computers in vehicle control

UNIT III FEEDBACK AND ADVANCED CONTROLLERS FOR VEHICLE CONTROL SYSTEM **9**

Introduction- Basic Control modes- Proportional Control- Integral Control- Reset windup- Derivative Control- various forms of PID control- Enhancements of PID controllers- On-off controllers- Typical responses of feedback control systems- Digital Version of PID controllers

Feed-Forward control-Cascade control- Design considerations for cascade control, Time delay compensation, Inferential control- Nonlinear control- Adaptive control

UNIT IV ENGINE CONTROL SYSTEM **9**

Fuel control- Ignition control- Lambda control- Idle speed control- Knock control-Adaptive knock control- Combustion torque estimation

UNIT V VEHICLE DRIVELINE, BRAKING AND SUSPENSION CONTROL SYSTEM **9**

Driveline modeling- Modeling for neutral Gear- driveline Control- Driveline Speed Control- Driveline control for gear shifting- Active suspension control

Antilock braking control - Traction Control - Electronic stability Program control

TOTAL : 45 PERIODS

OUTCOMES

- Knowing the procedure for modeling different automotive sub system, various control actions and get the exposure of different automotive actuators, tuning controllers.
- Get familiarized with various complex control schemes for automotive systems

TEXT BOOKS:

1. Uwe Kiencke and Lars Nielson, Automotive Control System, SAE Publications, 2006
2. Bosch Automotive Handbook, Sixth Edition,2004
3. Richard C.Dorf and Robert H.Bishop, Modern Control Systems, Pearson Prentice Hall,2008

REFERENCES:

1. Katsuhiko Ogata, System Dynamics, Prentice Hall International, Inc. Third Edition,1998
2. Benjamin C.Kuo and Farid Golnaraghi, Automatic Control System, John Wiley & Sons, Eight edition, 2003.

PR8602	MANAGEMENT SCIENCES	L T P C 3 0 0 3

OBJECTIVES:

The students should be made to:

- To make the students aware of the outline of managerial functions relating to manufacturing

UNIT I MARKETING AND PERSONNEL MANAGEMENT **7**

Functions of Marketing – Sales Promotion Methods – Advertising – Product Packaging – Marketing Variables – Distribution Channels – Organization – Market research – Market Research Techniques.

Functions of Personnel Management – Recruitment – Training – Leadership - Motivation – Communication – Conflict - Industrial Relations – Trade union – Management functions

UNIT II INVENTORY MANAGEMENT **10**

Purpose of Inventory – Cost Related to inventory – Basic EOQ Model – Variations in EOQ Model – Finite Production – Quantity Discounts – ABC Analysis – MRP – Lot size under constraints.

UNIT III OPERATIONS MANAGEMENT **9**

Plant Location – Layout – Materials Handling – Method Study – Time Study – Ergonomics – Aggregate Planning – Value Analysis.

UNIT IV FINANCIAL MANAGEMENT **8**

Capital – Types – Sources – Break Even Analysis – Financial Statements – Income Statement – Balance Sheet – Capital Budgeting – Working Capital Management – Inventory Pricing.

UNIT V OPERATIONS RESEARCH TECHNIQUES **11**

Replacement theory – Linear Programming - Transportation and assignment problems – Sequencing - Network Techniques - CPM and PERT.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- The students would be able to understand the basic application of operational tools and manufacturing.

TEXT BOOKS:

1. R.Kesavan, C.Elanchezhian and T.Sundar Selwyn – Engineering Management – Eswar Press, 2005
2. R.Panneerselvam – Operations Research – Prentice Hall of India, 2003.

REFERENCES:

1. Koontz and Odonnel-Essentials of Management, McGraw Hill 1992.
2. Philips Kotler – Principles of marketing, Prentice Hall of India, 1995
3. I.M.Pandey – Financial Management, Vikas Publishing House, 1995
4. K.K.Ahuja – Personnel Management, Kalyane Publication 1992
5. K.Panneerselvam – Production and Operations Management – Prentice Hall of India, 2003
6. Martand T. Telesand – Industrial and Business Management – S.Chand & Co., 2001
7. R. Kesavan, C.Elanchezian and B.Vijayaramnath – Production Planning and Control, Anuratha Publishing Co. Ltd., Chennai – 2008.

HS8561 **EMPLOYABILITY SKILLS**

(Lab / Practical Course)

(Common to all branches of Fifth or Sixth Semester B.E / B.Tech programmes)

L	T	P	C
0	0	2	1

OBJECTIVES

- To enhance the employability skills of students with a special focus on Presentation skills, Group discussion skills and Interview skills
- To help them improve their soft skills, including report writing, necessary for the workplace situations

1. Making presentations – introducing oneself – introducing a topic – answering questions individual presentation practice
2. Creating effective PPTs – presenting the visuals effectively
3. Using appropriate body language in professional contexts – gestures, facial expressions, etc.
4. Preparing job applications - writing covering letter and résumé
5. Applying for jobs online - email etiquette
6. Participating in group discussions – understanding group dynamics - brainstorming the topic
7. Training in soft skills - persuasive skills – People skills - questioning and clarifying skills – mock GD
8. Writing Project proposals – collecting, analyzing and interpreting data / drafting the final report
9. Attending job interviews – answering questions confidently
10. Interview etiquette – dress code – body language – mock interview

TOTAL: 30 PERIODS

OUTCOMES:

- The students will have enough confidence to present themselves well using proper oral and written communication skills to any interview (or) discussion (or) presentation.

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Requirements for a class of 30 students

1. A PC or a lap top with one or two speakers
2. A Collar mike and a speaker
3. An LCD projector and a screen
4. CD's and DVD's on relevant topics

REFERENCE BOOKS:

1. **Dhanavel, S.P. 2010. *English and Soft Skills*. Hyderabad: Orient BlackSwan** Ltd.
2. Corneilssen, Joep. *How to Prepare for Group Discussion and Interview*. New Delhi: Tata-McGraw-Hill, 2009.
3. D'Abreo, Desmond A. *Group Discussion and Team Building*. Mumbai: Better Yourself Books, 2004.
4. Ramesh, Gopalswamy, and Mahadevan Ramesh. *The ACE of Soft Skills*. New Delhi: Pearson, 2010.
5. Gulati, Sarvesh. *Corporate Soft Skills*. New Delhi: Rupa and Co. 2006.
6. Van Emden, Joan, and Lucinda Becker. *Presentation Skills for Students*. New York: Palgrave Macmillan, 2004.

EXTENSIVE READERS

1. Covey, Stephen R. The 7 Habits of Highly Effective People. New York: Free Press, 1989.
2. Bagchi, Subroto. The Professional. New Delhi: Penguin Books India, 2009.

Web Resources

1. **www.humanresources.about.com**
2. **www.careerride.com**

AU8611	CREATIVE AND INNOVATIVE PROJECT	L T P C 0 0 3 2

OBJECTIVES:

To find and enhance the creativity of the student.

The goal of this course is to help students to identify innovative projects that promotes and inhibit creativity to explore the variables that affect creativity and innovation. By the end of the period, students should be familiar with current thinking in their field, and able to apply the concepts to relevant research problems or practical applications.

The goal of this course is to drive them to learn concepts, models, frameworks, and tools that engineering graduates' need in a world where creativity and innovation is fast becoming a pre-condition for competitive advantage.

Each student will choose a nagging workplace problem or socially relavant problems that have been difficult for them to "solve." At the end of the semester, each or group of students have to submit a report for evaluation.

TOTAL : 45 PERIODS

OUTCOME:

Student's creativity can be identified and improved

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AU8612	ENGINE TESTING AND EMISSION MEASUREMENT LABORATORY	L T P C 0 0 3 2

OBJECTIVES:

- To train the students in testing of the Engines.

LIST OF EXPERIMENTS:

1. Study and use of IC engine testing Dynamometers.
2. Study of 2 and 4 wheeler chassis Dynamometers.
3. Study and use of Pressure pickups, charge amplifier, storage oscilloscope and signal analyzers used for IC engine testing.
4. Performance study of petrol engine.
5. Performance study of diesel engine.
6. Calculation of frictional power on petrol engines.
7. Heat balance test on an automotive diesel engine.
8. Testing of 2 and 4 wheelers using chassis dynamometers.
9. Study of NDIR Gas Analyzer and FID.
10. Study of Chemiluminescent NOx analyser.
11. Measurement of HC, CO, CO_2, O_2 using exhaust gas analyser.
12. Diesel smoke measurement.

TOTAL : 45 PERIODS

OUTCOMES:

- The student will get familiarized with the basics of engine testing of engine performance, combustion process and emission characteristics.

TEXT BOOK:

1. Giles,J.G., Vehicle Operation and performance, Illiffe Books Ltd., London, 1989.

REFERENCES:

1. Crouse,W.H. and Anglin,D.L., Motor Vehicle Inspection, McGraw Hill Book Co., 1978.
2. Ganesan,V., Internal Combustion engines, Tata McGraw Hill Co., 1994.
3. BIS Code Books, IS-10000 series, 1988.

AU8701	SIMULATION OF IC ENGINES	L T P C 3 0 0 3

OBJECTIVE:

To impart knowledge in simulating IC engine processes. The detailed concept of air standard, fuel air cycle, progressive and actual cycle simulation of SI engine will be taught to the students. At the end of the course the students will have command over simulation of IC engine process.

UNIT I INTRODUCTION **9**

Introduction to Simulation, Advantages of computer simulation, Classification of engine models. Intake and exhaust flow models – Quasi steady flow - Filling and emptying - Gas dynamic Models. Thermodynamic based in cylinder models. Step by step approach in SI engine simulation.

UNIT II COMBUSTION AND STOICHIOMETERY 9

Reactive processes, Heat of reaction, measurement of URP, measurement of HRP. Introduction - combustion equation for hydrocarbon fuels. Calculation of minimum air required for combustion, excess air supplied and stoichiometric air required for complete combustion. Conversion of volumetric analysis to mass analysis.

UNIT III ADIABATIC FLAME TEMPERATURE 9

Introduction, complete combustion in C-H-N-O systems, constant volume adiabatic combustion, constant pressure adiabatic combustion, calculation of adiabatic flame temperature, isentropic changes of state. SI Engine simulation with air as working medium, deviation between actual and ideal cycle.

UNIT IV SI ENGINE SIMULATION WITH ADIABATIC COMBUSTION 9

Introduction, Engine details, temperature drop due to fuel vaporization, full throttle operation, work output and efficiency calculation, part-throttle operation, engine performance at part throttle, super charged operation, SI Engines simulation with progressive combustion. Wiebe's law combustion analysis.

UNIT V SI ENGINE SIMULATION WITH GAS EXCHANGE PROCESS 9

Introduction, gas exchange process, Heat transfer process, friction calculations, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram, brake power, brake thermal efficiency, effect of speed on performance.

TOTAL : 45 PERIODS

OUTCOMES:

- The student will be familiar with the basics of simulation, combustion process, SI Engine modeling and simulation process

TEXTBOOK:

1. Ganesan.V. "Computer Simulation of spark ignition engine process", Universities Press (I) Ltd, Hyderbad, 1996.

REFERENCES:

1. John. B. Heywood, 'Internal Combustion Engines'", Tata McGraw Hill Co., Newyork, 1988.
2. Benson.R.S., Whitehouse.N.D., "Internal Combustion Engines", Pergamon Press, oxford, 1979
3. Ramoss.A.L., "Modelling of Internal Combustion Engines Processes", McGraw Hill Publishing Co., 1992.
4. Ashley Campbel, "Thermodynamic analysis of combustion engines", John Wiley & Sons, New York, 1986.

AU8702 VEHICLE DYNAMICS **L T P C**
3 0 0 3

OBJECTIVES:

- To know about the application of basic mechanics principles for dynamic analysis of vehicles.

UNIT I CONCEPT OF VIBRATION 9

Definitions, Modeling and Simulation, Global and Vehicle Coordinate System, Free, Forced, Undamped and Damped Vibration, Response Analysis of Single DOF, Two DOF, Multi DOF, Magnification factor, Transmissibility, Vibration absorber, Vibration measuring instruments, Torsional vibration, Critical speed.

UNIT II TIRES **9**

Tire forces and moments, Tire structure, Longitudinal and Lateral force at various slip angles, rolling resistance, Tractive and cornering property of tire. Performance of tire on wet surface. Ride property of tires. Magic formulae tire model, Estimation of tire road friction. Test on Various road surfaces. Tire vibration.

UNIT III VERTICAL DYNAMICS **9**

Human response to vibration, Sources of Vibration. Design and analysis of Passive, Semi-active and Active suspension using Quarter car, half car and full car model. Influence of suspension stiffness, suspension damping, and tire stiffness. Control law for LQR, H-Infinite, Skyhook damping. Air suspension system and their properties.

UNIT IV LONGITUDINAL DYNAMICS AND CONTROL **9**

Aerodynamic forces and moments. Equation of motion. Tire forces, rolling resistance, Load distribution for three wheeler and four wheeler. Calculation of Maximum acceleration, Reaction forces for Different drives. Braking and Driving torque. Prediction of Vehicle performance. ABS, stability control, Traction control.

UNIT V LATERAL DYNAMICS **9**

Steady state handling characteristics. Steady state response to steering input. Testing of handling characteristics. Transient response characteristics, Direction control of vehicles. Roll center, Roll axis, Vehicle under side forces. Stability of vehicle on banked road, during turn. Effect of suspension on cornering.

TOTAL : 45 PERIODS

OUTCOMES:

- The student will understand how passenger comfort is achieved along with vehicle stability.

TEXT BOOKS:

1. Singiresu S. Rao, Mechanical Vibrations (5th Edition), Prentice Hall, 2010
2. J. Y. Wong, Theory of Ground Vehicles, 3rd Edition, Wiley-Interscience, 2001
3. Rajesh Rajamani, Vehicle Dynamics and Control, 1st edition, Springer, 2005
4. Thomas D. Gillespie, Fundamentals of Vehicle Dynamics, Society of Automotive Engineers Inc, 1992

REFERENCES:

1. Dean Karnopp, Vehicle Stability, 1st edition, Marcel Dekker, 2004
2. G. Nakhale Jazar, Vehicle Dynamics: Theory and Application, 1st edition, Springer, 2008
3. Michael Blundell & Damian Harty, The Multibody Systems Approach to Vehicle Dynamics, Elsevier Limited, 2004
4. Hans B Pacejka, Tire and Vehicle Dynamics, 2nd edition, SAE International, 2005
5. John C. Dixon, Tires, Suspension, and Handling, 2nd Edition, Society of Automotive Engineers Inc, 1996
6. Jan Zuijdijk, Vehicle dynamics and damping, Author House, 2009.

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AU8703	VEHICLE MAINTENANCE	L T P C 3 0 0 3

OBJECTIVES:

- To know about the various methods of maintaining vehicles and their subsystems.

UNIT I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS 10

Maintenance – Need, importance, primary and secondary functions, policies - classification of maintenance work - vehicle insurance - basic problem diagnosis. Automotive service procedures – workshop operations – workshop manual - vehicle identification. Safety – Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring instruments – condition checking of seals, gaskets and sealants. Scheduled maintenance services – service intervals - Towing and recovering.

UNIT II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE 8

General Engine service- Dismantling of Engine components- Engine repair- working on the underside, front, top, ancillaries- Service of basic engine parts, cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls

UNIT III TRANSMISSION AND DRIVELINE MAINTENANCE 8

Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

UNIT IV STEERING, BRAKE, SUSPENSION, WHEEL MAINTENANCE 11

Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, Parking brake. Bleeding of brakes.

Inspection, Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Dismantling and assembly procedures.

Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation.

Inspection, Maintenance and Service of steering linkage, steering column, Rack and pinion steering, Recirculating ball steering service- Worm type steering, power steering system

UNIT V AUTO ELECTRICAL AND AIR CONDITIOING MAINTENANCE 10

Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis

Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon the completion of the course, the student can able to understand the importance of maintenance and also the step by step procedure for maintain the various automotive sub systems

TEXT BOOKS:

1. Ed May, Automotive Mechanics Volume One , Mc Graw Hill Publications, 2003
2. Ed May, Automotive Mechanics Volume Two , Mc Graw Hill Publications, 2003
3. Vehicle Service Manuals of reputed manufacturers

REFERENCE:

1. Bosch Automotive Handbook, Sixth Edition,2004

AU8711 COMPUTER AIDED CHASSIS DESIGN LABORATORY L T P C
1 0 2 2

OBJECTIVE:

Designing of the clutch, gear box, front axle and drive line systems of Automobiles.
Drafting and Modeling of

- **CLUTCH**
  1. Complete design of clutch components.
  2. Assembly drawing of clutch using drafting software.
- **GEAR BOX**
  1. Gear train calculations.
  2. Layout of gear box.
  3. Calculation of bearing loads
  4. Selection of bearings.
  5. Assembly drawing of gear box using drafting software.
- **FRONT AXLE**
  1. Design of front axle system for various cross section like circular, 'I' section
- **DRIVE LINE AND REAR AXLE**
  1. Design of propeller shaft.
  2. Design details of final drive gearing.
  3. Design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings

TOTAL : 45 PERIODS

OUTCOMES:

At the end of this course the student should be able to

- Can understand the design concept and principles of various chassis components.
- Familiarized with the design of chassis components.

AU8712 INDUSTRIAL TRAINING L T P C
0 0 3 2

OBJECTIVES:

- To experience and understand real life situations in industrial organizations and their related environments and accelerating the learning process of how student's knowledge could be used in a realistic way.
- To understand the formal and informal relationships in an industrial organization so as to promote favorable human relations and teamwork.

- To provide the exposure to practice and apply the acquired knowledge “hands - on” in the working environment.

1. The students have to undergo practical industrial training for four weeks in recognized industrial establishments during their vacation periods.

2. At the end of the training they have to submit a report with following information:
   a. Profile of the industry
   b. Product range
   c. Organization structure
   d. Plant layout
   e. Processes/Machines/Equipments/Devices
   f. Personnel welfare schemes
   g. Details of the training undergone
   h. Projects undertaken during the training, if any
   i. Learning points

The assessments will be based equally on the report in the prescribed format and viva-voce examination by a committee nominated by the Head of the Department

OUTCOMES:

- Demonstrate a thorough understanding of current engineering practice and the role of automotive engineering in the wider industrial and commercial context
- Demonstrate practical engineering skills in the current use and apply industry codes of practice and standards.

AU8713	VEHICLE MAINTENANCE AND RE-CONDITIONING LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES

- To impart practical knowledge in automotive maintenance
- To understand the different procedures involved in any maintenance shop
- To impart practical knowledge in reconditioning of degraded parts
- To impart practical knowledge in Tuning the vehicle for best performance

STUDY EXPERIMENTS:

1. Tools and instruments required for maintenance
2. Safety aspects with respect to man, machine and tools
3. General procedures for servicing and maintenance schedule
4. Wheel Alignment procedure

LIST OF EXPERIMENTS:

1. Minor and major tune up of gasoline and diesel engines
2. Calibration of Fuel pump
3. Engine fault diagnosis using scan tool
4. Fault diagnosis and service of transmission system
5. Fault diagnosis and service of driveline system
6. Fault diagnosis and service of braking system
7. Fault diagnosis and service of suspension system
8. Fault diagnosis and service of steering system
9. Fault diagnosis and service of Electrical system like battery, starting system, charging system, lighting system etc
10. Fault diagnosis and service of vehicle air conditioning system
11. Practice the following:
    i. Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play.
    ii. Air bleeding from hydraulic brakes, air bleeding of diesel fuel system.
    iii. Wheel bearings tightening and adjustment.
    iv. Adjustment of head lights beam.
    v. Removal and fitting of tire and tube.

TOTAL : 45 PERIODS

OUTCOMES

- Students can able to do understand the functioning of maintenance shop
- Students can able to perform different maintenance procedures
- Students can able to rectify and replace and damaged parts
- Students can able to do some minor tuning on engine and vehicle

REFERENCES:

1. Service manuals of reputed vehicles.
2. Automotive Trouble shooting and Maintenance by Anderson Ashburn.
3. Venk Spicer, Automotive Maintenance and Trouble shooting.

AU8811	PROJECT WORK	L T P C 0 0 12 6

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The objective of project work is to enable the students, to work in convenient groups of not more than four members in a group, on a project involving some design and fabrication work or theoretical and experimental studies related to the respective engineering discipline.

Every project work shall have a Guide who is a member of the faculty of the University. Twelve periods per week shall be allotted in the Time table for this important activity and this time shall be utilized by the students to receive directions from the Guide, on library reading, laboratory work, computer analysis, or field work as assigned by the Guide and also to present in periodical seminars or viva to review the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details, estimation of cost and conclusions. This final report shall be in typewritten form as specified in the guidelines.

The continuous assessment and semester evaluation may be carried out as specified in the guidelines to be issued from time to time.

OUTCOMES:

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

AU8001	ADVANCE THEORY OF IC ENGINES	L T P C
		3 0 0 3

OBJECTIVES:

- Knowledge in usage of software for simulating the performance of IC engines
- Acquiring ability to simulate the various types combustion processes of IC engines.
- Knowledge in performance simulation of IC engines.

UNIT I COMBUSTION OF FUELS **9**

Chemical composition and molecular structure of hydrocarbon fuels. Combustion Stoichiometry of hydrocarbon fuels – Chemical energy and heat of reaction calculations – Chemical equilibrium and adiabatic flame temperature calculation. Theory of SI and CI engine combustion – Flame velocity and area of flame front. Fuel spray characteristics – droplet size, depth of penetration and atomization.

UNIT II ENGINE CYCLE ANALYSIS **8**

Ideal air, fuel air cycle and actual cycle analysis. Progressive combustion analysis in SI engines. Parametric studies on work output, efficiency and other engine performance.

UNIT III COMBUSTION MODELLING **10**

Basic concepts of engine simulation – Governing equations, Classification of engine models- Thermodynamic models for Intake and exhaust flow process – Quasi steady flow - Filling and emptying - Gas dynamic Models. Thermodynamic based in cylinder models for SI engine and CI engines.

UNIT IV NON-CONVENTIONAL IC ENGINES **9**

Concept of L.H.R. engine and its recent developments. Variable compression ratio engine and its use in engine research. Wankel rotafry combustion engine. Dual fuel engine concept for multi fuel usage in CI engines - performance studies on dual fuel engine. Free piston engine. Stratified charge and lean burn engines . Locomotive and marine engines.

UNIT V COMBUSTION ANALYSIS IN IC ENGINES **9**

Photographic studies of combustion processes – Analysis of Pressure crank angle diagrams in SI and CI engines. Knock study for Pressure crank angle histories. Apparent heat release rate and Wiebe's law analysis for combustion. Calculation of Ignition delay and combustion duration. – Hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines.

TOTAL : 45 PERIODS

OUTCOMES:

- At the end of the course, the student can able to model and simulate the engine cycle, perform combustion analysis, instruments used in measurement, recent developments in the IC engines.

TEXTBOOKS:

1. Ganesan,V., Internal combustion engines, Tata McGraw Hill Publishing Co., 1994.
2. Ganesan.V. "Computer Simulation of spark ignition engine process", Universities Press (I) Ltd, Hyderbad, 1996.

REFERENCES:

1. Ramalingam. K.K., Internal combustion engine, scitech publications, Chennai, 2003.
2. Ganesan,V., Compute Simulation of Compression Ignition engine process, Universities Press (India) Ltd., Hyderabad, 1996.
3. John,B., Heywood, Internal Combustion Engine Fundamentals, McGraw Hill Publishing Co., New York, 1990.
4. Benson,R.S., Whitehouse,N.D., Internal Combustion Engines, Pergamon Press, Oxford, 1979.

AU8002 ADVANCE VEHICLE TECHNOLOGY L T P C 3 0 0 3

OBJECTIVES :

- To learn and understand the programming,data acquistion hardware and implementing small automotive related projects in virtual instrumention

UNIT I POWERTRAIN 9

Modern Engine Technology like DTS- i, DTS – Fi, DTS – Si, VVT, Camless Engine, GDi, CRDI

.

UNIT II VEHICLE SAFETY 9

Anti lock braking systems- Traction Control system- Electro-hydraulic brakes- Occupant safety systems- Airbags, seat belt tightening system, collision warning systems, child Lock – Power windows- Power Sunroof- Seat and steering Column- Biometric systems- Driver-assistance systems- Adaptive cruise control

UNIT III VEHICLE SECURITY AND COMFORT SYSTEM 9

Vision enhancement, road recognition system, Anti theft technologies, smart card system, number plate coding. Locking system- Central locking system- acoustic signaling devices
Active suspension systems, requirement and characteristics, different types, Vehicle Handling and Ride characteristics of road vehicle, pitch, yaw, bounce control, Climate control management system

UNIT IV VEHICLE INFORMATION AND COMMUNICATION 9

Instrumentation- Vehicle Information system- Trip Recorders- Parking systems- Analog and digital signal transmission- Automotive sound systems- Mobile and data radio- Mobile Information services- navigation system- Traffic telematics- Multimedia systems
OBD-I Engine diagnostic system- OBD-II Engine Control systems- SAE DTC Standards- Scan Tools- Strategy based diagnosis – Engine and vehicle performance problems.

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UNIT V INTELLIGENT TRANSPORTATION SYSTEM **9**

Traffic routing system - Automated highway systems - Lane warning system – Driver Information System, driver assistance systems - Driver conditioning warning - Route Guidance and Navigation Systems- Hybrid / Electric and Future Cars

TOTAL : 45 PERIODS

OUTCOMES:

- On completion of the course, the student will understand the new developments in the area of automobile area.

TEXT BOOKS:

1. Nadovich, C., "Synthetic Instruments Concepts and Applications". Elsevier,2005
2. Bitter, R., Mohiuddin, T. and Nawricki, M., "Labview Advanced programming Techniques", CRC Press, 2nd Edition, 2007.

REFERENCE:

1. Robert N.Brandy, "Automotive Electronics and Computer Systems", Prentice Hall ,2001

AU8003 ALTERNATIVE FUELS AND ENERGY SYSTEMS **L T P C 3 0 0 3**

OBJECTIVES

- To know about the types of alternative fuels and energy sources for IC engines.

UNIT I ALCOHOLS AS FUELS **9**

Introduction to alternative fuels. - Need for alternative fuels - Availability of different alternative fuels for SI and CI engines. Alcohols as fuels. Production methods of alcohols. Properties of alcohols as fuels. Methods of using alcohols in CI and SI engines. Blending, dual fuel operation, surface ignition and oxygenated additives. Performance emission and combustion characteristics in CI and SI engines.

UNIT II VEGETABLE OILS AS FUELS **9**

Various vegetable oils and their important properties. Different methods of using vegetable oils engines – Blending, preheating Transesterification and emulsification of Vegetable oils - Performance in engines – Performance, Emission and Combustion Characteristics in diesel engines.

UNIT III HYDROGEN AS ENGINE FUEL **9**

Production methods of hydrogen. Combustive properties of hydrogen. Problems associated with hydrogen as fuel and solutions. Different methods of using hydrogen in SI and CI engines. Performance, emission and combustion analysis in engines. Hydrogen storage - safety aspects of hydrogen.

UNIT IV BIOGAS, NATURAL GAS AND LPG AS FUELS **9**

Production methods of Biogas, Natural gas and LPG. Properties studies. CO_2 and H_2S scrubbing in Biogas., Modification required to use in SI and CI Engines- Performance and emission characteristics of Biogas, NG and LPG in SI and CI engines.

UNIT V ELECTRIC, HYBRID AND FUEL CELL VEHICLES **9**

Layout of Electric vehicle and Hybrid vehicles – Advantages and drawbacks of electric and hybrid vehicles. System components, Electronic control system – Different configurations of Hybrid vehicles. Power split device. High energy and power density batteries – Basics of Fuel cell vehicles.

TOTAL : 45 PERIODS

OUTCOMES:

- On completion of the course, the student will understand the various alternative fuels available, its properties, performance characteristics, combustion characteristics, emission characteristics, engine modifications required etc.,

REFERENCES:

1. Ayhan Demirbas, ' **Biodiesel A Realistic Fuel Alternative for Diesel Engines',** Springer-Verlag London Limited 2008,ISBN-13: 9781846289941
2. Gerhard Knothe, Jon Van Gerpen, Jargon Krahl, **The Biodiesel Handbook,** AOCS Press Champaign, Illinois 2005.
3. Richard L Bechtold P.E., **Alternative Fuels Guide book,** Society of Automotive Engineers, 1997 ISBN 0-76-80-0052-1.
4. Transactions of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc.).
5. Science direct Journals (**Biomass & Bio energy, Fuels, Energy, Energy conversion Management, Hydrogen Energy**, etc.) on biofuels.

AU8004 AUTOMOTIVE AERODYNAMICS **L T P C 3 0 0 3**

OBJECTIVE

At the end of the course, the students will be able to apply basic principles of aerodynamics for the design of vehicle body.

UNIT I INTRODUCTION **9**

Scope, historical developments, fundamental of fluid mechanics, flow phenomenon related to vehicles, external and internal flow problem, resistance to vehicle motion, performance, fuel consumption and performance potential of vehicle aerodynamics.

UNIT II AERODYNAMIC DRAG OF CARS **9**

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 SHAPE OPTIMIZATION OF CARS **9**

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. Case studies on modern vehicles.

UNIT IV VEHICLE HANDLING **9**

The origin of forces and moments on a vehicle, lateral stability problems, methods to calculate forces and moments – vehicle dynamics under side winds, the effects of forces and moments, characteristics of forces and moments, dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles and racing cars.

UNIT V WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS **9**

Introduction, principle of wind tunnel technology, limitation of simulation, stress with scale models, full scale wind tunnels, measurement techniques, equipment and transducers, road testing methods, numerical methods. CFD analysis.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students will understand the fundamentals of aerodyanmics, vehicle body optimisation, measuring aerodynamics forces etc.

TEXT BOOK :

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

REFERENCES :

1. A. Pope – "Wind Tunnel Testing" – John Wiley & Sons - 2nd Edition, New York – 1974.
2. "Automotive Aerodynamic", Update SP-706 – SAE – 1987
3. "Vehicle Aerodynamics" – SP-1145-SAE-1996.

AU8005 AUTOMOTIVE TEST INSTRUMENTATION **L T P C**
3 0 0 3

OBJECTIVES:

- The main objective of this course is to provide theoretical and applicative knowledge in automobile test instrumentation engineering based on virtual reality technologies through advanced instrumentation techniques, programming and data acquisition hardware and implementing small automobile related projects in virtual instrumentation environment.

UNIT I MEASUREMENT SYSTEMS **6**

Introduction to Measurement systems-static and dynamic measurement –closed and open loop system - Requirements and characteristics – Analysis of experimental detail. Error analysis

UNIT II TRANSDUCERS, MODIFIERS AND TERMINATING DEVICES **8**

Transducers for Automotive Applications – Amplifiers- filters –data Acquisition- Indicators, Printers and displays –Signal Analyzing.

UNIT III MECHANICAL MEASUREMENT **10**

Instrumentation for measuring Weight, Force, torque, pressure power, temperature, fluid flow, vibration, rotational speed, velocity, acceleration and angular motion.

UNIT IV ENGINE EXPERIMENTAL TECHNIQUES **12**

I.S Code for Engine testing – Instrumentation for performance testing of engine, Instrumentation for Research and development, Instrumentation for noise, vibration, in cylinder gas flow, flame temperature Dynamic Cylinder pressure measurements

UNIT V VEHICLE EXPERIMENTAL TECHNIQUES **9**

Laboratory tests- test tracks - Endurance Tests- crash tests- Vehicle performance test - Brake tests.

TOTAL : 45 PERIODS

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OUTCOMES:

- Possess knowledge in virtual instrumentation and how it can be applied in data acquisition and instrument control in automobile engineering.
- Can Experiment and analyze the automobile laboratory prototype measurement systems using a computer, plug-in DAQ interfaces.

REFERENCES:

1. A.W. JUDGE, Engineering Precision Measurement, Chapman and Hall Ltd, Essex Street W.C.,1951,
2. T.G. Beckwith and Buck, Mechanical Measurements, Oxford and IBH Publishing House, New Delhi, 1995
3. D.Patambis, Principle of Industrial Instrumentation, Tata McGraw Hill Publishing Co, New Delhi, 1990.
4. Rangan, Sharma and Mani, Instrumentation Devices and systems, Tata McGraw Hill Publishing Co., Ltd., 1990
5. J.G. Giles, Engine and Vehicle Testing, Illiffe books Ltd., London,1968.

AU8006	COMBUSTION THERMODYNAMICS AND HEAT TRANSFER	L T P C 3 0 0 3

OBJECTIVES:

The objectives of this course are to make the students to understand the principle of general and engine combustion. To understand engine heat release rate and various heat transfer models and to study the experimental methods for combustion and heat transfer in engines.

UNIT I THERMODYNAMICS OF COMBUSTION 10

Premixed and diffusion combustion process in IC engines. First and Second Law of Thermodynamics applied to combustion- combustion Stoichiometry- chemical equilibrium, spray formation and droplet combustion.

UNIT II CHEMICAL KINETICS OF COMBUSTION 10

Fundamentals of combustion kinetics, rate of reaction, equation of Arrhenius, activation energy. Chemical thermodynamic model for Normal Combustion.

UNIT III FLAMES 10

Laminar premixed – flame speed correlations- quenching, flammability, and ignition, flame stabilization, laminar diffusion flames, turbulent premixed flames-Damkohler number.

UNIT IV HEAT TRANSFER IN IC ENGINES 8

Engine Heat transfer and heat Balance. Measurement of Instantaneous heat transfer rate. Heat transfer modeling. Heat transfer coefficients, radiative heat transfer.

UNIT V EXPERIMENTS IN IC ENGINES 7

Cylinder pressure measurement. Rate of heat release calculation – hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines.

TOTAL : 45 PERIODS

Attested

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OUTCOMES:

Get familiarized with the following

- The principle of general and engine combustion,heat release rate and various heat transfer models.

REFERENCES:

1. **Spalding.D.B.**, "Some fundamental of Combustion", Butterworth Science Publications, London, 1985.
2. **Irvin Glasman**, "Combustion" Academic Press, London, 1987, ISBN 0-12-285851-4.
3. **Taylor.E.F.** "The Internal Combustion Engines ", International Text Book Co., Pennsylvania, 1982.
4. **V.Ganesan,** 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.
5. **Ashley Campbel,** "Thermodynamic analysis of combustion engine", John book company, Newyork, 1979.
6. **J.I.Ramos**, "Modeling of Internal Combustion Engine", Mcgraw hill book company New york 1990
7. **John. B. Heywood**,' "Internal Combustion Engines", Tata McGraw Hill Co., Newyork, 1988.
8. **Ganesan.V.** "Computer Simulation of Spark Ignition Engine Process ", Wiley eastern India ltd,1996.

AU8007 COMPUTATIONAL FLUID MECHANICS L T P C 3 0 0 3

AIM

This course aims to introduce numerical modeling and its role in the field of heat and fluid flow, it will enable the students to understand the various discretisation methods and solving methodologies and to create confidence to solve complex problems in the field of heat transfer and fluid dynamics.

OBJECTIVES :

- To develop finite difference and finite volume discretized forms of the CFD equations.
- To formulate explicit & implicit algorithms for solving the Euler Eqns & Navier Stokes Eqns.

UNIT I GOVERNING DIFFERENTIAL EQUATION AND FINITE DIFFERENCE METHOD 9

Classification, Initial and Boundary conditions – Initial and Boundary Value problems – Finite difference method, Central, Forward, Backward difference, Uniform and non-uniform Grids, Numerical Errors, Grid Independence Test.

UNIT II CONDUCTION HEAT TRANSFER 9

Steady one-dimensional conduction, Two and three dimensional steady state problems, Transient one-dimensional problem, Two-dimensional Transient Problems.

UNIT III CONVECTION HEAT TRANSFER AND FEM 9

Steady One-Dimensional and Two-Dimensional Convection – diffusion, Unsteady one-dimensional convection – diffusion, Unsteady two-dimensional convection – Diffusion – Introduction to finite element method – solution of steady heat conduction by FEM – Incompressible flow – simulation by FEM.

Attested

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UNIT IV INCOMPRESSIBLE FLUID FLOW 9

Governing Equations, Stream Function – Vortices method, Determination of pressure for viscous flow, SIMPLE Procedure of Patankar and Spalding, Computation of Boundary layer flow, finite difference approach.

UNIT V TURBULENCE MODELS 9

Algebraic Models – One Dimension model, K – T Models, Standard and High and Low Reynolds number models, Prediction of fluid flow and heat transfer using standard codes.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able

- To create numerical modeling and its role in the field of fluid flow and heat transfer
- To use the various discretization methods, solution procedures and turbulence modeling to solve flow and heat transfer problems.

TEXT BOOKS:

1. Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 1995.
2. Ghoshdasdidar, P.S., "Computer Simulation of flow and heat transfer" Tata McGraw-Hill Publishing Company Ltd., 1998.
3. Subas, V.Patankar "Numerical heat transfer fluid flow", Hemisphere Publishing Corporation, 1980.

REFERENCES

1. Taylor, C and Hughes, J.B. "Finite Element Programming of the Navier-Stokes Equation", Pineridge Press Limited, U.K., 1981.
2. Anderson, D.A., Tannehill, J.I., and Pletcher, R.H., "Computational fluid Mechanics and Heat Transfer " Hemisphere Publishing Corporation, New York, USA,1984.
3. Fletcher, C.A.J. "Computational Techniques for Fluid Dynamics 1" Fundamental and General Techniques, Springer – Verlag, 1987.
4. Fletcher, C.A.J. "Computational Techniques for fluid Dynamics 2" Specific Techniques for Different Flow Categories, Springer – Verlag, 1987.
5. Bose, T.X., "Numerical Fluid Dynamics" Narosa Publishing House, 1997.

AU8008 FLEET MANAGEMENT **L T P C**
3 0 0 3

OBJECTIVES:

- To provide detailed knowledge to students on Automobile management training, operation, vehicle maintenance, vehicle scheduling, fixation of fare and its structure. In addition the knowledge about vehicle parts supply management, budget allocation and the details of motor vehicle act will be imparted.

UNIT I MANAGEMENT TRAINING AND OPERATION 10

Basic principles of supervising. Organizing time and people. Job instruction training – training devices and techniques – drive and mechanic hiring – driver checklist – lists for driver and mechanic – trip leasing - vehicle operation and types of operation. Logistics and supply management over-view.

UNIT II VEHICLE MAINTENANCE **8**

Scheduled and unscheduled maintenance – planning and scope – evaluation of PMI programme – Work scheduling – Overtime – Breakdown analysis – control of repair backlogs – cost of options, electronically controlled vehicle maintenance system.

UNIT III VEHICLE PARTS, SUPPLY MANAGEMENT AND BUDGET **10**

Cost of inventory – Balancing inventory cost against downtime – Parts control – Bin tag systems – Time management – Time record keeping – Budget activity – Capital expenditures – Classification of vehicle expenses – Fleet management and data processing – Data processing systems, - Software. Models – computer controlling of fleet activity – Energy management.

UNIT IV SCHEDULING AND FARE STRUCTURE **10**

Route planning – scheduling of transport vehicles – preparation of timetable, costs, fare structure – Methods of fare collection – Preparation of fare table.

UNIT V MOTOR VEHICLE ACT **7**

Schedules and sections – Registration of motor vehicles – EURO Norms - Licensing of drivers – Control of permits – Limits of speed – traffic signs – Constructional regulations – Description of goods carrier, delivery van, tanker, tipper, Municipal, fire fighting and break down service vehicle.

TOTAL : 45 PERIODS

OUTCOMES:

- Demonstrate effective vehicle management skills such as scheduling, fare fixation for optimal usage on roads.
- Possess an extensive knowledge and understanding of the business and management practices on vehicles in fleets and their maintenance.

TEXT BOOK:

1. John Dolu, Fleet management, McGraw Hill Co., 1984

REFERENCES :

1. Government Publication, The Motor Vehicle Act, 1989.
2. Kitchin,L.D., Bus operation, Illiffe and Sons Ltd., London, III Edition, 1982
3. Kadiyali, L.R., Traffic engineering and Transport Planning.

AU8009 HYBRID AND ELECTRIC VEHICLES **L T P C**
3 0 0 3

OBJECTIVES :

- To understand the methods of representation of system and thier transfer finction models
- To provide adquate knowledge in the time response of systems and steady state error analysis
- To give basic knowledge in obtainig the open loop and closed loop frequency responses of system
- To understand the concept of stablity of control system and methos of stablity analysis
- To study the three way of designing compensators for a control system

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UNIT I NEED FOR ALTERNATIVE SYSTEM 9

Need of electric vehicles hybrid vehicles – comparative study of diesel, petrol, pure electric and hybrid vehicles. Limitations of electric vehicles. Specification of some electric and hybrid vehicles

UNIT II ENERGY SOURCES : BATTERIES AND FUELL CELLS 9

Battery Parameters-Power requirement of electric vehicles- Different types of batteries - Lead acid-Nickel based-Sodium based-Lithium based- Metal Air based. Battery charging- Charger design- Quick charging devices- Battery Modeling.

Fuel Cell- Fuel cell characteristics- Fuel cell types-Hydrogen fuel cell- Connecting cell in series- water management in the PEM fuel cell- Thermal Management of the PEM fuel cell

UNIT III PROPULSION MOTORS AND CONTROLLERS 12

A characteristic of permanent magnet and separately exited DC motors. AC single phase and 3-phase motor – inverters – DC and AC motor speed controllers.

UNIT IV VEHICLE DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES 6

Aerodynamic-Rolling resistance- Transmission efficiency- Vehicle mass- Electric vehicle chassis and Body design considerations- Heating and cooling systems- Controllers- Power steering- Tyre choice- Wing Mirror, Aerials and Luggage racks

UNIT V HYBRID VEHICLES 9

Types of Hybrid- Series, parallel, split – parallel, series - parallel - Advantages and Disadvantages. Power split device – Energy Management System - Design consideration - Economy of hybrid vehicles

TOTAL : 45 PERIODS

OUTCOMES:

- Get familiarized with hybrid and electric vehicle.

TEXT BOOKS:

1. James Larminie and John Lowry, "Electric Vehicle Technology Explained " John Wiley & Sons,2003
2. Iqbal Husain, " Electric and Hybrid Vehicles-Design Fundamentals", CRC Press,2003
3. Mehrdad Ehsani, " Modern Electric, Hybrid Electric and Fuel Cell Vehicles", CRC Press,2005

REFERENCES:

1. Ron HodKinson, " light Weight Electric/ Hybrid Vehicle Design", Butterworth Heinemann Publication,2005
2. Lino Guzzella, " Vehicle Propulsion System" Springer Publications,2005.

AU8010 HYDRAULIC AND PNEUMATIC SYSTEMS L T P C
3 0 0 3

OBJECTIVES :

- To understand the hydraulic and pneumatic prinicples, components and its selection
- To design the hydraulic circuit and control for automotive applications
- To design the Pneumatic circuit and control for automotive applications

UNIT I INTRODUCTION TO FLUID POWER & PRINICPLE 9

Introduction to fluid power control- Hydraulic and pneumatics- Selection criteria, application of fluid power, application of pascal's law, equation, Transmission and multiplication of force-pressure losses- fluids, selection and properties- ISO symbols

UNIT II FLUID POWER DRIVES 9

Fluid power drives- Pumps- working principle and construction details of gear, vane and piston pumps, hydraulic motor, Hydrostatic transmission drives and characteristics- Hydraulic supply components- Pneumatic power supply- Compressor, air distribution, air motors. Case study related to automotive application.

UNIT III FLUID POWER ELEMENTS 9

Control valves- pressure, flow direction- working principles and construction- Special type-valves- cartridge, modular, proportional and servo- Selection and actuation methods. Actuators- Selection and specification, cylinders- mounting, cushioning, pipe fittings- Fluid conditioning elements- Accumulators. Case study related to automotive application.

UNIT IV HYDRAULIC AND PNEUMATIC CIRCUITS DESIGN 9

Design of Hydraulic and Pneumatic circuits for automation, Selection and specification of circuit components, sequencing circuits, cascade and Karnaugh- Veitch map method- Regenerative, speed control, Synchronizing circuits. Case study related to automotive application.

UNIT V ELECTRO PNEUMATICS AND PLC CIRCUITS 9

Use of electrical timers, switches, solenoid, relay, proximity sensors etc. Electro pneumatic sequencing Ladder diagram- PLC: – elements, function and selection- PLC programming- Ladder and different programming methods- Sequencing circuits. Case study related to automotive application.

TOTAL : 45 PERIODS

OUTCOMES:

- Students will be able to understand the components of the hydraulic and pneumatic system and their functions and the latest developments in this field
- Students will be able to understand the hydraulic and pneumatic circuit design, electro pneumatics and PLC circuits

TEXT BOOKS:

1. Anthony Esposito, " Fluid power with applications" , 5th Edition, Pearson Education 2003.
2. Majumdar, " Oil Hydraulics: Principles and Maintenance", Tata McGraw Hill, 2004
3. Majumdar, "Pneumatic system: Prinicples and maintenance", Tata McGraw Hill,2004

REFERENCES:

1. William Kimberley," Bosch Automotive Handbook", 6th Edition, Robert Bosch GmbH,2004
2. William W.Reaves, "Technology of Fluid Power", Delmer Publishers,1997
3. Peter Rohner," Fluid Power Logic circuit Design" MacMillion Press Ltd., 1990.
4. Andrew Parr, " Hydraulics & Pneumatics" Jaico Publishing House,2004

AU8011	NOISE, VIBRATION, AND HARSHNESS	L T P C 3 0 0 3

OBJECTIVES:

- knowledge in basic of vibration and noise
- Understanding the effect of noise an human comfort and environment
- Knowing the methods of vibration and noise measurement

UNIT I FUNDAMENTALS OF ACOUSTICS AND NOISE, VIBRATION 8

Theory of Sound—Predictions and Measurement, Sound Sources, Sound Propagation in the Atmosphere, Sound Radiation from Structures and Their Response to Sound, General Introduction to Vibration, Vibration of Simple Discrete and Continuous Systems, Random Vibration, Response of Systems to Shock, Passive Damping

UNIT II EFFECTS OF NOISE, BLAST, VIBRATION, AND SHOCK ON PEOPLE 7

General Introduction to Noise and Vibration Effects on People and Hearing Conservation, Sleep Disturbance due to Transportation Noise Exposure, Noise-Induced Annoyance, Effects of Infrasound, Low-Frequency Noise, and Ultrasound on People, Auditory Hazards of Impulse and Impact Noise, Effects of Intense Noise on People and Hearing Loss, Effects of Vibration on People, Effects of Mechanical Shock on People, Rating Measures, Descriptors, Criteria, and Procedures for Determining Human Response to Noise.

UNIT III TRANSPORTATION NOISE AND VIBRATION—SOURCES, PREDICTION, AND CONTROL. 10

Introduction to Transportation Noise and Vibration Sources, Internal Combustion Engine Noise Prediction and Control—Diesel, Exhaust and Intake Noise and Acoustical Design of Mufflers, Tire/Road Noise—Generation, Measurement, and Abatement, Aerodynamic Sound Sources in Vehicles—Prediction and Control, Transmission and Gearbox Noise and Vibration Prediction and Control, Brake Noise Prediction and Control.

UNIT IV INTERIOR TRANSPORTATION NOISE AND VIBRATION SOURCES — PREDICTION AND CONTROL. 10

Introduction to Interior Transportation Noise and Vibration Sources, Automobile, Bus, and Truck Interior Noise and Vibration Prediction and Control, Noise and Vibration in Off-Road Vehicle Interiors—Prediction and Control,

UNIT V NOISE AND VIBRATION TRANSDUCERS, ANALYSIS EQUIPMENT, SIGNAL PROCESSING, AND MEASURING TECHNIQUES 10

General Introduction to Noise and Vibration Transducers, Measuring Equipment, Measurements, Signal Acquisition, and Processing, Acoustical Transducer Principles and Types of Microphones, Vibration Transducer Principles and Types of Vibration Transducers, Sound Level Meters, Noise Dosimeters, Analyzers and Signal Generators, Equipment for Data Acquisition, Noise and Vibration Measurements, Determination of Sound Power Level and Emission Sound Pressure Level, Sound Intensity Measurements, Noise and Vibration Data Analysis, Calibration of Measurement Microphones, Calibration of Shock and Vibration Transducers, Metrology and Traceability of Vibration and Shock Measurements.

TOTAL : 45 PERIODS

OUTCOMES:

- At the end of the course, the student will understand the sources, effects, prediction, control techniques, measurement techniques of noise, vibration pertain to an automobile.

REFERENCES:

1. Allan G. Piersol ,Thomas L. Paez "Harris' shock and vibration hand book" , McGraw-Hill , New Delhi, 2010
2. Clarence W. de Silva , "Vibration Monitoring, Testing, and Instrumentation ",CRC Press, 2007
3. *David A.Bies and Colin H.Hansen* "Engineering Noise Control: Theory and Practice " Spon Press , London . *2009*
4. Colin H Hansen "Understanding Active Noise Cancellation " , Spon Press , London .2003
5. Matthew Harrison "Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles ", Elsevier Butterworth-Heinemann, Burlington, 2004

AU8012	POLYMER COMPONENTS IN AUTOMOTIVE APPLICATIONS	L T P C 3 0 0 3

OBJECTIVES:

The subject exposes students to the basics of polymer, vibration and rubber spring and fluid sealing and flexible couplings..

UNIT I INTRODUCION **6**

Identification of plastics / rubber components in automobiles – function – selection criteria.

UNIT II STRUCTURE-PROPERTY RELATIONSHIPS IN RUBBERS **10**

Resilience, creep, hysteresis and damping, stability, set and stress relaxation, behavior in dynamic applications.

UNIT III VIBRATION AND RUBBER SPRING **10**

Principles of vibration isolation – rubber mounts – spring design – comparison with metallic springs – shape factor and its effect – forced and free vibrations with damping – typical mounts, compounding and manufacture.

UNIT IV FLUID SEALINGS AND FLEXIBLE COUPLINGS AND HOSES **10**

Seals for static and dynamic applications – effect of heat / oil ageing – frictional behaviour – fundamental of sealability.

UNIT V COMPOUNDING AND MANUFACTURE **9**

Types of couplings – specification and selection – torque vs deflection relationship – brake fluid / hydraulic hoses, materials and manufacture.

TOTAL : 45 PERIODS

OUTCOMES:

- Use of techniques for polymer processing.
- Ability to develop structure – property relationship in polymer.

REFERENCES:

1. Freakley.P.K., and Payne A.R., Theory and Practice of Engineering with Rubber, Applied Science Publishers Ltd.
2. Hobel.E.F., Rubber Springs Design
3. Blow.C.M. and Hepburn C., Rubber Technology and Manufacture, 1982.

AU8013	PRINCIPLES OF CONTROL SYSTEMS	L T P C 3 0 0 3

OBJECTIVES :

- To understand the methods of representation of system and thier transfer finction models
- To provide adquate knowledge in the time response of systems and steady state error analysis
- To give basic knowledge in obtainig the open loop and closed loop frequency responses of systems
- To understand the concept of stablity of control system and methos of stablity analysis
- To study the three way of designing compensators for a control system

UNIT I SYSTEM AND THIER REPRESENTATION 9

Basic elements in control systems-Open loop and Closed loop system-Feedback characteristics- Effects of feedback-mathematical modeling of physical systems:- mechanical, Thermal, hydraulic and Pneumatic systems-Transfer function- AC and DC servomotor- Block diagram reduction techniques-signal flow graph- control system components – computer simulation.

UNIT II TIME RESPONSE ANALYSIS 9

Time response- Types of test inputs- First and Second order responses- Error coefficient- Generalized error series- Steady state error- Time domain specifications- Problems related to automotive domain- Computer simulation

UNIT III FREQUENCY RESPONSE ANALYSIS 12

Frequency response- Frequency domain specifications-Bode plot-Polar plot- Determination of phase margin and gain margin- Constant M and N circles-Nichols chart- Determination of closed loop responses from open loop response- Problems related to automotive domain Computer simulation.

UNIT IV STABLITY OF CONTROL STYSTEM 6

Concepts of stability- Location of roots in S-plane for stability- Routh Hurwitz criterion- Root locus techniques- Construction-Nyquist stability criterion- Problems related to automotive domain -Computer simulation

UNIT V CONTROL SYSTEM DESIGN 9

PID controllers –Performance criteria- Selection of controller modes-lag, Lead, and lag-Lead networks-Compensator design for desired response using root locus and Bode diagrams-Problems related to automotive domain -Computer simulation

TOTAL: 45 PERIODS

OUTCOMES:

Get familiarized with the followings

- Mathematical modeling concepts of systems and their transfer functions models
- The time response of system and steady state error analysis

TEXT BOOKS:

1. Gopal, M., " Control System, Prinicples and Design",Tata MCGraw-Hill Pub. Co., 2nd Edition,New Delhi,2006.
2. Nagrath, I.J. and Gopal,M., "Control System Engineering", New Age International(p),4th Edition, Tata McGraw Hill, 2004

REFERENCES:

1. Ogata, K., " Modern Control Engineering", Prentice hall of India Ltd., 4th Edition, New Delhi,2006
2. Dorf Bishop, "Modern Control System",Prentice Hall,2004
3. Kuo, B.C., "Automatic Control System' Prentice Hall of India Ltd., New Delhi,2003

AU8014	RENEWABLE SOURCES OF ENERGY	L T P C 3 0 0 3

OBJECTIVES:

- To understand the energy conversion, utilization and storage for renewable technologies such as wind, solar, biomass, and other renewable energy sources such as geothermal and ocean.
- To study the potential of using renewable energy technologies as a complement to the extent possible, replacement for conventional technologies, and the possibility of combining renewable and non-renewable energy technologies in hybrid systems.
- To understand the environmental consequences of energy conversion and how renewable energy can reduce air pollution and global climate change and present the strategies for enhancing the future use of renewable energy resources.

UNIT I INTRODUCTION TO RENEWABLE ENERGY SOURCES 9

World energy usage -reserves for world energy resources. Principles of renewable energy – renewable energy resources and their importance. Conventional and non conventional fuels. Review of possible renewable energy resources. Scientific principles, technical implications, and social implications.

UNIT II SOLAR ENERGY 9

Solar radiation: Extraterrestrial solar radiation - Measurement and estimation of solar radiation. Solar heating devices: Solar water heaters. Systems with separate storage. Selective surfaces. Solar concentrators and other devices. Steam generation and solar thermal-electricity. Recent advancements in solar power generation. Photovoltaic Devices and Systems. Principles of photovoltaic generation of electricity; Silicon cell; Photon absorption; Cell efficiency; Solar cell construction; Types and usage of photovoltaic systems. Grid connection; system design and RAPS (remote area power supply) applications.

UNIT III BIOMASS AND BIOENERGY 9

Biomass resources - Reviews the use of agricultural crops and solid biomass wastes in the production of alternative fuels. Available Technologies for biomass energy production. Incineration, pyrolysis, gasification and other thermo-chemical processes. Ethanol and biogas production technologies. Recent advancements in Biomass energy production.

UNIT IV WIND ENERGY 9

Basics of Wind Energy. Current and Future Technologies - Benefits and Drawbacks of Wind Energy - Wind Turbine and its components- Loads on the wind turbine. Forces acting onwind turbines and calculation of wind turbine efficiency. Process of electricity generation and supply to the grid (wind farms).Current and Potential Uses - Issues, Challenges, and Obstacles

UNIT V OTHER RENEWABLE ENERGIES **9**

Introduction to Geothermal, Ocean thermal and tidal energies. Working principles of Geothermal, Ocean thermal and tidal power plants. Binary cycle power generation. Advantages and drawbacks. Current trends in geothermal, ocean thermal and tidal power technologies.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to identify the new methodologies / technologies for effective utilization of renewable energy sources.

REFERENCE BOOKS :

1. **Neil Schlager and Jayne Weisblatt**, Alternative Energy, Thomson Gale sales ISBN 1-4414-0507-3, 2006
2. **J. Dewulf and Herman Van** Langenhove, 'Renewables Based Technology: Sustainability Assessment'. 2006 John Wiley & Sons, Ltd. ISBN: 0-470-02241-8
3. **Sunggyu Lee James G. Speight Sudarshan K. Loyalka**,' Handbook of Alternative Fuel Technologies', Taylor & Francis Group, LLC International Standard Book Number-10: 0-8247-4069-6 2007.
4. **Donald L. Klass** Biomass for renewable energy fuels and chemicals
5. **Chris Higman and Maarten van der Burgt**, ' Gasification' , Elsevier Science (USA) ISBN 0–7506–7707–4 2003

AU8015 SPECIAL TYPES OF VEHICLES **L T P C 3 0 0 3**

OBJECTIVES:

- To know about the various types of special types of vehicles,equipment and their working principles and applications.

UNIT I EARTH MOVING EQUIPMENTS **10**

Construction layout, capacity and applications of earthmovers like dumpers, front-end loaders, bulldozers, backhoe loaders, scrappers, Bucket conveyors etc. Selection criteria of prime mover for dumpers and front end loaders based on vehicle performance characteristics.

UNIT II CONSTRUCTIONAL EQUIPMENTS **9**

Layout of Constructional equipments, excavators, Jip Cranes, hoist, motor graders, Mixing machine, concrete ready mixers, drillers, ramming machines for construction of bridges and working principles, Power generators

UNIT III FARM EQUIPMENTS **9**

Classification of tractors – Main components of tractor. Working attachment of tractors – Auxiliary equipment – Trailers and body tipping mechanism - plowing - paddy plantation machine harvesting machines. Sugarcane harvesting, power trailers

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UNIT IV INDUSTRIAL APPLICATIONS 9

Constructional features, capacity and stability of jib cranes. Vibratory compactors, forklifts. Towing vehicles. Case studies.

UNIT V MILITARY AND COMBAT VEHICLES 8

Ride and stability characteristics, power take off, special implementations. Special features and constructional details of tankers, gun carriers and transport vehicles, bridge builders, communication vehicles.

TOTAL : 45 PERIODS

OUTCOMES:

- Get familiarized with various types of special vehicles and equipment.

TEXT BOOKS:

1. Abrosimov. K. Bran berg.A. and Katayer.K., " Road making Machinery ", MIR Publishers, Moscow, 1971.
2. SAE Handbook Volume III
3. Wong.J.T., " Theory of Ground vehicles ", John Wiley & Sons, New York, 1987.
4. Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers, 1987.

REFERENCES:

1. B. Geleman and M. Moskovin, Farm tractors, MIR publishers, Moscow.
2. Off the road wheeled and combined traction devices - Ashgate Publishing Co. Ltd. 1998.
3. Bart H Vanderveen, Tanks and Transport vehicles, Frederic Warne and Co ltd., London.
4. Astokhov, Truck Cranes, MIR Publishers, Moscow.
5. Kolchin,A., and V.Demidov, Design of Automotive Engines for Tractor, MIR Publishers, 1972.

AU8016 VEHICLE AIR-CONDITIONING **L T P C 3 0 0 3**

OBJECTIVES:

- The course is designed to know about basic air-conditioning concepts, Principles, types , components and maintenance aspects of vehicle air-conditioning system

UNIT I AUTOMOTIVE AIRCONDITIONING FUNDAMENTALS 9

Purposes of Heating, Ventilation and Air Conditioning- Environmental Concerns- Ozone layer depletion- Location of air conditioning components in a car – Schematic layout of a vehicle refrigeration system.

Psychrometry – Basic terminology and Psychrometric mixtures- Psychrometric Chart- Related problems

UNIT II AUTOMOTIVE COOLING AND HEATING SYSTEM 9

Vehicle Refrigeration System and related problems- Fixed thermostatic and Orifice tube system- Variable displacement thermostatic and Orifice tube system- Vehicle air conditioning operation

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Types of compressor- Compressor Clutches- Compressor Clutch electrical circuit- Compressor lubrication- Condensers- Evaporators- Expansion devices- Evaporator temperature and pressure controls- receiver-drier- Accumulators- refrigerant hoses, Connections and other assemblies- Heating system

UNIT III AIR-CONDITIOING CONTROLS, DELIVERY SYSTEM AND REFRIGERANTS **9**

Types of Control devices- Preventing Compressor damage- Preventing damage to other systems- Maintaining driveability- Preventing Overheating

Ram air ventilation- Air delivery Components- Control devices- Vacuum Controls
Containers – Handling refrigerants – Discharging, Charging & Leak detection – Refrigeration system diagnosis – Diagnostic procedure – Ambient conditions affecting system pressures.

UNIT IV AUTOMATIC TEMPERATURE CONTROL **9**

Different types of sensors and actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system

UNIT V SYSTEM SERVICING AND TESTING **9**

Special tools for servicing vehicle air conditioning – Diagnosing components and air conditioning systems- Diagnosing cooling system- Air delivery system- Automatic temperature Control system diagnosis and service

TOTAL : 45 PERIODS

OUTCOMES:

- Students will be able to understand the components of the automotive air-conditioning and their functions and the latest developments in this field
- Students will be able to understand the of the automotive air-conditioning and their functions and the latest developments in this field

TEXT BOOKS:

1. Warren Farnell and James D.Halderman, Automotive Heating,Ventilation, and Air Conditioning systems, Classroom Manual, Pearson Prentice Hall,2004
2. Warren Farnell and James D.Halderman, Automotive Heating,Ventilation, and Air Conditioning systems, Shop Manual, Pearson Prentice Hall,2004
3. William H Crouse and Donald L Anglin, Automotive Air conditioning, McGraw Hill Inc., 1990.

REFERENCES:

1. Mitchell Information Services, Inc., Mitchell Automatic Heating and Air Conditioning Systems, Prentice Hall Inc., 1989.
2. Paul Weisler, Automotive Air Conditioing, Reston Publishing Co. Inc., 1990.
3. McDonald,K.L., Automotive Air Conditioning, Theodore Audel series, 1978.
4. Goings,L.F., Automotive Air Conditioning, American Technical services, 1974.

AU8017 VIRTUAL INSTRUMENTATION IN AUTOMOBILE ENGINEERING **L T P C 3 0 0 3**

OBJECTIVES :

- To learn and understand the programming,data acquistion hardware and implementing small automotive related projects in virtual instrumention.

UNIT I INTRODUCTION **9**

Virtual Instrumentation-Definition and flexibility-Block diagram and Architecture of Virtual Instrumentation- Virtual instruments versus Traditional Instruments- Review of software in virtual Instrumentation- VI programming techniques- VI, sub VI, Loops and charts, Arrays, Clusters and Graphs, Case and Sequence Structures, Formula nodes, string and File Input / Output.

UNIT II DATA ACQUISITION IN VI **9**

A/D and D/A Converters, plug-in Analog input / Output cards- Digital Input and Output cards, Organization of the DAQ VI system- Opto Isolation- Performing analog input and analog output- Scanning multiple analog channels- issues involved in selection of data acquisition cards- Data acquisition modules with serial communication- Design of digital voltmeter with transducer input-Timers and Counters.

UNIT III COMMUNICATION NETWORKED MODULES **9**

Introduction to PC buses-Local buses:-ISA,PCI,RS232,RS422 and RS 485- Interface buses:-USB,PCMCIA,VXI,SCXI and PXI – Instrumentation Buses:- Modbus and GPIB- Networked buses-ISO/OSI reference model, Ethernet and TCP/IP Protocols.

UNIT IV REAL TIME CONTROL IN VI **9**

Design of ON/OFF controller and proportional controller for a mathematically described processes using VI software- Modeling and basic control of level and Reactor Processes- Case Studies on development of HMI, SCADA in VI.

UNIT V AUTOMOTIVE APPLICATIONS **9**

PC based digital storage oscilloscope- Sensor technology and signal processing- virtual laboratory- spectrum analyzer- wave form generator- Data visualization and multiple locations:-Distributed monitoring and control-Vision and motion control. Case study related to automotive applications

TOTAL : 45 PERIODS

OUTCOMES:

- Possess knowledge in virtual instrumentation and how it can be applied in data acquisition and instrument control in automobile engineering.
- Experiment and analyze the automobile laboratory prototype measurement systems using a computer, plug-in DAQ interfaces.

TEXT BOOKS:

1. Nadovich, C., "Synthetic Instruments Concepts and Applications". Elsevier,2005
2. Bitter, R., Mohiuddin, T. and Nawricki, M., "Labview Advanced programming Techniques", CRC Press, 2nd Edition, 2007.
3. Gupta, S. and Gupta J. P., "PC Interfacing for Data Acquisition and Process Control", 2nd Edition, Instrument Society of America, 1994.

REFERENCES:

1. Jamal, R. and Picklik, H., "Labview-Applications and Solutions ", National Instrument Release
2. Johnson, G.," Labview Graphical programming " , McGraw-Hill, Newyork,1997.
3. Wells, L.K and Travis, J., " Labview for Everyone", Prentice Hall, New Jersey, 1997
4. Buchanan, W., "Computer Busses ", CRC Press, 2000

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AU8071	FINITE ELEMENT TECHNIQUES	L T P C 3 0 0 3

OBJECTIVES:

- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems.

UNIT I INTRODUCTION 8

Engineering design analysis-meaning and purpose. Basic concepts of FEM. Advantages and limitations of FEM. Test for convergence. Element choice. Commercial finite element packages-organization-advantages and limitations. Raleigh Ritz's, Galerkin and finite difference methods- Governing equation and convergence criteria of finite element method.

UNIT II STATIC ANALYSIS 10

Formulation of element stiffness matrices-1D bar and beam elements. Plane stress, Plane strain and axisymmetric problems, constant and linear strain triangular elements, stiffness matrix, axisymmetric load vector, quadrilateral elements, Isoparametric elements. Treatment of boundary condition. Numerical Integration.

UNIT III DYNAMICS ANALYSIS 8

Equations of motion for dynamic problems. Consistent and lumped mass matrices. Formulation of element mass matrices. Free vibration problem formulation. Torsion problems.

UNIT IV HEAT TRANSFER AND FLUID FLOW ANALYSIS 10

Basic equations of heat transfer and fluid flow problems. Finite element formulation. One dimensional heat transfer and fluid flow problems. Derivation of element matrices for two dimensional problems.

UNIT V AUTOMOTIVE APPLICATION 9

Force distribution on different parts of automotive structure, design of the parts, static, dynamic and thermal analysis of the parts using finite element method. Material redistribution to minimize stresses and deflection. Optimization of location of ribs to maximize rigidity.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to understand different mathematical Techniques used in FEM analysis and use of them in Structural and thermal problem

TEXT BOOKS:

1. Tirupathi.R. Chandrapatha and Ashok D. Belegundu – Introduction to Finite Elements in Engineering – Printice Hall India, Third Edition, 2003.
2. Rao. S.S., Finite Element Methods in Engineering, Butterworth and Heinemann, 2001

REFERENCES:

1. Reddy J.N. – An Introduction to Finite Element Method – McGraw Hill – 2000.
2. Krishnamurthy, C.S., Finite Element Analysis, Tata McGraw Hill, 2000.
3. Bathe, K.J. and Wilson, E.L., Numerical Methods in Finite Elements Analysis, Prentice Hall of India, 1985.
4. Robert D Cook, David S Malkus, Michael E Plesha, 'Concepts and Applications of Finite Element Analysis', 4th edition, John Wiley and Sons, Inc., 2003.
5. Larry J Segerlind, 'Applied Finite Element Analysis', Second Edition, John Wiley and Sons, Inc. 1984.

AU8651 MANUFACTURING OF AUTOMOTIVE COMPONENTS L T P C
3 0 0 3

OBJECTIVE:

To impart knowledge on basic principle and production methods of automotive components.

UNIT I CASTED ENGINE COMPONENTS 9

Material selection and Manufacturing methods for Piston, Piston rings, Cylinder block, wet and dry liners, Engine head, Oil pan, Carburetors. Thermal barrier coating of Engine head and valves.

UNIT II FORGED ENGINE COMPONENTS 8

Material selection and Manufacturing methods for Crank shaft, Connecting rod, Cam shaft, valve, Piston pin, Push rod, Rocker arm, tappets, spark plug.

UNIT III TRANSMISSION SYSTEM 10

Material selection and Manufacturing methods for Clutch – Clutch lining – Gear Box – Gear – Propeller Shaft – Differential – Axle Shaft – Bearing – fasteners – Wheel drum.

Methods of Gear manufacture – Gear hobbing and gear shaping machines - gear generation - gear finishing and shaving – Grinding and lapping of hobs and shaping cutters – gear honing – gear broaching.

UNIT IV VEHICLE CHASSIS 8

Material selection and manufacturing methods for chassis, dead axle, leaf spring, coil spring and shock absorbers – wheel housing – steering system, Brake shoes, wheel rim, Tyres. Heat treatment procedures.

UNIT V RECENT DEVELOPMENTS 10

Surface treatment – Plastics – Plastics in Automobile vehicles – Processing of plastics - Emission control system – catalytic converter – Hydro forming of exhaust manifold and lamp housing – stretch forming of Auto body panels – MMC liners –Selection of materials for Auto components. Use of Robots in Body weldment.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to know the methodology for manufacturing casted engine and forged engine components .

TEXT BOOK:

1. Heldt.P.M, High speed combustion engines, Oxford publishing Co., New York, 1990.

REFERENCES:

1. Kirpal Singh, Automobile Engineering, Vol. I & II, Standard Publishers, New Delhi, 1997.
2. Newton and steels, the motor vehicle, ELBS, 1990
3. Serope Kalpakjian and Steven R. Schmid, Manufacturing Processes for Engineering Materials, Fourth Edition – Pearson Education publications – 2003
4. Gupta K.M. Automobile Engineering Vol.I & II, Umesh Publishers, 2000.

GE8071	FUNDAMENTALS OF NANOSCIENCE	L T P C
		3 0 0 3

OBJECTIVES:

- To learn the fundamentals of nano science
- To learn the methods to make the nano particles
- To learn the characterization of nano particles

UNIT I INTRODUCTION **10**

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II PREPARATION METHODS **10**

Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES **5**

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

UNIT IV PREPARATION ENVIRONMENTS **10**

Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.

UNIT V CHARECTERISATION TECHNIQUES **10**

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

TOTAL : 45 PERIODS

OUTCOMES:

- Get familiarized with the following
- Fundamentals of nano science and nanopreparation methods
- patterning and lithography for nanoscale devices
- Charecterisation Techniques

TEXT BOOKS

1. Edelstein, A.S. and Cammearata, R.C., eds. Nanomaterials: Synthesis, Properties and Applications, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. John Dinardo, N., Nanoscale. Characterization of Surfaces & Interfaces, 2nd Edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES

1. G Timp, G. (Editor). Nanotechnology, AIP Press/Springer, 1999.
2. Akhlesh Lakhtakia (Editor). The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations, Prentice-Hall of India (P) Ltd, New Delhi, 2007.

GE8751	ENGINEERING ETHICS AND HUMAN VALUES	L T P C
		3 0 0 3

OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES **10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time– Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality.

UNIT II ENGINEERING ETHICS **9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION **9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law – The Challenger Case Study

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS **9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl Case Studies

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES **8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Sample Code of Conduct

TOTAL: 45 PERIODS

OUTCOMES;

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

TEXT BOOK

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Thompson Wadsworth, A Division of Thomson Learning Inc., United States, 2000
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001

WEB SOURCES:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

MG8654 TOTAL QUALITY MANAGEMENT L T P C 3 0 0 3

AIM

To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES

- To understand the various principles, practices of TQM to achieve quality.
- To learn the various statistical approaches for Quality control.
- To understand the TQM tools for continuous process improvement.
- To learn the importance of ISO and Quality systems

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality - Basic concepts of TQM – TQM Framework - Contributions of Quality Gurus – Barriers to TQM – Cost of Quality.

UNIT II TQM PRINCIPLES **9**

Quality statements - Customer focus –Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Continuous process improvement – PDCA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I **9**

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II **9**

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures - BPR.

UNIT V QUALITY SYSTEMS **9**

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits –Quality Council – Leadership, Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward.

TOTAL : 45 PERIODS

OUTCOMES

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

1. Dale H.Besterfiled, et al., "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint , 2006.

REFERENCE BOOKS:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition , 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006 .
4. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases",Prentice Hall (India) Pvt. Ltd., 2006.

ML8071 AUTOMOTIVE MATERIALS **L T P C 3 0 0 3**

OBJECTIVES:

- To introduce fundamental concepts on automotive materials and its selection criteria, materials for engine, transmission system, structure and application.

UNIT I ENGINEERING MATERIALS AND THEIR PROPERTIES 9

Classes of engineering materials - the evolution of engineering materials, Definition of materials properties, Displaying material properties using materials selection charts, Forces for change in materials selection and design, Materials and the environment

UNIT II BASIS OF MATERIAL SELECTION 9

Selection strategy, Attribute limits and Material indices, structural index Selection procedure: Design process - types of design, design requirements, Function, Material attributes, Shape and Manufacturing processes - Materials processing and design processes and their influence on design, Process attributes, Systematic process selection, Process selection diagrams, Process cost, Energy consumption for production, Material costs, Availability, Recyclability, Environmental consideration. Computer aided selection.

UNIT III MATERIALS FOR ENGINES AND TRANSMISSION SYSTEMS 9

Materials selection for IC engines: Piston, piston rings, cylinder, Engine block, Connecting rod, Crank shaft, Fly wheels, Gear box, Gears, Splines, Clutches.

UNIT IV MATERIALS FOR AUTOMOTIVE STRUCTURE 9

Materials selection for bearings, leaf springs, chassis & frames, Bumper, shock absorbers, wind screens, panels, brake shoes, Disc, wheels, differentials , damping and antifriction fluids, Tyres and tubes.

UNIT V ELECTRONIC MATERIALS FOR AUTOMOTIVE APPLICATIONS 9

Materials for electronic devices meant for engine control, ABS, Steering, Suspension, Sensors, anti-collision, Anti-fog, Head lamps.

TOTAL : 45 PERIODS

OUTCOMES:

- Student can able to know fundamental concepts about materials and its selection. Study on the materials Material costs, Availability, Recyclability, Environmental consideration Enhance knowledge on materials used for various automotive components, chassis, and its applications.

TEXTBOOKS:

1. Gladius Lewis, "Selection of Engineering Materials", Prentice Hall Inc. New Jersey USA, 1995.
2. Charles J A and Crane. F A. A., "Selection and Use of Engineering Materials", 3rd Edition, Butterworths, London UK, 1996.

REFERENCES:

1. James A. Jacobs, Thomas F. Kilduff., "Engineering Materials Technology: Structure, Processing, Properties & Selection", Prentice Hall, USA, 1996.
2. ASM Handbook, "Selection of Materials Vol. 1 and 2", ASM Metals Park, Ohio. USA, 1991.
3. M F Ashby, "Materials Selection in Mechanical Design", third edition, Butterworth-Heineman, New York, 2005.
4. ASM Handbook. "Materials Selection and Design", Vol. 20- ASM Metals Park Ohio. USA, 1997.
5. Cantor," Automotive Engineering: Lightweight, Functional, and Novel Materials", Taylor & Francis Group, London, 2006

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PR8072	ENERGY MANAGEMENT	L T P C
		3 0 0 3

AIM:

To instruct the importance of energy conservation in both thermal and electrical energy and its management for the better utilization of resources.

OBJECTIVE:

At the end of the course, the student expected to do

i. Understand and analyze the plant energy data
ii. Energy audit and suggest methodologies for energy savings
iii. Energy accounting and balance and
iv. Able to utilize the available resources in optimal way

UNIT I IMPORTANCE OF ENERGY CONSERVATION AND MANAGEMENT 8

World, national Energy consumption – environmental aspects – Energy prices, policies – Energy auditing: methodology, analysis, energy accounting – Measurements – Thermal and Electrical.

UNIT II ELECTRICAL SYSTEMS 12

AC / DC current systems, Demand control, power factor correction, load management, Motor drives : motor efficiency testing, energy efficient motors, motor speed control – Lighting : lighting levels, efficient options, daylighting, timers, Energy efficient windows – electrical distribution systems – Transformers – Power quality – harmonic distortion.

UNIT III THERMAL SYSTEMS 10

Boiler – efficiency testing, excess air control, Steam distribution & use – steam traps, condensate recovery, flash steam utilization, Thermal Insulation. Heat exchanger networking – concept of pinch, target settling, problem table approach.

UNIT IV ENERGY CONSERVATION 8

Energy conservation in Pumps, Fans (flow control) and blowers, Compressed Air Systems, Refrigeration and air conditioning systems – Waste heat recovery recuperators, heat sheets, heat pipes, heat pumps.

UNIT V ENERGY MANAGEMENT, ECONOMICS 7

Energy resource management – Energy Management information systems – Computerized energy management – Energy economics – discount rate, payback period, internal rate of Return, life cycle costing – Financing energy conservation Projects.

TOTAL : 45 PERIODS

OUTCOMES:

- The student will be in a position to plan for energy saving machinery, energy economy equipment

TEXT BOOKS:

1. L.C. Witte, P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilization" Hemisphere Publ, Washington, 1988.
2. O. Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford, 1981.

REFERENCES:

1. I.G.C. Dryden, "The Efficient Use of Energy" Butterworths, London, 1982
2. W.C. turner, "Energy Management Hand book" Wiley, New York, 1982.
3. W.R. Murphy and G. Mc KAY "Energy Management" Butterworths, London 1987.

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Centre For Academic Courses
Anna University, Chennai-600 025.

PR8075	ROBOTIC ENGINEERING	L T P C 3 0 0 3

OBJECTIVES:

- To study the kinematics, drive systems and programming of robots.

UNIT I FUNDAMENTALS OF ROBOT 7

Robot – Definition – Robot Anatomy – Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions – Need for Robots – Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 10

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of All These Drives.

End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic grippers, vacuum grippers, two fingered and three fingered grippers, internal grippers and external grippers, selection and design considerations of a gripper - gripper force calculation and analysis.

UNIT III SENSORS IN ROBOTICS 8

Force sensing, touch and tactile sensors, proximity sensors, non contact sensors, safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism

Machine vision system - camera, frame grabber, sensing and digitizing image data – signal conversion, image storage, lighting techniques, image processing and analysis – data reduction, segmentation, feature extraction, object recognition, other algorithms, applications – Inspection, identification, visual servoing and navigation.

UNIT IV ROBOT KINEMATICS AND PROGRAMMING 12

Forward kinematics, inverse kinematics and the difference: forward kinematics and Reverse Kinematics of Manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) – derivations and problems. Homogeneous transformation matrices, translation and rotation matrices.

Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effector Commands, and simple programes.

UNIT V APPLICATIONS OF ROBOT 8

Role of robots in inspection, assembly, material handling, underwater, space and medical fields.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply the basic engineering knowledge for the design of robotics

TEXT BOOK:

1. Groove M.P., Industrial Robotics – Technology, Programming and applications, McGraw Hill.

REFERENCES:

1. Fu K.S. Gonalz R.C. and ice C.S.G.Robotics Control, Sensing, Vision and Intelligence, McGraw Hill book co., 1987.
2. Yoram Koren, Robotics for Engineers, McGraw Hill Book, Co., 1992
3. Janakiraman P.A., Robotics and Image Processing, Tata McGraw Hill 1995.

PR8551 QUANTITATIVE TECHNIQUES IN MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

To introduce the various quantitative techniques and optimization techniques and to make the students apply these techniques for modeling and solving many engineering situations in general and manufacturing situations in particular.

UNIT I LINEAR PROGRAMMING **10**

Problem formulation - Graphical method – simplex method – Special cases – transportation and assignment method – applications.

UNIT II REPLACEMENT MODELS AND GAME THEORY **8**

Basic replacement model – individual and group replacement problems – applications – game theory – terminology – decision criteria – solution to a 2 x 2 and 2 x n games – applications of LP in game theory – applications.

UNIT III QUEUING MODELS AND SIMULATION **9**

Elements of queue – queue discipline – Poisson arrival and exponential service – queue length – waiting time – steady state conditions – applications – concept of simulation – Monte Carlo method – applications.

UNIT IV FORECASTING AND SEQUENCING **9**

Forecasting – purpose – methods – measures of forecast error; scheduling – priority rules - sequencing – methods of sequencing – Johnson's rule – Heuristic approach

UNIT V PROJECT NETWORK ANALYSIS, LINE BALANCING AND DECISION TREE ANALYSIS **9**

Network – CPM/PERT – Project time estimation – critical path – crashing of network; line balancing – applications; Decision tree analysis – applications

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

(i) Formulate the given problem into a suitable model

(ii) Apply the appropriate optimisation technique

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TEXT BOOK:

1. R. Panneerselvam, Operation Research, Prentice Hall of India, 2002

REFERENCES:

1. P.K.Guptha and Man-Mohan, Problems in Operations Research-Sultan chand & Sons, 1994
2. MONKS J.G. – Operations Management theory and Practice, McGraw Hill, 1992
3. Ravindran, Philips and Sojberg, Operations Research Principles and Practice, John Wiley & Sons, Singapore, 1992
4. J.K. Sharma, Operations Research – Theory and Applications – Macmillan India Ltd., 1997
5. Hamdy A.Taha, Operations Research – An Introduction, Prentice Hall of India, 1997.

PR8651 QUALITY CONTROL AND RELIABILITY L T P C 3 0 0 3

OBJECTIVES:

- To impart the knowledge of the quality control, control charts and application and construction of various quality control charts and the selection.
- To study the significance of design of experiments and its application.
- To train the students in the field of reliability and its estimation.

UNIT I STATISTICAL PROCESS CONTROL 9

Quality control – Definition – Quality Assurance Variation in process – Factors – control charts – variables X_R and $X_{\bar{A}}$, - Attributes P, C and U-Chart Establishing and interpreting control charts process capability – Quality rating – Short run SPC.

UNIT II ACCEPTANCE SAMPLING 9

Lot by lot sampling types – probability of acceptance in single, double, multiple sampling plans – OC curves – Producer's risk and consumer's risk. AQL, LTPD, AOQL, Concepts Design of single sampling plan – standard sampling plans for AQL and LTPD – Use of standard sampling plans – Sequential sampling plan.

UNIT III EXPERIMENTAL DESIGN AND TAGUCHI METHOD 9

Fundamentals – factorial experiments – meantime to failure – maintainability and availability – reliability – system reliability – OC curves – reliability improvement techniques – Reliability testing techniques – Pareto analysis.

UNIT IV RELIABILITY AND ITS PREDICTION 9

Life testing – Failure characteristics – MTBA MTTF – System reliability – OC curve Availability and Maintainability – Reliability Improvement techniques.

UNIT V FAILURE DATA ANALYSIS 9

Real time distribution, exponential, normal, log normal, gamma and weibull – reliability data requirements – Graphical evaluation.

TOTAL : 45 PERIODS

OUTCOMES:

- The students will be able to solve engineering problems in 1D, 2D problems by various methods like classical method and nodal approximation method.

TEXT BOOKS:

1. Amita Mitra "Fundamentals of Quality Control and Improvement" Pearson Education, 2002
2. Modares: Reliability & Risk Analysis Marcel Decker Inc. 1993.

REFERENCES:

1. Bester field D.H., "Quality Control" Prentice Hall, 7th edition 2003
2. Manohar Mahajan, "Statistical Quality Control" Dhanpal Rai & Sons, 2001
3. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publications, 2004.

GE8072 DISASTER MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT I V DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOK:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

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1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

GE8073 **HUMAN RIGHTS** **L T P C**
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OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOME :

- Engineering students will acquire the basic knowledge of human rights.

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1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.