DEPARTMENT OF AUTOMOBILE ENGINEERING

B.Tech - Automobile Curriculum and Syllabus 2015

KALASALINGAM UNIVERSITY
(Kalasalingam Academy of Research and Education)
Anand Nagar, Krishnankoil - 626 126

DEPARTMENT OF AUTOMOBILE ENGINEERING

Program Educational Objectives:

PEO 1: Pursue higher studies or be employed in automobile or allied disciplines.
PEO 2: Be a successful entrepreneur in creating jobs related to automobile or related engineering fields.
PEO 3: Promote ethics, sustainability and environmental responsibility in their practice.

Student outcomes as described by ABET:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Outcomes:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

B. TECH. AUTOMOBILE ENGINEERING

Curriculum Structure

S.No	Category		Credits
I.	Basic Sciences and Mathematics	25	31
	Free Elective (Basic Science Stream)	6	
II.	Humanities and Social Science		19
	Soft Skills	3	
	Humanities Elective	9	
III.	Basic Engineering		14
IV.	**Program Core**		
	a) Core Courses	85	98
	b) Community service Project	3	
	c) Project work	10	
V.	**Elective Courses**		
	a) Major/ Minor Elective (Professional Elective)	18	27
	b) Self-Study Elective	3	
	Total Credits		**183**

Semester I

Code No.	Subject	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
HSS101	English for Technical Communication I	1,3	6,7,8,9,10,11,12	2	0	0	2
MAT101	Mathematics I	1,2	1,2,3,4,5,12	3	0	0	3
PHY101	Physics I	1,2	1,2,3,4,5,6,7,9,10	3	0	0	3
CHY106	Chemistry	1,2	1,2,3,4,5,6,7,9,10,11,12	3	0	0	3
MEC101	Engineering Drawing	1,2.3	1,2,3,4,5,6,7,8,9,10,11,12	1	0	3	2
CIV101	Basic Civil and Mechanical Engineering	1,3	1,2,3,4,5,6,7,8,9,10,11,12	4	0	0	4
MEC181	Work Shop	1,2	1,2,3,4,5,8,9,10	0	0	3	1
CHY181	Chemistry Laboratory	2	1,2,3,4,6,7,8,9,10,12	0	0	3	1
	Total			16	0	9	19

Semester II

Code No.	Subject	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
HSS102	English for Technical Communication II	1,3	8,9,10	2	0	0	2
MAT102	Mathematics II	1,2	1,2,3,4,5	3	0	0	3
PHY103	Physics II	1,2	1,3,4,7	3	0	0	3
EEE101	Basic Electrical and Electronics Engineering	2	1,2,5,7,12	4	0	0	4
CHY101	Environmental Sciences	2,3	1,2,3,6,7,8	2	0	0	2
CSE102	Programming Languages	2,3	1,2,3,5,6,7	2	0	0	2
MEC103	Engineering Mechanics (except BT, IT, CSE)	1,2	1,2,3,4,5,7, 8,9,10,11,1 2	3	0	0	3
PHY181	Physics Laboratory	2	1,4,5,8,9, 10	0	0	3	1
CSE181	Programming Language Laboratory	2,3	1,2,3,4,5,8, 9,10	0	0	3	1
HSS036	Soft Skills – I						1
	Total			19	0	6	22

Semester III

Code No.	Subject	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
MAT209	Mathematics III	1,2	1,2,4,5,12	3	0	0	3
HSSxxx	Humanities Elective I	1,3		3	0	0	3
MEC201	Strength of Mateirals	1,2	1,3,4,5,8,9, 10,12	3	1	0	4
MEC203	Fluid Mechanics and Machinery	2	1,2,3,4,7,10, 12	3	1	0	4
AUT201	Advanced Manufacturing Technology	1,2	1,2,3,4,5,10, 12	3	1	0	4
AUT207	Thermodynamics and thermal engineering	1,2	1,3,4,5,8,10, 11,12	3	0	0	3
MEC281	Strength of Materials / Fluid Mechanics Laboratory	2	1,2,3,4,6,8,9 ,10,11,12	0	0	3	2
MEC282	Manufacturing Technology Laboratory	2	1,3,5,7,8,10, 12	0	0	3	2
AUT283	Industrial Case Study						1
HSS037	Soft Skills – II						1
	Total			18	4	9	27

Semester IV

Code No.	Subject	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
MAT211	Numerical Methods	1,2	1,2,3,4,5,7,1 0,12	3	0	0	3
AUT202	Mechanics of Machines	1,2	1,2,3,4,7	3	1	0	4
AUT204	Automotive fuels and Lubrications	1,2	1,3,4,5,6,7,1 1,12	3	0	0	3
AUT205	Automotive Chassis	1	1,2,3,4,9,12	3	0	0	3
AUT206	Automotive Engines – I	1,2	1,2,12	3	1	0	4
AUT208	Electronics and Instrumentation	1	1,2,3,4,6,7,1 0,11,12	3	0	0	3
AUT282	Automotive fuels and Lubrications laboratory	1,2,3	1,3,4,5,7,12	0	0	3	2
AUT284	Engine testing laboratory	1,2,3	1,2,3,4,5,6,7 ,10,11,12	0	0	3	2

AUT285	Electronics and Instrumentation Laboratory			0	0	3	2
HSS038	Soft Skills – III						1
	Total			18	3	9	27

Semester V

Code No.	Subject	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
AUTxxx	Department Elective – I			3	0	0	3
	Minor Elective – I			3	0	0	3
AUT301	Automotive Electrical Systems	1,2	1,2,3,5,10,12	3	0	0	3
AUT302	Automotive Engines – II	1,2	1,2,3,4,5,6,7,10,12	3	1	0	4
AUT303	Automotive Transmission	1,2	1,2,3,5,6,8,10,12	3	0	0	3
AUT314	Automotive component design	1,2	1,2,3,4,5,6,7,12	3	1	0	4
AUT387	Vehicle Testing Laboratory	1,2,3	1,2,3,4,5,6,10,12	0	0	3	2
AUT388	Automotive component design Laboratory	1,2,3	1,2,5,6,8,10,11,12	0	0	3	2
AUT391	Community Service Project – Phase I	1,2,3	1,2,3,5,10,12			2	1
	Total			18	1	11	25

Semester VI

Code No.	Subject	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
AUTxxx	Department Elective – II			3	0	0	3
	Free Elective – I (Basic Science Course)			3	0	0	3
AUT304	Automotive Material and Metallurgy			3	0	0	3
AUT306	Automotive Aerodynamics			3	1	0	4

AUT307	Automotive Pollution and Control	1,2	1,2,3,4,5,7, 8,9,10,11, 12	3	0	0	3
AUT310	Vehicle Body Engineering	1,2	1,2,3,5,7,9, 12	3	1	0	4
AUT389	Measurements and Metrology Laboratory	1,2,3	1,2,3,4,5,6, 7,8,9,10,11, 12	0	0	3	2
MEC383	Dynamics and Vibration Laboratory	1,2,3	1,2,3,4,5,6, 7,8,10,11, 12	0	0	3	2
AUT386	Comprehension			0	0	3	1
AUT392	Community Service Project – Phase II					3	2
	Total			18	2	12	27

Semester VII

Code No.	**Subject**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
HSSxxx	Humanities Elective II			3	0	0	3
HSSxxx	Humanities – Elective – III			3	0	0	3
	Free Elective – II (Basic Science Course)			3	0	0	3
AUTxxx	Department Elective – III			3	0	0	3
AUTxxx	Department Elective – IV	1,2	1,2,3,4,5,7	3	0	0	3
	Minor Elective – II	1,2	1,2,3,4,7, 9,12	3	0	0	3
AUT401	Vehicle Dynamics	1,2	1,2,3,4,12	3	0	0	3
MEC481	Simulation Laboratory	1,2,3	1,2,3,4,5	0	0	3	2
	Total			21	0	3	23

Semester VIII

Code No.	Subject	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
AUTxxx	Self Study Elective			3	0	0	3
AUT499	Project Work	1,2,3	1,2,3,4,5,6, 7,8,9,10,11, 12	0	0	24	10
	Total			3	0	24	13

Total Credits (from 1st semester to 8th semester = 183)

LIST OF ELECTIVES

MAJOR ELECTIVES

No.	Subject	L	T	P	C
AUT305	Automotive Electronics	3	0	0	3
AUT308	Alternate Fuels and Energy Systems	3	0	0	3
AUT309	Combustion and Heat Transfer	3	0	0	3
AUT312	Microprocessor Application in Automobiles	3	0	0	3
AUT313	Instrumentation and Metrology	3	0	0	3
AUT315	Modern Vehicle Technology	3	0	0	3
AUT316	Off-road Vehicles	3	0	0	3
AUT317	Energy , Ecology, Environment and Society	3	0	0	3
AUT318	Vehicle Maintenance	3	0	0	3
AUT319	Foundry engineering	3	0	0	3
AUT320	Computer Simulation of IC Engines Process	3	0	0	3
AUT322	Two and Three Wheelers	3	0	0	3
MEC321	Optimization Techniques	3	0	0	3
MEC327	Heat and Mass Transfer	3	0	0	3
AUT402	Advanced Theory of IC Engines	3	0	0	3
AUT403	Vehicle Vibration and Noise Control	3	0	0	3
AUT404	Tractor and Farm Equipments	3	0	0	3
AUT405	Production Processes for Automotive Components	3	0	0	3
AUT406	Computer Aided Vehicle Design	3	0	0	3
AUT407	Transport Management	3	0	0	3
AUT408	Automotive Safety	3	0	0	3
AUT409	Theory and Design of Jigs and Fixtures	3	0	0	3

AUT410	Renewable Sources of Energy	3	0	0	3
AUT411	Applied Numerical Techniques and Computing	3	0	0	3
AUT412	Fleet Management	3	0	0	3
AUT413	Hydrogen and fuel cells	3	0	0	3
AUT414	Lean Manufacturing	3	0	0	3
AUT415	Automotive Air-conditioning	3	0	0	3
MEC412	Micro Electro Mechanical Systems	3	0	0	3
MEC418	Rapid Prototyping	3	0	0	3
MEC420	Industrial Engineering	3	0	0	3

MINOR ELECTIVES

No.	Subject	L	T	P	C
CHE325	Computational Fluid Dynamics	3	0	0	3
CHE326	Computational Heat Transfer	3	0	0	3
CIV425	Disaster Management and Thermo Dynamics	3	0	0	3
CSE314	Digital Image Processing	3	0	0	3
EEE306	Special Electrical Machines	3	0	0	3
EEE410	Neural Network And Fuzzy Logic	3	0	0	3
MEC315	Design for Manufacture	3	0	0	3
MEC317	Tribology	3	0	0	3
MEC323	Material Management	3	0	0	3
MEC327	Heat and Mass Transfer	3	0	0	3
MEC410	Mechanical Behavior of Materials	3	0	0	3
MEC421	Non-Destructive Examination	3	0	0	3
MEC424	Industrial Automation and Robotics	3	0	0	3

FREE ELECTIVES

Course id	Course name	Credits
BPY502	Laser Physics	3
BPY503	Nonlinear Optics	3
BPY504	Radiation Physics	3
BPY506	Nuclear Physics	3
BPY507	Space Physics	3
BCY501	Nano chemistry	3
BCY504	Applied Chemistry	3
BMA332	Mathematical Modeling	3
BCY506	Environmental Chemistry	3
BMA331	Combinatorics	3
BCY505	Instrumental Method of Analysis	3

HUMANITIES ELECTIVE

Course Code	Course Name	L	T	P	C
HSS001	Total Quality Management	3	0	0	3
HSS002	Engineering Management	3	0	0	3
HSS003	Indian Economic Development	3	0	0	3
HSS004	Industrial Psychology	3	0	0	3
HSS006	Professional Ethics	3	0	0	3
HSS008	Basics of Economics	3	0	0	3
HSS010	International Trade and Finance	3	0	0	3
HSS011	Information Systems for Managerial Decision Making	3	0	0	3
HSS013	Cost Analysis and Control	3	0	0	3
HSS014	Marketing Management	3	0	0	3
HSS015	Management Concepts and Techniques	3	0	0	3
HSS016	Organizational Psychology	3	0	0	3
HSS017	International Economics	3	0	0	3
HSS018	Communication Skills	3	0	0	3
HSS019	Operations Research	3	0	0	3
HSS020	Human Resource Management	3	0	0	3

HSS022	Banking Theory and Practice	3	0	0	3
HSS023	Entrepreneurship Development	3	0	0	3
HSS024	Industrial Psychology	3	0	0	3
HSS031	English Advance Level	3	0	0	3

ONE CREDIT COURSES

Course Code	Course Name	Credits
MECX001	Non destructive testing	1
MECX002	Advanced welding processes	1
MECX003	CNC programming	1
MECX004	Plastic processing technology	1

ONLINE COURSES

Course Code	Course Name	Credits
MECO001	Material selection and design	3
MECO002	Micro and smart systems	3
MECO003	Finite element analysis of solids and fluids - i	3
MECO004	Mechanical assembly and its role in product	3

THEORY SUBJECT WITH PRACTICAL COMPONENT (*)

1.	AUT203 – Automotive Design
2.	AUT304 – Automotive Material and Metallurgy
3.	MEC327 – Heat and Mass Transfer

LABORATORY COURSES WITH PROJECT (**)

1	MEC282 – Manufacturing Technology Lab
2	MEC481 – Simulation Lab

SEMESTER-I

HSS101	ENGLISH FOR TECHNICAL COMMUNICATION I (Common to all branches)	L	T	P	C
		2	0	0	2
Prerequisite	Basics in English				
Objective(s)	To train the students on improving their listening , speaking , reading and Writing skills				

Course Outcome(s)	
CO1	Listen and comprehend different spoken excepts critically and infer unspoken and Implied meanings.
CO2	Speak convincingly, express their opinions clearly, initiate a discussion, Negotiate, and argue using appropriate communicative strategies.
CO3	Read different genres of texts , infer implied meaning s and critically analyze and evaluate them for ideas as well as for method of presentation
CO4	Write effectively and persuasively and produce different types of writing

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						H				M	L	
CO2						H	L	L		H	M	L
CO3										H	L	L
CO4								L	L	H	M	L

Course Topics

FOCUS ON LANGUAGE

Parts of speech - nominal compounds, noun phrases - relative pronoun - adjective - numerical, comparison and contrast, collocation and word combinations - verb - preposition and relative - conjunction- connectives, expressions of purpose and function, cause and effect - articles - adjectives - sentence pattern - tenses - voice - rewriting the sentences in impersonal/abbreviated passive grammatical structures - concord - sentence level verb noun agreement - gerund - rewriting infinitive into gerund - imperative - rewriting imperative into recommendation using should - word formation - varied grammatical function of the same word - affixes - prefix and suffix, number prefix, negative prefix - reported speech - editing strategies - conditional structures - real, unreal, no possibility, zero condition - writing formal definition - abbreviation and acronym - idioms and phrases - varieties of English - British versus American.

LISTENING SKILLS

Comprehension practice - vocabulary development - familiarity to varied types of spoken English and accents - developing ability to understand audio and video media - aiming at overcoming barriers to listening - listening to documentaries, radio news broadcasts, TV news telecasts - active listening in discussions and to lectures - taking notes while listening - extracting information from listening.

SPEAKING SKILLS

Oral practice - role play - interplay - seminar - transcoding visual into oral - participating in short and longer conversation - voice record, replay, correction of intonation, pronunciation and flow of speech - phonemes - vowels, consonants, stress, rhythm, intonation - group discussion - participative learning - acquiring proficiency, fluency, accuracy in oral communication - speaking practice - developing confidence - extempore speech - learning professional/conversational etiquette.

READING SKILLS

Vocabulary extension - improving vocabulary - intensive reading - reading strategies - identifying topic sentence - guessing meaning from content - picking out specific information - professional reading - reading practice - predicting the content, critical and analytical reading - reading articles in English newspapers, sports magazines, encyclopedias - reading aloud, use of stress and intonation - reading and comprehending technical materials - cloze reading.

WRITING SKILLS

Discourse cohesion - improving writing skills, avoiding common grammatical errors in academic writing - extending the hints - writing shorter sentences - punctuation - dialogue writing - paragraph writing, problems and solutions, achieving coherence, transition words, sequence words - essays of descriptive and argumentative

- writing instructions, use of imperatives - jumbled sentences into sequential paragraph using linguistic clues - report writing - technical reports, industry visit reports, events reports - writing recommendations - letter writing - formal and informal letters - job application and resume, permission for in-plant training, business correspondence letters, calling for quotation, placing order, lodging complaint, persuasive letters - assignment writing - mini-project - transcoding - transferring of information from text to pictorial/graphical representation and vice versa.

Text Book

1. Rizvi M Ashraf, Effective Technical Communication, Tata McGraw-Hill, 2005.

References

1. Daniel Jones, English Pronouncing Dictionary, Universal Book Stall, New Delhi, 17th Edition, 2000.
2. Geoffrey Leech, Fan Svartvik, A Communicative Grammar of English, Pearson Education Asia, 1994.
3. Hornby, AS, Oxford Advanced Learner's Dictionary of Current English, OUP, 7th Edition, 2005.
4. Manivannan G, English for Engineers - A Book on Scientific and Technical Writing, Govi Publications, 2005.
5. Martin Cutts, Plain English Guide - How to Write Clearly and Communicate Better, Oxford University Press, 1999.

MAT101	MATHEMATICS I (Common to all Branches)	L	T	P	C
		3	0	0	3
Prerequisite	Basics in Mathematics.				
Objective(s)	To make the students acquire knowledge in matrix theory a part of linear algebra which has wider applications in engineering problems. To make the student knowledge in the area of infinite series and their convergence so that the students will be familiar with in finite series approximations for a solutions arising in mathematical modeling and to solve first and higher order differential equations and to Laplace transform to solve differential equations using algebraic operations.				

Course Outcome(s)

CO1	Perform elementary matrix and vector operations and use them in applications
CO2	Find derivatives of functions and use derivatives to solve applied problems.
CO3	Use polar coordinates in solving the problems.
CO4	Apply definition, concepts of analytical geometry.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	M	M								
CO2	H	M	M	M	L							L
CO3	H	H		M	L							L
CO4	H	M	M	M								

Course Topics

MATRICES

Review of linear algebra - matrix operations - addition, scalar multiplication, multiplication, transpose, adjoint and their properties- special types of matrices - null, identity, diagonal, triangular, symmetric, skew - symmetric, Hermitian, skew - Hermitian, orthogonal, unitary, norma – rank - consistency of a system of linear equations - solution of the matrix equation Ax = b – row - reduced Echelon form.

EIGEN VALUE PROBLEMS

Eigen value and eigen vector of real matrix – properties of eigen values and eigen vectors – Cayley - Hamilton theorem – Orthogonal transformation of a real symmetric matrix to diagonal form – reduction of quadratic form to canonical form by orthogonal transformation – index, signature and nature of quadratic form.

DIFFERENTIAL CALCULUS

Review of limits - continuity and differentiability - curvature – Cartesian and Parametric Co-ordinates – centre and radius of curvature – circle of curvature - evolutes - involutes - envelopes - partial differentiation – Euler's theorem for homogeneous functions - total differential – Taylor's expansion (two variables) - Maxima / Minima for functions of two variables – Method of Lagrangian multiplier – Jacobians.

THREE DIMENSIONAL ANALYTICAL GEOMETRY

Direction cosines and ratios – angle between two lines – equations of a plane – equations of straight line – coplanar lines – shortest distance between two skew lines – sphere – tangent plane – plane section of a sphere – orthogonal spheres.

ORDINARY DIFFERENTIAL EQUATIONS

Solutions of second and higher order linear ODE with constant coefficients – Cauchy's and Legendre's linear equations - Simultaneous first order linear equations with constant coefficients - Method of variation of parameters.

Text Books

1. Kreyszig, E, Advanced Engineering Mathematics, John Wiley and Sons (Asia) Limited, Singapore, 8th Edn., 2001.
2. Arumugam, S., Thangapandi Isaac, A., Somasundaram, A., Engineering Mathematics Volume I, Scitech Publications (India) Pvt. Ltd., Chennai, 2nd Edn., Reprint 2000, 1999.

References

1. Grewal, B.S., Grewal, J.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 37th Edn. 2003.
2. Venkataraman, M. K., Engineering Mathematics First Year, The National Publishing Company, Chennai, 2nd Edn., 2000.

PHY 101	PHYSICS – I (Common to all Branches)	L	T	P	C
		3	0	0	3
Prerequisite	Basics of Physics				
Objective(s)	To make the student to learn about the basics of types waves and application of waves and to make the student learn about the new adapting techniques.				

Course Outcome(s)

CO1	Learn the basics of the different types of sound waves and production & application of ultrasonic. And the basic concepts, production & applications of different types of laser sources.
CO2	Learn the basic knowledge of crystallography and it's preparation techniques
CO3	Gain the knowledge about the fundamentals, theory of quantum physics
CO4	Gain the knowledge about various mechanical properties & thermal properties of matters

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M			M	M				M	M		
CO2	H	M	H	M	H	M	H		M			
CO3	H		H	H	H		M		M			
CO4	H		M		M	H			M			

Course Topics

ACOUSTICS AND STRUCTURE OF SOLIDS

Classification of sound - reverberation, Sabine's formula, common acoustical defects and remedies - classification of solids- Crystal structures, X-ray diffraction, crystal growth, Crystal defects.

LASER AND FIBRE OPTICS

Interaction of radiation with matter – quantum mechanical view, three and four - level laser system, engineering and medical applications - introduction of fibre optics- classification of fibre, engineering and medical applications

QUANTUM PHYSICS

Inadequacy of classical mechanics – black body radiation, Plancks law, photoelectric effect, Compton effect, Einstein's photoelectric equation, Schrödinger wave equation, Particle in one, three dimensional box.

NDT, NEW ENGG.MATERIALS

Ultrasonics, Ultrasonics flaw detectors, X-ray photography, Fluoroscopy, Thermography, Gamma ray spectroscopy, Characterization technique Nanophase materials, Biomaterials, Non linear materials, polymer materials.

DIGITAL ELECTRONICS

Introduction, Analog to Digital circuits, Conversion of numbers one's complement, 2's complement, logic gates, Boolean algebra, DeMorgan's theorem, Karnaugh's maps.

Text Book

1. Gaur R. K. and Gupta S. L., Engineering Physics, Dhanpat Rai Publishers, New Delhi, 2001.

References

1. Murthy V.S.R.., Jena AK., Gupta K.P. and Murthy G.S., Structures and Properties of Engineering Materials, Tata McGraw Hill Publishing company Limited, New Delhi, 2003.
2. Ali Omar. M, Elementary Solid State Physics, Pearson Education (Singapore), Indian Branch, New Delhi, First Edition, 2006.
3. William F. Smith., Foundations of materials science and Engineering, McGraw-Hill, New York, 3rd Edition, 2003.
4. Mathews. P.M., Venkatesan. K., Text Book of Quantum Mechanics, Tata McGraw Hill Company, Delhi, 2003.
5. Gupta S.L., Kumar.V., Hand book of Electronics, Pragati Prakashan, Meerut, 28th Edition, 2001.

CHY106	CHEMISTRY	L	T	P	C
		3	0	0	3
Prerequisite	Basics in Chemistry				
Objective(s)	To make the students to learn the basic science behind the testing of water and to make the students to gain some basic about the theory behind the corrosion and analyzing using spectroscopy, scale measurements. To make the students to learn about the PVC, polymers and biomolecules.				

Course Outcome(s)

CO1	Learn the techniques of purification of water
CO2	Explain the principles of chemical & electrochemical reactions and prevention of corrosion of materials
CO3	Discuss the principles, instrumentations and applications of analytical techniques
CO4	Explain the principles and generation of energy in batteries, solar cells and fuel cells

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	H	M	M		M		M	M		L
CO2	M	H				L	H		H	H	H	
CO3	M	M	L	L	M	M			M	M		L
CO4	M	H	M			L	M		M	M		L

Course Topics

WATER

Water Quality Parameter (Industry and Drinking Water) – Hardness, Definition, Classifications, Expressions, Units of Hardness of Water with respect to $CaCO_3$, Problems -Estimation of Hardness by EDTA Method (Theory Only) - Definition of Alkalinity (Theory Only) – Boiler feed water - Requirements, Disadvantages of using hard water in boilers, Removal of boiler scales and sludges - Water Softening - Zeolite Process, Demineralization (Ion – Exchange Process), Desalination.

CORROSION SCIENCE AND CONTROL ENGINEERING

Corrosion, definitions – Electrode potential - Principles of Dry and Wet Corrosion, Factors Influencing rate of corrosion, Types of Corrosion - Corrosion Control – Impressed Current Cathodic Protection and Sacrificial Anodic Protection Method - Corrosion Inhibitors – Protective Coatings, Surface conversion coatings, organic coatings (paints).

POLYMERS

Introduction, Classification, Difference Between Thermoplastic and Thermosetting Plastics – Properties of Plastic - Degree of Polymerization – Types of Polymerization (Mechanism) - Phenol Formaldehyde Resin, Epoxy Resin, polyurethanes, Teflon -Amino Resins (Urea Formaldehyde, Nylon.11, Nylon.66 and Nylon 6), PET, PVC – Composites - Definition, characteristics, Constituent. Types- Fibre reinforced plastics (FRP), Metal Matrix Composites (MMC), Ceramic Matrix Composites (CMMC), Properties and Applications.

INSTRUMENTAL METHODS OF ANALYSIS

Electro Magnetic Radiation - Absorption of Radiation , Beer - Lambert's Law – UV-VIS. Spectroscopy – IR Spectroscopy - Principle and Instrumentation (Black Diagram Only) Estimation of Iron by Colorimetry – Flame Photometry, Principle and Instrumentation (Black Diagram Only), Estimation of Na by Flame Photometry - Atomic Absorption Spectroscopy, Principle and Instrumentation (Block Diagram Only), Quantitative Estimation of Nickel by Atomic Absorption Spectroscopy.

METALLURGY AND NANOTECHNOLOGY

Introduction, Characteristic of Metals, Occurrence of Metals, Flux, Slags - Classification of Ores – Metallurgy – Ore Dressing, Purification of Metals, (Physical and Chemical Methods) - Powder Metallurgy - Introduction, Principles of Powder Metallurgy, Characteristic of Powder Metallurgy, Various Steps Involved in Powder Metallurgy, Application of Powder Metallurgy - Nanotechnology – Introduction, Preparation, Characterization and Application.

Text Books

1. Jain, P.C and Monika Jain, Engineering Chemistry, Dhanpat Rai Publishing company (P) Ltd., New Delhi, 14th Edition 2002.
2. Sharma, B.K., Industrial Chemistry, Goel Publishing House, Meerut, 12th edition 2001.

References

1. Puri B.R.and Sharma L.R. Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., Jalandhar, 40th edition 2003.
2. Vogel A.I., A text book of Quantitative Inorganic Analysis, ELBS, London, 3rd edition 2000.
3. Mick Wilson and Kamali Kannangara, Nanotechnology: Basic science and emerging technology, Overseas India Pvt. Ltd. Press, New Delhi, Ist edition 2005.
4. Bandyopadhyay, A.K., Nano Materials, New Age International Publishers, New Delhi, 1st edition 2007.

MEC101	ENGINEERING DRAWING (Common to all Branches)	L	T	P	C
		1	0	3	2
Prerequisite	Basics in Drawing				
Objective(s)	This course aims to introduce the concept of graphic communication, develop the drawing skills for communicating concepts, ideas and designs of engineering products, Demonstrate skills in interpreting, and producing engineering drawings accurately and to give exposure to national standards relating to engineering drawing				

Course Outcome(s)

CO1	Know the purpose, procedures, materials, standards and conventional symbols used
CO2	Create and read an engineering drawing using standard views and convert pictorial (3-D) drawings to orthographic (2-D) drawings and vice versa
CO3	Know the principles projection, distinguish the types of projection and first angle projection of various objects like straight line, planes and solids
CO4	Explain the principle and application of sectioning
CO5	Understand and apply the concepts of development of surfaces

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M		M				M			H		M
CO2		H			M			H		M		H
CO3	M		H	L		H			M		M	
CO4	L	M					L		M			L
CO5	H			M	M				M			L

Course Topics

INTRODUCTION

Importance of graphics – use of drafting instruments – BIS conventions and specifications – size, layout and folding of drawing sheets – lettering dimensioning and scales - orthographic principles – missing view - free hand sketching in first angle projection from pictorial views.

PROJECTION OF POINTS, STRAIGHT LINES AND PLANES

Projection of points, located in all quadrants - projection of straight lines located in the first quadrant, determination of true lengths and true inclinations, projection of polygonal surface and circular lamina located in first quadrant inclined to one or both reference planes.

PROJECTION OF SOLIDS AND SECTION OF SOLIDS

Projection of solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method – types of section – full section and half section -conventional section lines - section of simple solids like prisms, pyramids, cylinder and cone in vertical position by cutting planes inclined to any one of the reference planes, obtaining true shape of section

DEVELOPMENT OF SURFACES

Development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders and cones

ISOMETRIC AND PERSPECTIVE PROJECTION

Principles of isometric projection – isometric view and projections of simple solids, truncated prisms, pyramids, cylinders and cones - Orthographic to isometric view – Introduction to perspective projection.

Text Book

1. Basant Aggarwal and C. Aggarwal, Engineering Drawing, Tata McGraw-Hill publishing company, New Delhi, 2008

References

1. Shah, M.B., and Rana, B.C., Engineering Drawing, Pearson Education, New Delhi, 2005.
2. Nataraajan, K.V., A text book of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 2006.
3. Bhatt, N.D., Engineering Drawing, Charotar publishing House, New Delhi, 46th Edition, 2003.
4. Luzadder and Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt Ltd, New Delhi, XI Edition, 2001.
5. Venugopal, K., Engineering Graphics, New Age International (P) Limited, 2002.

CIV101	BASIC CIVIL AND MECHANICAL ENGINEERING (Common to all Branches)	L	T	P	C
		4	0	0	4
Prerequisite	Basics in civil and mechanical science				
Objective(s)	The aim of undergoing this course is to develop basic understanding the topics in Civil Engineering like surveying, building materials, components of building, different modes and importance of transportation and in Mechanical Engineering like power plants, boilers and various manufacturing technologies etc.				
Course Outcome(s)					
CO1	To describe the scientific terminologies related to mechanical sciences and familiarize with different components, equipments in boilers & turbines				
CO2	To know the purpose, procedures, and the materials used and standards adopted in industries				
CO3	Understand the basic laws pertaining towards the subject, explain the principle, working and application of Engines and Power plants				
CO4	Understand and apply the concepts of manufacturing and the technology related. Mention some of the applications of the manufacturing processes				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	M	M		M			M	M		
CO2	M	H	H	M	M		M			M	L	
CO3	M	M	M	M			L	M		M		M
CO4	M	M	M		M		M					M

Course Topics

CIVIL ENGINEERING

BUILDINGS

Characteristics of good building materials such as stones, bricks, plywood and ceramic tiles, timber, cement, aggregates and concrete - Basic functions of buildings – Major components of buildings – Foundations - Purpose of a foundation – Bearing capacity of soils – types of foundations. Proper methods of construction of Brick masonry – Stone masonry – Hollow Block masonry. Beams – Lintels – Columns – Flooring – Damp proof course – surface finishes – Doors and windows – Roofing.

TRANSPORTATION ENGINEERING

Principles and Classification of surveying, Chain surveying, Compass surveying and leveling - Importance of roads – Classification of Highways –water bound macadam, bituminous and cement concrete roads –. Railways - Importance of railways – Gauges – Components of a permanent way. Bridges - Components of Culverts – Causeways, Slab Bridge, T-beam and slab bridge, Suspension bridge

MECHANICAL ENGINEERING

BOILERS AND TURBINES

Boilers - boiler mountings and accessories – Cochran boiler, Locomotive boiler, Babcock and Wilcox boiler, fire and water tube boilers - Steam turbine - single stage impulse turbine, Parson's reaction turbine, difference between impulse and reaction turbines.

POWER PLANTS AND INTERNAL COMBUSTION (IC) ENGINE

Classification of power plants – steam, nuclear, diesel and hydro power plants - Alternate sources of energy - solar, wind, tidal, geothermal, ocean thermal energy conversion. – IC engine - components, working of four and two stroke petrol and diesel engines.

PRODUCTION TECHNOLOGY

Metal casting and forming process –patterns, moulding, melting of cast iron, casting – forging – rolling – extrusion – drawing - Metal joining process - welding – arc welding, gas welding, brazing and soldering - Metal machining – lathe, drilling machine, milling machine, shaping machine, planing machine, introduction to Computer Numerical Control machining.

Text Book

1. Shanmugam, G,, and Palanichamy, M.S., Basic Civil and Mechanical Engineering, Tata McGraw Hill Publishing Co., New Delhi, 1996.

References

1. Khanna, K., Justo C E G, Highway Engineering, Khanna Publishers, Roorkee, 2001
2. Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Rai and Sons, New Delhi, 1997.
3. Venugopal K., Basic Mechanical Engineering, Anuradha Publications, Kumbakonam, 2000.
4. Shanmugam G., Basic Mechanical Engineering, Tata McGraw Hill Publishing Co., New Delhi, 2001.

MEC181	WORK SHOP (Common to all Branches)	L	T	P	C
		0	0	3	1
Prerequisite	Basics of the workshop process				
Objective(s)	To make the student familiarize with the workshop process and to gain some basic knowledge about the foundry technology.				

Course Outcome(s)	
CO1	To make the joints and to understand their uses in wooden products
CO2	To fabricate metal joining with simple saw process.
CO3	To make hollow channels, containers using sheet metal development.
CO4	To carry out various machining techniques like Drilling, Tapping, etc…

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L		M							M		
CO2	L	L	M	L	M				L	M		
CO3			M	L	M					M		
CO4			M	M	L			L	L	M		

Course Topics

CARPENTRY

Carpentry tools - practice in marking, sawing, planing and chiseling – making simple joints: lap joint, T-joint, dovetail joint, mortise and tenon joint.

FITTING

Fitting tools - practice in marking, filing, punching, hacksawing - fitting to size and drilling - making of simple mating profiles: V, square, dovetail, half round joints.

SHEET METAL

Study of press, die and tools - sheet metal layout - development of lateral surfaces -simple exercises: blanking, forming, bending and flanging.

DRILLING

Drilling and tapping in drilling machines

Demonstration on

1. Welding operations like butt joint and lap joints in Arc welding
2. Foundry operations like mould preparation for split pattern
3. Smithy operations like the production of hexagonal bolt
4. Preparation of plumbing line sketches – basic pipe connections involving the fittings like valves, taps, couplings, unions, reducers, elbows and other components used in household fittings.

CHY 181	CHEMISTRY LABORATORY (Common to all Branches)	L	T	P	C
		0	0	3	1
Prerequisite	Basics in science				
Objective(s)	Know to carry out basic chemical engineering process				

Course Outcome(s)

CO1	Estimate the strength of the solution by chemical and instrumental methods.
CO2	Analyze the water quality parameters of given water samples .
CO3	Apply the chemical engineering concepts in solving engineering problems

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L		M	M					L	M		
CO2	L		M	M		M	M		L	M		
CO3	H	L	M	M		M		M		M		L

Course Topics

1. Preparation of standard and buffer solutions.
2. Estimation of hardness of water sample by EDTA method
3. Determination of dissolved oxygen in a sample of water.
4. Estimation of chloride and fluoride ion in water sample.
5. Determination of alkalinity of water sample.
6. Estimation of hydrochloric acid by pH titration
7. Estimation of ferrous ion by potentiometric titration
8. Estimation of mixture of acid by conductometric titration
9. Estimation of iron by spectrophotometric method.
10. Flame photometry – Determination of Na and K

References

1. Vogel A.I., A text book of Quantitative Inorganic Analysis, ELBS, London, 3rd edition 2000.

HSS102	ENGLISH FOR TECHNICAL COMMUNICATION II (Common to all branches)	L	T	P	C
		2	0	0	2
Prerequisite	Basic knowledge in English for Technical Communication.				
Objective(s)	To improve the students communicate skills				

Course Outcome(s)

CO1	Communicate effectively in both written and oral forms
CO2	Write different forms of business and technical report effectively
CO3	Execute editing and proof reading in manuscript preparation

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									L	H		
CO2								L	L	H		
CO3								L	L	H		

Course Topics

GRAMMAR AND VOCABULARY

Grammar and vocabulary - introduction to grammatical models - proper use of tenses, concord, voice, articles, punctuation, and modal auxiliaries.

RECEPTION SKILLS

Listening and language development - improving listening skills - comprehension practice - comprehend classroom lectures, simple technically oriented passages - listening to news bulletins, pre-recorded talks, different speech styles, comprehending the essential meaning - physical and psychological barriers to listening - steps to overcome the barriers - practice in note-taking while listening.

SPEAKING TECHNIQUES

Speaking practice - improving conversing skills - improving self-expression - developing confidence and fluency in oral communication - physical and psychological barriers to speaking - steps to overcome the barriers - formal and public speaking practice - extemporary talk practice - speech process - fluency and accuracy in speech - developing persuasive speaking skills - conversation in a given milieu, social and cultural surroundings - practice in giving small talks on local topics for a minute or two - goal oriented group discussion - participating in seminars - independent and effective communication.

READING STRATEGIES

Reading comprehension - vocabulary extension methods - speed reading practice - technical and non-technical materials - practice in various reading techniques – skimming - scanning, eye reading - looking for specific information - comprehending the given passages, technical information.

WRITTEN COMMUNICATION

Basic grammatical structures - alphabet of other languages - paragraph writing - expressing the idea in writing - avoiding and correcting common errors - effective writing techniques - brevity, clarity, objectivity and simplicity - discourse writing - definition, description, instruction - note-making - proof reading - mechanics of writing - writing formal, informal letters, technical reports - reference skills - using dictionary better.

Text Books

1. Rizvi M Ashraf, Effective Technical Communication, Tata McGraw-Hill, 2005.
2. Rutherfoord Andrea J, Basic Communication Skills for Technology, Pearson Education, 2002.

References

1. Deborah C Andrews, Margaret D Bickle, Technical Writing - Principles and Forms, Macmillan, 1978.
2. Manivannan G, English for Engineers - A Book on Scientific and Technical Writing, Govi Publications, 2005.
3. Sarah Freeman, Written Communication in English, Orient Longman, 2000.
4. Thomson A J and AV Martinet, A Practical English Grammar, OUP, 4th Edition, 1986.
5. Tom Hutchinson, Alan Waters, English for Specific Purpose, Cambridge University Press, 1987.

MAT102	MATHEMATICS II (Common to all branches)	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in Mathematics				
Objective(s)	Acquire knowledge to use multiple integrals to find area and volume of surface and solids respectively Have a good grasp of analytic functions , complex integration and their interesting properties and its applications				

Course Outcome(s)

CO1	Acquire more knowledge in basic concepts of engineering mathematics
CO2	Improve problem evaluation technique
CO3	Choose an appropriate method to solve a practical problem

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M		M							
CO2	H		H	M	M							
CO3	H	L		M	H							

Course Topics

SEQUENCES AND SERIES

Convergence and divergence of infinite series – series of positive terms – comparison, D'Alembert's ratio, Raabe's and Cauchy's root tests – Convergence of alternating series – Leibnitz's test (proof of theorems and tests not included) – elementary notions of absolute and conditional convergence - Power series – Taylor's theorem(one variable).

ANALYTIC FUNCTION AND CONFORMAL MAPPING

Function of a complex variable – Analytic function – Necessary conditions – Cauchy – Riemann equations – Sufficient conditions (excluding proof) – Properties of analytic function – Harmonic conjugate – Construction of Analytic functions - Conformal mapping - w = z+a, az, 1/z, e^z , sin z, cos z and bilinear transformation – fixed points – cross ratio.

COMPLEX INTEGRATION

Statement and application of Cauchy's integral theorem and integral formula – Taylor and Laurent expansions – Isolated singularities – Residues - Cauchy's residue theorem - Contour integration over unit circle and semicircular contours (excluding poles on boundaries)- evaluation of real integrals using contour integration.

MULTIPLE INTEGRALS

Review of Riemann integrals - Double integration – Cartesian and polar coordinates – change of order of integration – change of variable between Cartesian and polar – area as double integral – Triple integration in Cartesian, cylindrical and spherical polar coordinates – volume as triple integral.

VECTOR CALCULUS

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proof) – Simple applications.

Text Books

1. Kreyszig, E, Advanced Engineering Mathematics, John Wiley and Sons (Asia) Limited, Singapore , 8th Edn., 2001.
2. Arumugam, S., Thangapandi Isaac, A., Somasundaram, A., Engineering Mathematics Volume II, Scitech Publications (India) Pvt. Ltd., Chennai, 1st Edn., Reprint 2000, 1999.

References

1. Grewal, B.S., Grewal, J.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 37th Edn. 5th Reprint 2004, 2003.
2. Venkataraman, M. K., Engineering Mathematics First Year, The National Publishing Company, Chennai, 2nd Edn., Reprint 2001, 2000.
3. Venkataraman, M. K., Engineering Mathematics –III A, The National Publishing Company, Chennai, 11th Edn., Reprint 2002, 1998.

PHY 103	PHYSICS – II (Common to Civil and Mechanical Engineering)	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge about structure of solids and its types				
Objective(s)	To gain knowledge and understand about the solid state materials , conducting , semiconducting , super conducting , di electric , magnetic , optical materials To learn the latest developments on new engineering materials To gain some knowledge about the different material characterization techniques				
Course Outcome(s)					
CO1	Understand the free electron theories, formation of energy bands, energy distribution and also the electron behavior in solids				
CO2	Know and understand the cooper pair electron behavior, applications of superconducting materials in developing technologies				
CO3	Learn the importance of semiconducting materials in engineering fields by projecting the view of energy bands.				
CO4	Gain the knowledge about various kinds of magnetic materials, their properties and applications in advanced technologies.				
CO5	Gain the knowledge about dielectric materials, their properties and significant applications in advanced technologies.				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M	M			L					
CO2	M		M									
CO3	M		M				L					
CO4	M		M	M								
CO5	M		M				L					

Course Topics

THERMAL AND NUCLEAR PHYSICS

Mode of heat transfer, thermal conductivity, thermal diffusivity, thermal insulation in the buildings, application of heat transfer - nuclear forces, nuclear fission, nuclear reactor uncontrolled chain reaction, nuclear fusion .

CONDUCTING MATERIALS

Electron theory of solids – classical free electron theory, quantum free electron theory, band theory of solids

SEMI CONDUCTING AND SUPER CONDUCTING MATERIALS

Semi-conducting materials - introduction, types of semi-conducting materials, carrier concentration – hall effect – determination of hall coefficient - superconducting phenomena - properties of superconductors, Type I and Type II superconductors, High Tc

Superconductors, application of super conductors.

MAGNETIC MATERIALS

Classical theory of magnetism quantum theory of paramagnetism, Ferromagnetism, Ferrites, Applications of magnetic materials.

DIELECTRIC MATERIALS AND OPTICAL MATERIALS

Polarization - electronic, ionic, orientational and space charge polarization, internal field and deduction of Clausius - Mosotti relation - dielectric materials – properties, classification, insulating materials - optical properties of semiconductor-imperfection of crystals, luminescence, fluorescence and phosphorescence, light emitting diode, liquid crystal displays

Text Book

1. Arumugam M, Materials Science 3rd Edition, Anuradha Agencies, Kumbakonam, 2003.

References

1. Aswani K.G., A Text book of Material Science, S.Chand and Co., Ltd., New Delhi, 2nd Edition 2001.
2. William F.Smith, Foundations of Materials Science and Engineering, McGraw-Hill, New York, 3rd Edition, 2003.
3. Wahab M.A., Solid State Physics, Narosa Publishing House, New Delhi, Second edition, 1999.
4. Avadhanulu M.N., Kshirsagar P.G., A Text Book of Engineering Physics, S.Chand and Co. Ltd., New Delhi, 6th edition, 2003.
5. Pillai S.O., Solid State Physics, 5th edition, New Age International Publication, New Delhi, 2003.

6. Ali Omar.M., Elementary Solid State Physics, Pearson Education (Singapore) Pvt. Ltd., Indian Branch, New Delhi, 2002.
7. Murthy V.S.R., Jena A.K., Gupta K.P. and Murthy G.S., Structure and Properties of Engineering Materials, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2005.
8. Kenneth G., Budinski, Michel K. Budinski, Engineering Materials Properties and Selection, Pearson, Singapore (Prentice Hall), 7th Edition, 2002.
9. Vasudeva A.S., Modern Engineering Physics, S.Chand and Co. Ltd., New Delhi, 2nd Edition, 2003.

EEE101	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		4	0	0	4
Prerequisite	Basics in electrical, electronics and physics.				
Objective(s)	To familiarize the students on basics of electronics and electrical engineering like working and characteristics of electron devices , electrical machines				

Course Outcome(s)

CO1	Do the basic estimation of electrical quantities
CO2	Interpret the basic electrical and electronics circuits
CO3	Understand the DC and AC single phase and three phase fundamentals
CO4	Understand the working principle of various Electrical AC and DC machines
CO5	Get the knowledge about various Analog type measuring instruments and house Wiring.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L										
CO2	H				H							H
CO3	H											H
CO4	H						M					H
CO5		L					M				H	

Course Topics

ELECTRICAL CIRCUITS
Introduction to electric symbols and circuits - Ohm's Law – Kirchoff's Laws - analysis of DC circuits - introduction to AC circuits - Average Value, RMS value, power and power factor, single phase balanced and unbalanced circuits.

ELECTRICAL MACHINES
Principle of operation and characteristics of DC machines – single phase transformer - principle and operation of three phase and single phase induction motors.

ELECTRICAL MEASUREMENTS
Moving coil and moving iron instruments (Ammeter and Voltmeter) – dynamometer type wattmeter and energy meter.

BASIC ELECTRONICS
Conduction in semiconductor devices -working principle and characteristics of PN Junction diode, Zener diode, UJT, FET - half wave and full wave rectifiers.

DIGITAL ELECTRONICS
Binary number system-AND, OR, NOT, NAND, NOR Circuits - Boolean Algebra-Exclusive OR gate - half and full adders

INTEGRATED CIRCUITS
Introduction to op-amp (Operational amplifier) - inverting and non-inverting op amp – applications - scalar, adder, subtract or, differentiator, and integrator.

Text Books

1. B.L. Theraja, Electrical Technology Vol I and II, S. Chand and Co., 2005.
2. Edward Hughes, Electrical and Electronics Technology, Pearson Education Limited, Ninth edition, 2005.
3. D.P.Kothari and I.J.Nagrath,"Basic Electrical Engineering",Tata Mc Graw Hill Second Edition.
4. K.A. Muraleedharan, R. Muthusubramanian and S. Salivahanan, Basic Electrical and Electronics and Computer Engineering, Tata McGraw Hill, 1997.

References

1. B.R. Guptha, Principles of Electrical Engineering, S. Chand and Co., 2002.
2. Robert L. Boylestad and Louis Nashelsky Electronics devices and Circuit Theory, Pearson Education, 8th Edition, 2002.
3. Malvino A P, "Electronic Principles", McGraw Hill International, 1998.
4. S.Salivahanan, N.Sureshkumar and A.Vallavaraj, Electronic Devices and Circuits, TMH, 1998

CHY101	ENVIRONMENTAL SCIENCES (Common to all branches)	L	T	P	C
		2	0	0	2
Prerequisite	Engineering Chemistry				
Objective(s)	Imparting knowledge on principles of environmental science and engineering Understanding the concepts of eco systems, bio diversity and impact of environmental pollution. Awareness on value education, population and social issues.				

Course Outcome(s)

CO1	Know the importance of environmental studies and methods of conservation of natural resources.
CO2	Describe the structure and function of an ecosystem.
CO3	Identity the values and conservation of bio-diversity
CO4	Explain the causes, effects and control measures of various types of pollutions.
CO5	Select the appropriate methods for waste management

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M	H					
CO2						L	H	M				
CO3	L					H	H					
CO4		M				H		L				
CO5			M			H	H					

Course Topics

NATURAL RESOURCES

Definitions – scope of environmental sciences - forest resource – food resource – land resource – water – mineral resources - utilization of natural resource, impact on environment – conservation of natural resources.

ECOSYSTEM AND BIODIVERSITY

Concept – structure and function – energy flow in ecosystem – ecological succession – food chain – food web, ecological pyramids – biodiversity, definition, values, threats to biodiversity, conservation of biodiversity.

ENVIRONMENTAL POLLUTION

Definition, causes, effects and control measures of air, water and soil pollution – thermal and nuclear pollution.

MANAGEMENT OF ENVIRONMENTAL POLLUTION

Solid waste management – treatment methods adopted for municipal sewage and industrial effluent – hazardous and biomedical waste management.

TOOLS FOR ENVIRONMENTAL MANAGEMENT

Environment impact assessment – precautionary and polluter pay principle - constitutional provision – (air, water and forest) - waste minimization techniques, cleaner technology options, bioremediation.

Text Book

1. Dhameja, S.K., Environmental engineering and Management, S. K. Kataria and sons, New Delhi, 1st edition 2004.

References

1. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad, 1st edition 2001.
2. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. USA, 2nd edition 2004.
3. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media., New Delhi, 2nd edition 2004.
4. Masters, G. M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi, 2nd edition 1997.
5. Henry, J. G. and Heike, G. W. Environmental Science and Engineering, Prentice Hall International Inc., New Jersey, 1st edition 2005.

CSE102	PROGRAMMING LANGUAGES	L	T	P	C
		2	0	0	2

Prerequisite	Basics in Mathematics , Computing
Objective(s)	To develop the basic programming skills To understand the basics concepts of arrays and pointers To implement the file concepts and operations

Course Outcome(s)

CO1	Demonstrate the knowledge of the steps in the development of computer program.
CO2	Formulate the structure of C program.
CO3	Apply the control structures, arrays strings , functions and pointers in C programming
CO4	Demonstrate proficiency in computer programming.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L	L									
CO2	H	H	M									
CO3	H				M							
CO4			M		M	M	M					

Course Topics

BASIC ELEMENTS OF C AND CONTROL STATEMENTS

Introduction to C - structure of C language – lexical elements of C - operators and expressions - operator precedence and associativity of operators -input and output functions-library functions – header files - simple computational problems - decision making: if statement – if-else statement - else-if ladder - switch statement – looping control structure - the break statement - operator - continue statement – go to statement – problems using control structures.

FUNCTIONS, PROGRAM STRUCTURES AND ARRAYS

Prototypes and functions – declaring, defining and accessing functions- parameter passing methods-recursion - storage classes -automatic variables - external variables – static and register variables – programs using functions - defining and processing an array - passing arrays to functions - multidimensional arrays - arrays and strings - enumerated data types-programs using sorting, searching and merging of arrays.

POINTERS, STRUCTURES AND UNIONS

Pointer fundaments - pointer declarations - passing pointers to functions - arrays and pointers - pointers and one-dimensional arrays - pointers and multidimensional arrays - operations on pointers - pointers and structures - dynamic memory allocation – command line arguments – programs using pointers with functions, arrays and structures - defining a structure - processing a structure – user - defined data types – union – nested structure - structures and pointers - passing structures to functions - self referential structures.

DATA FILES AND DATA STRUCTURES

Opening and closing a data file - creating a data file - high level file operations - processing and updation of data files - unformatted data files - low level programming – file handling programs - linked list – creation, insertion and deletion of elements - stack and queue implementation using linked list.

UNIX BASICS AND SHELL PROGRAMMING

Shell fundamentals - shell commands - shell decisions and repetitions - command line usage - wildcard expansion - redirection of I/O, pipes and filters - shell programming - simple scripts - specifying the interpreter - shell variables - the environment - control flow; test, if, for, while, case - command substitution - signal catching - shell functions - aliases - reading from the standard I/P - startup files - basename and dirname - expression evaluation.

Text Books

1. Byron S. Gottfried, Theory and Problems of Programming with C, Tata McGraw Hill, Second Edition, 1996.
2. Lowell Jay Arthur and Ted Burns, UNIX Shell Programming, John Wiley and Sons Canada, Ltd, Fourth Edition, 1997.

3. P. S. Deshpande , O.G. Kakde, C and Data Structures , Dreamtech Press, First edition, 2004

References

1. Brian W. Kerninghan and Dennis M.Richie, The C Programming language", Pearson Education, 2005.
2. Johnsonbaugh R.and Kalin M, Applications Programming in ANSI C, Pearson Education, Third Edition, 2003.
3. Behrouz A.Forouzan and Richard F.Gilberg, A Structured Programming Approach Using C, Brooks-Cole Thompson Learning Publications, Second Edition, 2001.
4. Bruce Molay, Understanding UNIX/LINUX Programming: A Guide to Theory and Practice, Prentice Hall, First Edition, 2002.
5. Glass, G., Ables, K.UNIX for Programmers and Users, Prentice Hall, 1999.
6. Stephen Kochan and Patrick Wood, UNIX Shell Programming, Pearson Education, Third Edition, 2003.

MEC103	ENGINEERING MECHANICS	L	T	P	C
		3	0	0	3

Prerequisite	Basics in science and analytical skills.
Objective(s)	To give an introduction on engineering mechanics concepts commonly used in analysis and design of engineered structure

Course Outcome(s)

CO1	Understand and Apply the fundamental Engineering Mechanics principles and their knowledge of mathematical principles.
CO2	Analyze the engineering problems physically and mathematically.
CO3	Applying the acquired knowledge in situation to solve the engineering problem.
CO4	Understanding of safety and reliability concepts in the designing of a solution for a situation
CO5	Ability to justify a design project in a formal report and present design calculations in a neat and organized manner.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	M	M			M				
CO2	H	H	H	M	M							
CO3	H		H	H	H			M				
CO4	H		M				M	M		M		M
CO5									M	M	M	M

Course Topics

STATICS OF PARTICLES

Six Fundamental principles and concepts - vector algebra- basics, external and internal forces, concurrent and non-concurrent coplanar forces - resultant and resolution static equilibrium of particles in 2-D and 3-D,

STATIC OF RIGID BODIES

Moment about point and about axis - Varignon's theorem - Static equilibrium of rigid body in 2-D and 3-D, free body diagram, supports and reactions - Problem formulation concept in 2-D and 3-D.

FRICTION

Frictional forces- Types- laws of dry friction- simple contact friction - Sliding block, wedges, ladder friction - rolling resistance - belt friction - Axle friction, disk friction –Examples.

PROPERTIES OF SURFACES AND SOLIDS

Centroids of lines - areas, volumes, composite bodies, Centre of gravity- center of mass - Area moment of Inertia - principal moment of inertia

DYNAMICS OF PARTICLES

Introduction – Kinematics of particles – Displacements, velocity and acceleration, their relationship - Equations of motions– Rectilinear motions - relative motion – Curvilinear motion –Kinetics of particles - Newton's second law – Equations of motion – rectangular components – Work Energy equation of particles.

Text Book

1. Beer, F.P., and Johnson, E.R., Vector Mechanics for Engineers – Statics and Dynamics, Tata McGraw Hill, 2007.

References

1. Merriam, J.L., Engineering Mechanics, Volume I – Statics, and Volume – II, Dynamics 2/e, Wiley International, 1998.
2. Irving , H., Shames, Engineering Mechanics, Statics and Dynamics, Prentice Hall of India Pvt. Ltd., 2004.

PHY 181	PHYSICS LABORATORY (Common to all Branches)	L	T	P	C
		0	0	3	1
Prerequisite	Basics of Physics				
Objective(s)	To develop an ability to identify , formulate and solve engineering problems using basic physics				

Course Outcome(s)	
CO1	Develop the observation and analytical skills
CO2	Explain the various properties of matter
CO3	Analyze the different optical properties.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				M	L			H	H	H		
CO2	H			L				H	H	H		
CO3	H			L	L			H	H	H		

Course Topics

1. To determine the acceleration due to gravity using Compound Pendulum
2. To determine the Rigidity Modulus of wire using Torsional Pendulum
3. To find thickness of the given two glass plates using single optic lever.
4. To determine the thermal conductivity of a bad conductor
5. To determine the refractive index of the material of the prism.
6. To find the number of rulings per cm length of the given transmission grating.
7. To determine the particle Size Using Laser
8. Verification of Logic operations OR ,AND, NOT,NOR, NAND Using Logic Gates
9. To determine the coefficient of viscosity of the liquid by Poiseuille's method
10. To determine the young's modulus of given material using Uniform Bending
11. To Determine the thickness of a given material using Air wedge method
12. To determine the focal length of a biconvex lens using Newton's Rings method
13. To determine the specific heat capacity of solid using method of mixers
14. Emissivity of the surface of the spherical calorimeter
15. To determine the velocity of ultrasonic waves in the liquid using ultrasonic Interferometer.
16. To calibrate the given ammeter using potentiometer
17. To verify the Laws of stretched string using sonometer
18. To determine the band gap energy of a semiconductor using Post office Box Method
19. To study the characteristics of common emitter Transistor
20. To study the characteristics of FET

CSE181	PROGRAMMING LANGUAGES LABORATORY	L	T	P	C
		0	0	3	1

Prerequisite	Basics in computing program.
Objective(s)	Objective of this course is to get an introduction and survey of artificial intelligence methods for robots. It covers both theory and practice of an unmanned systems , focusing on biological and cognitive principles that are often quite different from control theory formulations

Course Outcome(s)

CO1	Work in various application packages
CO2	Write a C program effectively using arrays and pointers
CO3	Perform basic unix commands and shell programming.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H								L	H		
CO2		M	H	M				H	L			
CO3					L				L			

Course Topics

1. APPLICATION PACKAGES

a. Word Processing
b. Spreadsheet
c. Powerpoint
d. Database Management

2. C PROGRAMMING

a. Basics
b. Operators and Expressions
c. I/O formatting
d. Control Statements

3. ARRAYS AND FUNCTIONS

a. Arrays
b. String Manipulation
c. Functions

4. POINTERS, STRUCTURES AND FILES

a. Pointers
b. Structures and Unions
c. File Handling

5. UNIX PROGRAMMING

a. Basic Unix Commands
b. Basic Shell Programming

MAT209	MATHEMATICS III (Common to Bio-Technology, Chemical Engg., Civil Engg., CSE, EEE, ICE and Mechanical Engg.)	L	T	P	C
		3	1	0	4

Prerequisite	Mathematics I(MAT101), Mathematics II(MAT102)
Objective(s)	To demonstrate how differential equations can be useful in solving many types of problems - in particular, to show how to translate problems into the language of differential equations, to find or numerically approximate the solution of the resulting differential equation subject to given conditions, and to interpret the solutions obtained. To study Fourier series and solve boundary values problems. . To understand Fourier Transform, the convergence issues, relation to Fourier Series To understand the properties of Fourier Transform, use these to derive Fourier Transforms for related signals To know the various definitions of the Fourier Transforms, sufficient conditions for its existence how to compute inverse Fourier Transform. To know the various rules (convolution Theorem etc) for the Fourier and z- transform and how to use them.

Course Outcome(s)

CO1	Evaluate integrals and solve boundary value problems using Laplace transform
CO2	Solve standard type of first order partial differential equations and higher order partial differential equations with constant coefficients
CO3	Apply the concept of Fourier series to find the sum of certain series.
CO4	Solve difference equations using Z-transform
CO5	Find Fourier, Sine and Cosine transforms of given functions

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L		M	M							
CO2	L				L							H
CO3	M	M			M							
CO4	L	M			L							
CO5	H	L		M	L							L

Course Topics

LAPLACE TRANSFORM

Definition of Laplace Transform - Linearity property - condition for existence of Laplace Transform - First and Second Shifting properties - Laplace Transform of derivatives and integrals - Unit step functions - Dirac delta-function - Differentiation and Integration of transforms - Convolution Theorem - Inversion - Periodic functions - Evaluation of integrals by Laplace Transform - Solution of boundary value problems.

PARTIAL DIFFERENTIAL EQUATIONS

Formation of PDE – Solution of std types of first order PDE – Lagrange's linear equation – Linear PDE of second and higher order with constant coefficients.

FOURIER SERIES

Dirichlet's conditions – General Fourier series – odd and even functions – Half range sine and cosine series – complex form of Fourier series – Parseval's identity – Harmonic analysis

Z – TRANSFORM

Z-transform – elementary properties – Inverse Z-transform – convolution theorem – formation of difference equation – solution of difference equation using Z-transform.

FOURIER TRANSFORM

Fourier Integral formula - Fourier Transform - Fourier sine and cosine transforms - Linearity, Scaling, frequency

shifting and time shifting properties - Self reciprocity of Fourier Transform - Convolution theorem -Application to boundary value problems.

Text Books

1. Kreyszig, E, Advanced Engineering Mathematics, John Wiley and Sons (Asia) Limited, Singapore , 8th Edn., 2001.
2. Arumugam, S., Thangapandi Isaac, A., Somasundaram, A., Engineering Mathematics Volume II, Scitech Publications (India) Pvt. Ltd., Chennai, 1st Edn., Reprint 2000.

References

1. Grewal, B.S., Grewal, J.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 37th Edn. 2004.
2. Venkataraman, M. K., Engineering Mathematics –III A, The National Publishing Company, Chennai, 11th Edn. 2002.
3. Venkataraman, M. K., Engineering Mathematics - III B, The National Publishing Company, Chennai, 13th Edn. 1999.

MEC201	STRENGTH OF MATERIALS	L	T	P	C
		3	1	0	4
Prerequisite	Students must know the basic knowledge in Engineering Mechanics and Basic Mathematics				
Objective(s)	To establish an understanding of the fundamental concepts of mechanics of deformable solids; including static equilibrium, geometry of deformation, and material constitutive behavior. To provide students with exposure to the systematic methods for solving engineering problems in solid mechanics. To discuss the basic mechanical principles underlying modern approaches for design of various types of structural members subjected to axial load, torsion, bending, transverse shear, and combined loading. To build the necessary theoretical background for further structural analysis and design courses.				

Course Outcome(s)

CO1	Understand Stress Vs Strain graph and can be able to determine yield strength, ultimate strength and elastic constants
CO2	Determine safe working stresses, thermal stress for compound and composite components
CO3	Understand the concepts and principles applied to members under various loadings and the effect of these loadings
CO4	Determine normal and shear stress on any plane
CO5	Analyze thin and spherical pressure vessels under various loadings
CO6	Understand shear force and bending moment diagrams for different types of beams
CO7	Set up and conduct experiments, and to present the results in a professional manner Interpret theoretical results and its effects
CO8	Design circular members under torsion and apply stress concentration factors according to real world engineering problems

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				M					L	L		L
CO2				L				L		M		M
CO3	H							L				M
CO4			M					M		L		M
CO5			L					M		L		M
CO6					L			L		M		M
CO7			L					M		L		M
CO8			M					H		L		M

Course Topics

STRESS, STRAIN AND DEFORMATION IN SOLIDS

Tension, compression and shear stresses – Hook's law – stress- ultimate stress and working stress – elastic constants and relationships between them – composite bars – temperature stresses – strain energy due to axial load – stress due to suddenly applied load and impact load.

TWO DIMENSIONAL STATE OF STRESS

Two dimensional state of stress at a point – normal and shear stresses on any plane , principal planes and principal stresses – graphical method – two dimensional state of strains at a point, principal strains and their directions – stresses and deformations in thin cylinders and spherical shells due to internal pressure.

BEAMS

Types of beams and supports – shear force and bending moment at any cross section, sketching of shear force and bending moment diagrams for cantilever, simply supported and over hanging beams for any type of loading –

relationship between rates of loading - shear force and bending moment.

STRESSES IN BEAMS

Theory of simple bending – analysis for bending stresses – load carrying capacity of beams – proportioning sections – flitched beams – strain energy due to bending moment – shear stress distribution – strain energy due to transverse shear force.

STRESSES DUE TO TORSION

Elastic theory of torsion – stresses and deformation in solid circular and hollow shafts – stepped shafts – composite shaft – stress due to combined bending and torsion– strain energy due to torsion-deformations and stresses in helical springs – design of buffer springs -leaf springs

Text Book

1. Popov, E.P., Engineering Mechanics of solids, Prentice Hall of India, New Delhi, 1996.

References

1. Punmia, B. C., Strength of Materials, Laxmi Publications, 1992.
2. Kazimi, S. M. A., Solid Mechanics, Tata McGraw Hill Book Co Ltd., 1998.
3. Rajput, Strength of Materials, S. Chand Publications, 1999.
4. Bansal, R. K., Strength of Materials, Laxmi Publications, 2003.
5. Gere, Mechanics of Materials, Thomson Publications, 2006.
6. Junarkar, Mechanics of Structure, Vol.-I, Charator Publications, 2005.

MEC203	**FLUID MECHANICS AND MACHINERY**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**
Prerequisite	Basic knowledge in mechanics				
Objective(s)	To understand the various properties of the fluid. To analyze and appreciate the complexities involved in solving the fluid flow problems. To study the mathematical techniques already in vogue and apply them to the solutions of practical flow problems. To understand the energy exchange process in fluid mechanics handling incompressible fluids. To understand the concepts and working principle of hydraulic pumps and turbines				
Course Outcome(s)					
CO1	Be able to calculate density and viscosity for fluids				
CO2	Locate/calculate the focus inside the fluid at various heights				
CO3	Provide the students with some knowledge about fluid flow phenomenon and flow regimes (laminar/turbulent/compressibility)				
CO4	To apply the knowledge of Bernoulli's equation in various flow measuring devices				
CO5	Ability to solve internal flow in pipe and channels through simple solutions using Navier Stokes and Darcy weishbash equation				
CO6	Apply principle of fluid mechanics to design turbines and pumps				
CO7	Analyze the need of fluid machinery and able to suggest the type (pump/turbine) according to need				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M				M							M
CO2	L			L						M		
CO3	H			L	H							M
CO4	H				H			L			M	L
CO5	M			H	L			M			L	M
CO6	H				H			L			M	L

CO7	H		M	M	L							L

Course Topics

BASIC CONCEPTS AND PROPERTIES

Fluid – definition, distinction between solid and fluid - units and dimensions, properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension - fluid statics - concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges.

FLUID KINEMATICS AND FLUID DYNAMICS

Fluid kinematics - flow visualization, lines of flow, types of flow, velocity field and acceleration, continuity equation (one and three dimensional differential forms) - equation of streamline, stream function, velocity potential function, circulation, flow net, fluid dynamics - equations of motion, Euler's equation along a streamline, Bernoulli's equation, applications - Venturi meter, Orifice meter, Pitot tube - dimensional analysis - Buckingham's π theorem- applications - similarity laws and models.

INCOMPRESSIBLE FLUID FLOW

Viscous flow - Navier-Stoke's equation (Statement only) - shear stress, pressure gradient relationship - laminar flow between parallel plates, Laminar flow through circular tubes (Hagen Poiseulle's) - Hydraulic and energy gradient - flow through pipes - Darcy -Weisback's equation - pipe roughness -friction factor- Mody's diagram- minor losses - flow through pipes in series and in parallel - power transmission - boundary layer flows, boundary layer thickness, boundary layer separation - drag and lift coefficients.

HYDRAULIC TURBINES

Fluid machines-definition and classification - exchange of energy - Euler's equation for turbo machines - construction of velocity vector diagrams - head and specific work - components of energy transfer - degree of reaction.

Hydro turbines- definition and classifications - Pelton wheel, Francis turbine, propeller turbine , Kaplan turbine - working principles - velocity triangles, work done, specific speed, efficiencies, performance curve for turbines.

HYDRAULIC PUMPS

Pumps- definition and classifications - Centrifugal pump - classifications, working principle, velocity triangles, specific speed, efficiency and performance curves - reciprocating pump- classification, working principle, indicator diagram, work saved by air vessels and performance curves - cavitations in pumps - rotary pumps - working principles of gear and vane pumps, performance of positive displacement pump.

Text Book

1. Streeter, V.L., and Wylie, E.B., Fluid Mechanics, McGraw-Hill, 1983.

References

1. Kumar, K.L., Engineering Fluid Mechanics, Eurasia Publishing House (P) Ltd, New Delhi, 7th edition, 2000.
2. Vasandani, V.P., Hydraulic Machines - Theory and Design, Khanna Publishers, 1992.
3. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi publications (P) Ltd, New Delhi, 5th edition,1995.
4. White, F.M., Fluid Mechanics, Tata McGraw-Hill, c, 5th Edition, 2003.
5. Ramamirtham, S., Fluid Mechanics and Hydraulics and Fluid Machines, Dhanpat Rai and Sons, Delhi, 1998.
6. Som, S.K., and Biswas, G., Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw-Hill, New Delhi, 2nd Edition, 2004.

AUT 201	AUTOMOBILE MANUFACTURING TECHNOLOGY	L	T	P	C
		3	1	0	4
Prerequisite	Basic manufacturing process				
Objective(s)	To learn about various casting, forming and heat treatment process for automotive application.				

Course Outcome(s)

CO1	Ability to theorize various type of casting process with suitable sketch
CO2	Capable to choose suitable heat treatment techniques for different applications.
CO3	Familiarize on different types of welding, brazing and soldering process.
CO4	Acquire the knowledge on bulk deformation process.
CO5	Able to describe the techniques of sheet metal forming process.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L			M								
CO2	M	M										
CO3					M						M	
CO4			M								M	
CO5									L			

Course Topics

CASTING FUNDAMENTALS OF SAND CASTING

Mold Casting Processes - mold types - sand casting types - pattern designs/mold designs - gating systems - cores - solidification of metals - cast structures - fluidity of molten metals - heat transfer - shrinkage - casting defects - foundry methods - cast alloys - Investment Casting Processes - ceramic mold casting - plaster mold casting - shell mold casting - centrifugal casting - squeeze casting - turbine blade casting methods

CASTING HEAT TREATMENT

Ferrous alloys - Non-ferrous alloys - heat treatment processes - cleaning/finishing methods – inspection/testing methods - allowance and tolerance - no destruction inspection

FABRICATION PROCESS

Classification of welding process - principle of gas welding - arc welding - resistance welding - solid state welding - thermo-chemical welding - radiant energy welding - brazing and soldering - thermal cutting of metals or alloys.

BULK DEFORMATION PROCESSES

Forging - classification of forging processes, forging defects and inspection - rolling - classification of rolling processes, rolling mill, rolling of bars and shapes - extrusion - classification of extrusion processes, extrusion equipments.

SHEET METAL FORMING PROCESS

High velocity forming - explosive forming, electro hydraulic forming - magnetic pulse forming - pneumatic - mechanical high velocity forming.

Text Book

1. Jain, R.K., Production Technology, Khanna Publishers, 2002.

References

1. Hajra Choudhry, Elements of Workshop Technology-Vol I, Dhanpat Rai and Sons, 1992.
2. HMT Production Technology, Tata Mc Graw-Hills Publishing Co. Ltd, 1994.
3. Chapman, W.A.J., Workshop Technology-Vol - II, Oxford and IBH Publishing.

AUT207	THERMODYNAMICS AND THERMAL ENGINEERING	L	T	P	C
		3	0	0	4

Pre requisite	Understanding of thermodynamic laws and cycles
Objective(s)	To learn about thermodynamic air stranded, steam power cycles. To impart knowledge on refrigeration, air conditioning and air compressor.

Course Outcome(s)

CO1	To apply the laws of thermodynamic in automobile working operations.
CO2	To conceptualize different types of thermodynamic air standard cycles.
CO3	To capable to illuminate steam power cycle and steam nozzles.
CO4	To design and analyze of refrigeration and air conditioning problems.
CO5	To scrutinize of efficiency, pressure, p-v diagrams of air compressor.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H											
CO2				H	L							
CO3			M	M								
CO4		M					L			M	H	
CO5				M								

Course Topics

BASIC THERMODYNAMICS

Systems, zeroth law, first law, steady flow energy equation. Heat and work transfer in flow and non flow processes. Second law, Kelvin – planck statement – clausies statement – concept of entropy, clausius inequality, entropy change in non-flow processes

AIR STANDARD CYCLES

Otto, diesel, dual and Brayton cycles. Air standard efficiency, mean effective pressure, reciprocating compressors.

STEAM POWER CYCLES AND STEAM NOZZLES

Properties of steam – rankine cycle – steam nozzles – condition for maximum discharge – flow of steam through nozzles

REFRIGERATION AND AIR CONDITIONING

Principles of psychrometry and refrigeration – vapour compression – vapour absorption – coefficient of performance, properties of refrigerents – basic principle and types of air conditioning

AIR COMPRESSORS

Operation of a single stage reciprocating compressor, work input through p-v diagram and steady state steady flow analysis, effect of clearance and volumetric efficiency, adiabatic, isothermal and mechanical efficiencies, multistage compressor, saving in work, optimum intermediate pressure, inter colling, minimum work for compression (use of standard thermodynamic tables, Mollier diagram and refrigerant property tables are permitted)

Text Books

1. Kothandaraman, C.P., Domkundwar, S., and Domkundwar, A.V., A course in Thermal Engineering, Dhanpat Rai and Sons, Fifth edition, 2002.
2. Rajput, R.K, Thermal Engineering, S.Chand publishers, 2000

References

1. Holman, J.P., Thermodynamics, McGraw-Hill, 1985.
2. Rogers, Engineering Thermodynamics, ELBS, 1992.
3. Arora, C.P., Refrigeration and Air conditioning, Tata McGraw-Hill, New Delhi, 1994.
4. Sarkar, B.K., Thermal Engineering, Tata McGraw-Hill, New Delhi, 1998

MEC281	STRENGTH OF MATERIALS / FLUID MECHANICS LABORATORY	L	T	P	C
		0	0	3	2
Prerequisite	Basic knowledge of Fluid Mechanics, Engineering Mechanics, Strength of Materials and Mathematics Basic knowledge in Graph Plotting				
Objective(s)	To learn the basic principles, properties of materials and behavior of materials under loading conditions. To learn the basic principles behind Flow and Machine Experiments and develop an aptitude for research work To learn the technical details of designing an experimental set-up To learn writing technical report and result analysis To develop basic character of honesty in observing/recording/reporting results				

Course Outcome(s)

CO1	To know the details about the properties of materials
CO2	To procure knowledge on various fluids involved in experiments
CO3	To analyze the hardness of various metals
CO4	To inspect the details about pumps and turbines
CO5	Test the efficiency of various meter involved in experiments

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M		L			L						L
CO2	L		M	L				M		M	M	M
CO3	M	M	H	M				M	L	L	L	H
CO4			L					L	L	H		
CO5			M					M	L	L		

Course Topics

Strength of Materials Laboratory

1. Tension test on mild steel rod
2. Double shear test on Mild steel and Aluminum rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
11. Unhardened specimen
12. Quenched Specimen and
13. Quenched and tempered specimen.
14. Microscopic Examination of
15. Hardened samples and
16. Hardened and tempered samples.

Fluid Mechanics Laboratory

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturimeter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of Centrifugal pump / Submergible pump.
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.

10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

MEC282	**MANUFACTURING TECHNOLOGY LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**2**
Prerequisite	Basics of Manufacturing Technology.				
Objective(s)	To develop an ability to operate and perform machining, foundry, welding and plumbing practice				
Course Outcome(s)					
CO1	Able to perform operations using lathe and drilling machine				
CO2	Able to handle tools and equipments in foundry and smithy practice				
CO3	Able to perform welding and plumbing operations				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M			H	H		L					H
CO2	H		M	H	H		M					
CO3	M		M	M	H		H					M

Course Topics

MACHINING PRACTICE

Lathe: Plain turning, step turning, taper turning, parting off, knurling, thread cutting, eccentric turning, Boring, Counter boring and counter sinking, cutting force measurement, special operations in capstan and turret lathe.

Drilling: Through hole, blind hole, reaming, tapping, cutting force measurement

FOUNDRY PRACTICE

Study of moulding tools, equipments, furnaces, preparation of moulding sand, exercise: flange, gland, bush, straight pipe, bend pipe, tee pipe and grooved pulley.

SMITHY PRACTICE

Study of forging tool - making a square out of round rod, making an L-bend, making a hook, square headed bolt, hexagonal headed bolt and V-clamp.

WELDING PRACTICE

Study of welding tools, equipments, exercise in Arc welding and Gas welding: Lap joint, butt joint, V-joint and Tee joint

PLUMBING PRACTICE

Study of plumbing tools – laying pipe connection to the suction side of a pump inlet and the delivery side of a pump outlet – practice in mixed pipe connections: metal, plastic and flexible pipes used in household appliances.

SEMESTER-IV

MAT211	NUMERICAL METHODS (Common to Civil Engg., EEE, ICE and Mechanical Engg.)	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in Partial Differential equations, differentiation and integration, Laplace equations, matrix.				
Objective(s)	To understand the basic numerical methods to solve partial differential equations To analyze the error for a particular numerical method and appreciate the efficiency in implementation of numerical algorithms To obtain numerical solutions of simple PDEs with the help of MATLAB				
Course Outcome(s)					
CO1	Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.				
CO2	Apply numerical methods to obtain approximate solutions to mathematical problems.				
CO3	Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.				
CO4	Analyze and evaluate the accuracy of common numerical methods.				
CO5	Implement numerical methods in Matlab.				
CO6	Write efficient, well-documented Matlab code and present numerical results in an informative way.				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L		L	M							
CO2	H		M	M	M							
CO3	H		M	M								
CO4	H	L		M	M							
CO5	M		M	H	H		M			M		H
CO6	M			M	H		M					H

Course Topics

SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS

Review of open end methods, bracketed end methods - the intermediate theorem (excluding proof) - iterative method - False position method - Newton – Raphson method for single variable and for simultaneous equations with two variables - Solutions of a linear system by Gaussian, Gauss-Jordan, Jacobi and Gauss – Seidel methods - Eigen value of a matrix by Power method.

INTERPOLATION

Newton forward and backward difference formulae - Newton's divided difference formulae - Lagrange's polynomials - Stirling's Central difference formulae.

NUMERICAL DIFFERENTIATION AND INTEGRATION

Numerical differentiation with interpolation polynomials - Numerical integration by Trapezoidal and Simpson's (both 1/3rd and 3/8th) rules - Two and Three point Gaussian quadrature formulae - Double integrals using Trapezoidal and Simpson's rule.

INITIAL VALUE PROBLEMS

Single step Methods – Taylor Series, Euler and Modified Euler, Runge – Kutta method of order four for first and second order differential equations - Multistep Methods-Milne's predictor and corrector method.

BOUNDARY VALUE PROBLEMS

Finite difference solution for the second order ordinary differential equations - Finite difference solution for one dimensional heat equation (both implicit and explicit) , One-dimensional wave equation and two-dimensional

Laplace and Poisson equations.

Text Books

1. Kreyszig, E, Advanced Engineering Mathematics, John Wiley and Sons (Asia) Limited, Singapore , 8th Edn., 2001.
2. Arumugam, S., Thangapandi Isaac, A., Somasundaram, A., Numerical Methods, Scitech Publications (India) Pvt. Ltd., Chennai, 2nd Edn., Reprint 2006, 2001.

References

1. Jain, M.K., Iyengar, S.R.K., Jain, R.K., Numerical Methods for Scientific and Engineering Computation, New Age International (P) Ltd., New Delhi, 4th Edn., 2003.
2. Francis Scheid, Theory & Problems of Numerical Analysis, Schaum's Outline Series, Singapore, 1989.

AUT202	MECHANICS OF MACHINES	L	T	P	C
		3	1	0	4
Prerequisite	Basic knowledge in Engineering Mechanics				
Objective(s)	To understand the layout of linkages in the assembly of a system To analyze the motion resulting from a specified set of linkages in a mechanism To study the principles of working machines and its motions To analyze the motions of cam mechanisms To study the different types of gears and their terminology				

Course Outcome(s)

CO1	Discuss the fundamentals of various mechanisms.
CO2	Examine the velocity and acceleration diagram for a mechanism
CO3	Construct the cam profile
CO4	Analyses the gear train
CO5	Predict the effect of friction in clutches

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		L	M								
CO2	M	H	M									
CO3	M		L	M								
CO4	H	M	H				M					
CO5	M	M	M	L								

Course Topics

MECHANISMS

Machine Structure - Kinematic link, pair and chain - constrained motion - slider crank and crank rocker mechanisms - inversions - applications - Kinematic analysis and synthesis of simple mechanisms - Degrees of freedom - Grueblers criteria

FRICTION

Friction in screw and nut - Pivot and collar - Thrust bearing - Plate and disc clutches - Belt (flat and V) and rope drives - Ratio of tensions - Effect of centrifugal and initial tension - Condition for maximum power transmission - Open and crossed belt

GEARING AND CAMS

Gear profile and geometry - Nomenclature of spur and helical gears - Law of gearing - Interference - Requirement of minimum number of teeth in gears - Gear trains - Simple and compound gear trains - Determination of speed and torque in epicyclic gear trains - Cam profile - Different types of followers.

BALANCING

Static and dynamic balancing - Single and several masses in different planes - Primary and secondary balancing of reciprocating masses - Single and multi cylinder engines - Inline, V and W arrangements of engines.

VIBRATION

Free, forced and damped vibrations of single degree of freedom systems - Force transmitted to supports - Vibration isolation - Vibration absorption - Torsional vibration of shaft - Single and multi rotor systems – Geared shafts - Critical speed of shaft.

Text Books

1) Ballaney, P.L., "Theory of Machines ", Khanna Publishers, New Delhi, 1998.

References

1) Rao, J.S. and Dukkipati, R.V., "Mechanism and Machine Theory ", Second Edition, Wiley Eastern Ltd., 1992.
2) Malhotra, D.R. and Gupta, H.C., "The Theory of Machines ", Satya Prakashan, Tech. India Publications, 1988.
3) Gosh, A., and Mallick, A.K., "Thoery of Machines and Mechanisms ", Affiliated East West Press, 1989.
4) Shigley, J.E. and Uicker (K), J.J., "Theory of Machines and Mechanisms ", McGraw Hill 1980.
5) Burton Paul, "Kinematic and Dynamic of Planer Machinery ", Prentice Hall, 1979.

AUT204	AUTOMOTIVE FUELS AND LUBRICATIONS	L	T	P	C
		3	0	0	3
Prerequisite	Fundamental knowledge in fuels and lubricants				
Objective(s)	To understand the production of automotive fuels and lubricants. To study the properties, fuel rating, combustion, alternative fuels and testing of fuels.				

Course Outcome(s)

CO1	Understand about petroleum refining process and automotive lubricants.
CO2	Able to test and analyze the properties of fuels and lubricants.
CO3	Attain knowledge about fuel additives and mechanism of combustion.
CO4	Explore alternative fuels to reduce emission from the vehicle.
CO5	Ability to understand synthesis, oxidation, deterioration and degradation of lubricants.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L											
CO2		M								H		
CO3				L					L			
CO4			M		H			L			M	
CO5				M								

Course Topics

MANUFACTURE OF FUELS AND LUBRICANTS

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

PROPERTIES & TESTING OF FUELS

Thermo-chemistry of fuels - properties and testing of fuels & Lubricants - relative density - calorific value - fire point - distillation - vapour pressure - flash point spontaneous ignition temperature - viscosity - pour point - flammability - ignitability diesel index - API gravity - aniline point Viscosity index.

FUEL RATING & COMBUSTION

Cetane rating - Fuel requirements additive – mechanism, requirements of an additive petrol fuel additives and diesel fuel additives – specifications of fuels SI Engine – flame propagation and mechanism of combustion - normal combustion knocking – octane – rating - fuel requirements CI engine - mechanism of combustion - diesel knock

ALTERNATE FUELS

Use of alternate fuel in engines- LPG, CNG need for alternate fuels - availability & their properties - general use of alcohols, LPG, CNG, LNG, hydrogen, ammonia, vegetable oils – bio diesel and bio gas – merits and demerits of alternate fuels. Introduction to alternate energy sources like, electric vehicle, hybrid, fuel cell & solar cars

LUBRICANTS

Classification of lubricating oils, properties of lubricating oils, tests on lubricants, Grease- classification, properties, test. Specific requirements for automotive lubricants, oxidation, deterioration and degradation of lubricants, additives, synthetic lubricants.

Text Books

1. Internal Combustion Engineering by Ganesan V, Tata McGraw –Hill Publishing Co., New Delhi.
2. Lubrication, Raymond G.Gunther, Chipton Book Co.- 1971

References

1. Fuels – Solids, Liquids, Gaseous by Brame, J.S.S. and King, J.G
2. Fuels and Fuel Technology by Francis, W, Vol. I & II
3. Modern Petroleum Technology by Hobson, G.D. & Pohl. W
4. Lubrication–A practical guide to lubricant selection by A.R. Lansdown, Pergamon press 1982
5. Energy today & tomorrow by Maheswar Dayal, I & B Horishr India.
6. Internal Combustion Engineering and Air Pollution by Obert. E.F., International Book Co., 1988.

AUT205	AUTOMOTIVE CHASSIS	L	T	P	C
		3	0	0	3
Prerequisite	Theory of Machine, Machine Design				
Objective(s)	To discuss different types of chassis. The student shall gain appreciation and understanding function of front axle, types of stub axle, types of steering gear box etc. State modern drive line. Shall be able to understand need of suspension. Student shall gain knowledge of design consideration braking system, suspension system and for chassis etc.				

Course Outcome(s)

CO1	Understand the construction details of various types of automotive chassis and basic functions of subsystems in the chassis
CO2	Demonstrate a working knowledge of different steering geometry, steering system and various types of front axle
CO3	Develop knowledge on modern drive line.
CO4	Study about the various suspension systems
CO5	Learn about the different braking systems like power brake, assisted brakes, disc brakes.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	M					L			
CO2	L	H		H					M		M	
CO3	H			M					M		L	
CO4	L	M	L	M					H			
CO5		H		M					H		M	

Course Topics

INTRODUCTION

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

FRONT AXLE AND STEERING SYSTEM

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

DRIVE LINE AND DIFFERENTIAL

Effect of driving thrust and torque reactions. Hotch kiss drive, torque tube drive and radius rods. Propeller shaft. Universal joints. Constant velocity universal joints. Front wheel drive. Different types of final drive. Worm and worm wheel, straight bevel gear, Spiral bevel gear and hypoid gear final drives. Double reduction and twin speed final drives. Differential principles. Construction details of differential unit. Non-slip differential. Differential locks - Differential housings.

REAR AXLE AND SUSPENSION SYSTEM

Construction of rear axles. Types of loads acting on rear axles. Full floating. Three quarter floating and semifloating rear axles. Rear axle housing. Construction of different types of axle housings. Multi axled vehicles. Construction details of multi drive axle vehicles.Need of suspension system - Types of suspension - Suspension springs - Constructional details and characteristics of leaf, coil and torsion bar springs - Independent suspension - Rubber suspension – Pneumatic suspension - Shock absorbers

BRAKING SYSTEM

Classification of brakes - Drum brakes and Disc brakes. Constructional details - theory of braking, Mechanical hydraulic and pneumatic brakes - Servo braker. power and power assisted brakes - Different types of retarders like eddy current and hydraulic retarder-Anti lock braking systems.

Text Book

1) Heldt P.M., “Automotive chassis ", Chilton Co., New York, 1990.

References

1) Steed W., “Mechanics of Road vehicles ", Illiffe Books Ltd., London, 1960.
2) Newton Steeds & Garrot, “Motor vehicles ", Butterworths, London, 1983.
3) Judge A.W., “Mechanism of the car ", Chapman and Halls Ltd., London, 1986.
4) Giles.J.G., " Steering, Suspension and tyres ", Iliffe Book Co., London, 1988.
5) Crouse W.H., “Automotive Chassis and Body ", McGraw Hill. Newyork. 1971.

AUT206	AUTOMOTIVE ENGINES-I	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge about IC engines				
Objective(s)	To learn about Spark Ignition and Compressed Ignition and other types of engines. It also includes combustion, engine friction, and its lubrication.				

Course Outcome(s)

CO1	Describe the basics of automobile components and its working
CO2	Analyze the air standard cycle and correlate with actual engine cycle.
CO3	Explain the working of various Spark Ignition Engine Fuel System
CO4	Explain the construction and working of various CI Engine Fuel Systems
CO5	Summarize the constructional difference between combustion chambers of C. I. Engines.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									M			
CO2	S			S		M				S		
CO3		M		M								
CO4		M							L			
CO5							L		M			

Course Topics

INTRODUCTION

Historical Development of Automobiles classification of Automobiles - Type of Automobile Engines - Principle of engine operation, two and four stroke engine CNG/LPG engine - classification of engine - engine parts and their function cylinder head piston, piston rings, piston pin, connecting rod, crank shaft, flywheel, camshaft, valve and valve mechanism and crank case.

AIR CYCLES FOR AUTOMOTIVE USE

Air standard cycles-Otto, Diesel and Dual, Fuel air cycles, Actual cycle analysis, Effects of variable specific heats and dissociation on indicator diagram. Port and valve timing diagrams related numericals.

S.I ENGINE FUEL SYSTEM

Classification of I.C. Engines - carburation, factors affecting carburation, air fuel mixture requirements, working principle of simple carburator, drawbacks of a simple carburator, compensating devices in a carburator, introduction to basic electronics petrol injection system, its merit and demerits, introduction to multipoint fuel injection system, CNG/LPG systems

ENGINES FUEL SYSTEM

Introduction, requirements of diesel fuel injection system, classification of injection systems, injection pumps- Jerk type and distributor type, injection Nozzles – requirements, types of injection nozzles, injection lag, injection timing, Calibration of injection pumps, Common Rail Direct Injection System (CRDI)

COMBUSTION AND COMBUSTION CHAMBERS OF S.I ENGINE

Combustion in S.I engine, stages of combustion, Flame propagation, rate of pressure rise, abnormal combustion, detonation effect of engine variables on detonation & flame propagation, pre ignition. Desirable characteristics of gasoline, rating of gasoline – HUCR, Octane number, performance number, combustion chambers, types & factors controlling combustion chamber design

Text Books

1. Internal Combustion Engine by Ganesan V., Tata McGraw – Hill Publishing
2. A Course in Internal Combustion Engine by M.L. Mathur & R.P. Sharma, Dhampat Rai & Sons 2002
3. Internal combustion Engines by K.K.Ramalingam, Scitech puli, Chennai – 2000

References

1. The I.C. Engine by Taylor, C.F. & Taylor, E.S Mitpress

2. Automotive Engine by Crouse/Anglin, McGraw Hill International Edition
3. Elements of I.C. Engine by Rogowski, A.R. McGraw Hill
4. Combustion Engine Processes by Litchiy, L.C. McGraw Hill
5. Internal Combusion Engine Fundamentals by John B.Heywood, M Graw Hill – 1988.
6. Engineering Fundamentals of Internal Combustion Engines– PH1 – 2003

AUT208	ELECTRONICS AND INSTRUMENTATION	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in electrical and electronics				
Objective(s)	To incorporate electronic functions in automotive vehicle by using digital and analog circuits, measuring instruments and microprocessor.				

Course Outcome(s)

CO1	Able to acquire knowledge in electronic components and devices.
CO2	Ability to develop digital and analog circuits.
CO3	To demonstrate decoders / drivers, timer, display devices, A/D and D/A converters.
CO4	Capable to analyze electronic measurement and instruments.
CO5	To apply program interfacing in microprocessor- 8255, 8251.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M											
CO2		L			M							
CO3				M					L		M	
CO4			L		M				H			
CO5	L								M		H	

Course Topics

ELECTRONICS COMPONENTS AND DEVICES

Resistors, capacitors, inductors and transformers – properties, types, simple PN junction diodes, Zener diode, Bipolar junction transistor and field effect transistors – operating principles and characteristics. Other devices – UJT, SCR, LED, photo detectors

ANALOG CIRCUITS

Rectifier and power supply circuits, clipper, clamper using diodes, operational amplifiers – properties and typical circuits like differentiator, integrator, summer, comparator, single – stage BJT's and FET's amplifiers – multistage amplifier principles (quantitative treatment only)

DIGITAL CIRCUITS

Basics of Boolean logic – logic gates, flip flops, shift register, counters, decoders / drivers, timer, display devices, A/D and D/A converters

MEASUREMENTS AND INSTRUMENTS

Definitions of accuracy, precision, sensitivity, resolution, linearity, range, measurement of electrical quantities – voltmeter, ammeter, wattmeter, DMM, CRO, DSO, transducers and signal conditioning systems for pressure, temperature, acceleration measurements (quantitative treatment only)

MICROPROCESSORS AND APPLICATIONS

Architecture of 8085 processors, address modes, instruction set, simple programming like addition, subtraction, multiplication, logical operation, peripheral and interfacing – 8255, 8251. Applications like motor control, keyboard and PC interface, introduction to micro controllers

Text Books

1. Millman. J and Halkias. C., "Integrated Electronics", Tata Mcgraw Hill, 2004
2. Paul Horowitz and Wilfred Hill " The Art of Electronics", Cambridge University Press, 1989

References

1. Donald P leach, Albert Paul Malvino and Goutam saha, "Digital Principles and Applications", 6E, Tata Mcgraw Hill, 2006
2. A. K. Sawhney, "Acourse in electrical dn electronic Measurement and Instrumentation", Dhanpat rai and sons, New delhi, 1999

AUT282	AUTOMOTIVE FUELS AND LUBRICATIONS LAB	L	T	P	C
		0	0	3	2
Prerequisite	To understand the fuel quality and constituents. To work with the gaseous fuels. To examine the flash and fire point of fuels.				
Objective(s)	To demonstrate working of automotive fules and lubrication				
Course Outcome(s)					
CO1	Test the performance of various engines using dynamometers.				
CO2	Asses the performance characteristics of automotive engines				
CO3	Measure the properties of fuels and lubricants.				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H		M				H		
CO2	H	H	H	H		M				H		
CO3	H	H	H	H		H	M					

Course Topics

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 Diesel, K-Oil, and Bio Diesel.
4) Flash and Fire points of lubricants.
5) Drop point of grease and mechanical penetration in grease.
6) Calorific value of liquid fuel
7) Calorific value of gaseous fuel
8) Study of semi solid lubrication in various Automobile Unit & Joints
9) Study of lubrication in transmission, final drive, steering gearbox.
10) Study of analytical equipment for oil analysis.
11) To find out volatility characteristic of different fuels by ASTM distillation methods (diesel, gasoline lubricants).

AUT284	ENGINE TESTING LABORATORY	L	T	P	C
		0	0	3	2
Prerequisite	Automotive Engines Thermodynamics and Thermal Engineering				
Objective(s)	To conduct performance test on the IC engines and air compressors.				

Course Outcome(s)	
CO1	Apply the knowledge for finding performance characteristics of thermal equipment's
CO2	Test the performance of various engines using dynamometers.
CO3	Asses the performance characteristics of automotive engines

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H		H	M					
CO2	H	H	H	H		M				H		
CO3					H	H	H	H		H	M	

Course Topics

1) Port timing diagram (Petrol and Diesel)
2) Valve timing diagram (Petrol and Diesel)
3) Performance test of four stroke diesel engine
4) Heat balance test on four stroke diesel engine
5) Performance test of four stroke Petrol engine
6) Heat balance test on four stroke Petrol engine
7) Retardation test to find frictional power of diesel engine
8) Performance test on air compressors

AUT285	ELECTRONICS AND INSTRUMENTATION LABORATORY	L	T	P	C
		0	0	3	2
Prerequisite	Automotive electrical and electronics				
Objective(s)	To study the working principle of the various electrical and electronic subsystem of an automobile.				

Course Outcome(s)	
CO1	Recognize and understand the different wiring diagrams used in automobile manuals.
CO2	To recognize basic electrical and electronic circuits used in automobile systems and also understand the basic programming with the 8085 microprocessor
CO3	To demonstrate UJT, FET,SCR, DIAC and TRIAC.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H									M		
CO2		M		H	H							
CO3				M							M	

Course Topics

1) Characteristics of semiconductor diode and zener diode
2) Characteristics of transistor under common emitter configuration
3) Characteristics of transistor under common base configuration
4) Characteristics of transistor under common collector configuration
5) Characteristics of UJT and FET
6) Characteristics of SCR, DIAC and TRIAC
7) Characteristics of RTD
8) Characteristics of Thermistor
9) Characteristics of thermocouple
10) Characteristics of strain gauge load cell

SEMESTER-V

AUT301	AUTOMOTIVE ELECTRICAL SYSTEMS	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in electrical and electronics Practical knowledge in electrical circuits and electrical terminology related to automobiles				
Objective(s)	Understand the concepts behind the electrical instruments in an automobile and to get practical knowledge. Examining the working of different electrical components in the automobile. Analysing the necessity of the electronics in the automobile sector				

Course Outcome(s)

CO1	Understand the concept of battery operation and its necessity
CO2	Examining the working of starting system.
CO3	Application of batteries in the automobile and their charging system.
CO4	Analyzing the ignition system and spark plugs construction.
CO5	Understanding the function of lighting system and accessories.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S		S									L
CO2		M			L		S		M			
CO3	S							L				
CO4			S			L			M			
CO5				L								M

Course Topics

BATTERIES

Principle and construction of lead-acid battery. Characteristics of battery, rating, Capacity and efficiency of batteries. Various tests on battery condition charging methods, details of modern storage batteries

STARTING SYSTEM

Condition at Starting Behaviour of starter during starting. Series motor and its characteristics. Principle & construction of starter motor. Working of different starter drive units, care & maintenance of starter motor. Starter switches

CHARGING SYSTEM

Function, components of DC and AC charging system for automobile, construction, operating principle, characteristics, charging circuit controls – cutout, relays, voltage and current regulators, trouble shooting

IGNITION SYSTEM

Types, construction & working of battery coil and magneto ignition systems - centrifugal and vacuum advance mechanisms - Types and construction of spark plugs, Electronic Ignition system, digital ignition system

LIGHTING SYSTEM AND ACCESSORIES

Insulated & earth return systems. Positive & negative earth systems. Details of head light & side light. Head light dazzling & preventive methods. Electrical fuel-pump, Speedometer, Fuel, oil & temperature gauges, Horn, Wiper system, Trafficator.

1.

AUT302	AUTOMOTIVE ENGINES-II	L	T	P	C
		3	1	0	4
Prerequisite	Basic knowledge about IC engines				
Objective(s)	To learn about Spark Ignition and Compressed Ignition and other types of engines.				

Course Outcome(s)

CO1	Describe the basics of automobile components and its working
CO2	Analyze the air standard cycle and correlate with actual engine cycle.
CO3	Explain the working of various Spark Ignition Engine Fuel System
CO4	Explain the construction and working of various CI Engine Fuel Systems
CO5	Summarize the constructional difference between combustion chambers of C. I. Engines.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									M			
CO2	S			S		M				S		
CO3		M		M								
CO4		M							L			
CO5							L		M			

Course Topics

COMBUSTION AND COMBUSTION CHAMBERS OF CI ENGINES

Importance of air motion, swirl, squish & turbulence, swirl ratio, stages of combustion in C.I engines, delay period, factors affecting delay period, knock in C.I engines combustion chambers, design requirements, types of combustion chambers, desirable characteristics of diesel fuel, rating of diesel fuel, cetane number, diesel index, aniline point.

TESTING & PERFORMANCE OF I.C. & C.I. ENGINES

Purpose of testing of I.C. & C.I. Engines, performance parameters & characteristics variable's affecting performance characteristics, measurement of F.H.P., I.H.P. & B.H.P. Fuel consumption, Air consumption, Heat carried by exhaust gases, Heat balance sheet, performance calculations, Numerical Problems

IGNITION, SUPER CHARGING & ENGINE BALANCING

Ignition systems, requirements, types battery, magneto ignition system, spark plug ignition timing and exhaust emissions, demerits of conventional ignition system Introduction to electronic ignition system, supercharging, Turbo charging, stratified charge, objectives, effects & limits of supercharging of S.I. & C. I Engine, engine balancing, general consideration, power balance & its importance, firing order and its significance, power overlap, power flow charts, dampeners

COOLING AND LUBRICATION SYSTEM

Need for cooling system, Types of cooling system: air cooling system, liquid cooling system, forced circulation system, pressure cooling system. Lubrication system; mist wet sump lubrication system, properties of lubricants

ENGINE FRICTION

Engine friction – introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary design of a lubricating system

Text Books

1) Ganesan.V. "Internal Combustion Engines ", Tata-McGraw Hill Publishing Co., New Delhi 1994.
2) Dr.K.K.Ramalingam "Internal Combustion Engines Theory and Practice", Scitech Publications(India) Pvt.Ltd, Chennai-17, 2001.

References

1) Heldt.P.M. "High Speed Combustion ", Oxford IBH Publishing Co., Calcutta, 1985.
2) Obert.E.F. "Internal Combustion Engine analysis and Practice ", International Text Book Co., Scranton, Pennsylvania, 1988.
3) Maleev.V.M. "Diesel Engine Operation and Maintenance ", McGraw Hill, 1974.
4) Dicksee.C.B. "Diesel Enignes ", Blackie & Son Ltd., London, 1964.

AUT303	AUTOMOTIVE TRANSMISSION	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in automotive chassis, gears and gear trains.				
Objective(s)	To develop the basic knowledge of the students in mechanics, torque conversion areas. To develop the skills of the students in the areas of alternative drives and concepts. To serve as a pre-requisite course for other courses in UG and PG programs specialized studies and research.				

Course Outcome(s)

CO1	Understand the concept of clutches and gear boxes
CO2	Know about the fluid coupling and torque converters, performance characteristics
CO3	Study about Automatic transmission
CO4	Learn about the different drive systems.
CO5	Know the applications of Automatic Transmission

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			L									L
CO2	L	H		M					M			
CO3			L	M								M
CO4	M	L		H								
CO5			L				H					

Course Topics

CLUTCH AND GEAR BOX

Requirement of transmission system - Different types of clutch, principle, construction, torque capacity and design aspects. Determination of gear ratios for vehicles - Performance characteristics in different speeds - Different types of gear boxes - conventional gear boxes.

HYDRODYNAMIC DRIVE

Fluid coupling - Principle of operation, constructional details, torque capacity, performance characteristics and reduction of drag torque. Torque converter - Principle of operation, constructional details, performance characteristics, converter coupling, multistage torque converters and polyphase torque converters.

AUTOMATIC TRANSMISSION

Ford - T-model gear box, Wilson Gear box, Cotal electromagnetic transmission, Automatic over drive, Hydraulic control system for automatic transmission.

HYDROSTATIC DRIVE AND ELECTRIC DRIVE

Hydrostatic drive - Various types of hydrostatic systems - principles of hydrostatic drive system, advantage and limitations, comparison of hydrostatic drive with hydrodynamic drive - construction and working of typical Janny hydrostatic drive. Electric drive - principle of early and modified Ward Leonard control system, advantage & limitations and performance characteristics.

AUTOMATIC TRANSMISSION APPLICATIONS

Chevrolet "Turbo glide" Transmission - Power glide Transmission - Toyota "ECT-i" Automatic Transmission with Intelligent Electronic control system - Clutch Hydraulic Actuation system.

TEXT BOOK

1. Newton and Steeds, “Motor vehicles ", llliffe Publishers, 1985.

REFERENCES BOOK

1. Heldt.P.M., " Torque converters ", Chilton Book Co., 1992.
2. Judge.A.W., " Modern Transmission systems ", Chapman and Hall Ltd., 1990.
3. SAE Transactions 900550 & 930910.
4. Hydrostatic transmissions for vehicle applications ", I Mech E Conference, 1981-88.
5. Crouse. W.H., Anglin., D.L., " Automotive Transmission and Power Trains construction ", McGraw-Hill, 1976.

AUT314	AUTOMOTIVE COMPONENT DESIGN	L	T	P	C
		3	1	0	4
Prerequisite	Strength of Materials Mechanics of Machines				
Objective(s)	To make the students understand the design concept and principles of various engine components.				

Course Outcome(s)

CO1	Understand the design assumptions.
CO2	Understand and Apply Engineering Design process
CO3	Apply engineering principles and analytical techniques in designing shafts and springs.
CO4	Design of various automotive engine components like cylinder piston, connecting rod, flywheel and valves.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L									
CO2	M			M								
CO3	M	M	H		M							
CO4							H					

Course Topics

INTRODUCTION

Engineering materials and their physical properties appolied to design, selection of materials, factor of safety, endurance limit, notch sensitivity, principles of design optimization, future trends, computer aided drafting

LIMITS, FITS, TOLERANCES, SURFACE FINISH, SHAFTS AND SPRINGS

Definitions, types of tolerances and fits, design considerations, Engineering materials and their physical properties applied to design, selection of materials, factor of safety, endurance limit, notch sensitivity, principles of design optimization, future trends, computer aided drafting for interference fits, surface finish, surface roughness, design of power transmission shafts, design of helical springs

DESIGN OF CYLINDER AND PISTON

Choice of material for cylinder and piston, piston friction, piston slap, design of cylinder, piston, piston pin, piston rings, piston failures, lubrication of piston assembly

DESIGN OF CONNECTING ROD AND CRANKSHAFT

Material for connecting rod, determining minimum length of connecting rod, small end and big end design, shank design, design of big end cap bolts, connecting rod failures, balancing of IC engines, significance of fire order, material for crank shaft, design of crankshaft under bending and twisting, balancing weight calculations

DESIGN OF VALVES AND FLYWHEEL

Design aspects of intake and exhaust manifolds, inlet and exhaust valves, valve springs, tappets, valve train. Materials and design of flywheel

TEXTBOOKS

1. R. K. Jain, “Machine Design”, Khanna Publishers, New Delhi, 1997
2. Design data book, PSG college of Technology, Coimbatore, 2000
3. P. M. Heldt, “High Speed Combustion Engines”, Oxford-IBH Publishing Co., Calcutta, 1965

AUT387	VEHICLE TESTING LABORATORY	L	T	P	C
		0	0	3	2
Prerequisite	Basic knowledge in vehicle auxiliary systems				
Objective(s)	To execute the various testing and reconditioning of vehicle parts.				

Course Outcome(s)

CO1	Understand the concept of vehicle and engine performance evaluation
CO2	Understand about the Laboratory and On road testing of vehicles
CO3	Understand the various mechanical measurement devices used in vehicle testing

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M			M								
CO2			L		H				M			
CO3				M							H	

Course Topics

1) Study of IC engine testing dynamometers
2) Study of 2 wheeler chassis dynamometer
3) Study of 4 wheeler chassis dynamometer
4) Study of pressure pickup, charge amplifier, storage oscilloscope and signal analyzers used for IC engine pressure testing
5) Testing of 2 wheeler with chassis dynamometer
6) Testing of 4 wheeler with chassis dynamometer
7) Measurement of HC, CO, CO2, O2 using exhaust gas analyzer in 2 wheeler and 4 wheeler
8) Diesel smoke measurement in 2 wheeler and 4 wheeler

AUT388	AUTOMOTIVE COMPONENT DESIGN LABORATORY	L	T	P	C
		0	0	3	2
Prerequisite	Nil				
Objective(s)	To famiarise the students to use modelling software to model engine components and chassis design				

Course Outcome(s)

CO1	Design and assemble the Chassis components using Modelling
CO2	Design and assemble the Engine components using Modelling

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		L		H				M				
CO2			M							H		

Course Topics

1) Design and drawing of piston
2) Design and drawing of piston pin and piston rings
3) Design of crank shaft
4) Design of connecting rod, small end and big end, shank design, design of big end cap, bolts and drawing of connecting rod assembly
5) Design of crankshaft , balancing weight calculations
6) Design and drawing of flywheel
7) Design and drawing of the inlet and exhaust valves
8) Design of cam and camshaft, cam profile generation, drawing of cam and cam shaft
9) Design of cylinder

SEMESTER VI

AUT304	AUTOMOTIVE MATERIALS AND METALLURGY	L	T	P	C
		3	0	0	3
Prerequisite	Basics in Physics and Chemistry – Basic knowledge in Mechanical, Magnetic and Thermal Properties.				
Objective(s)	To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for Automobile engineering applications.				

Course Outcome(s)

CO1	Gain basic knowledge in various fundamentals of alloy design with emphasis on Fe-C system
CO2	Acquire knowledge in fracture and fracture mechanics of engineering materials
CO3	Acquire fundamental knowledge in the characterization of engineering materials
CO4	Provide basic knowledge in the selection of materials for automobile components
CO5	Gain knowledge on the importance of heat treatment and phase transformations with studies on surface treatment.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S		S		M				L			
CO2		M		S	L		S			S		
CO3	S	M		L	S				S	M		
CO4	M			M	L		M				S	
CO5	S		M	M					S			

Course Topics

ELASTIC AND PLASTIC BEHAVIOUR OF MATERIALS

Elasticity-forms - Stress and strain relationship in engineering materials - Deformation mechanism - Strengthening material - Strain hardening, alloying, polyphase mixture, martensitic precipitation, dispersion, fibre and texture strengthening - iron carbon diagram.

FRACTURE, FATIGUE AND CREEP

Fracture, classification and types, Griffith's theory - Notch effects, stress concentration - Concept of fracture toughness - Ductile brittle transition - Fatigue-mechanism of crack initation and growth, factors affecting fatigue creep - Creep curve, Ashby deformation mechanism maps, creep mechanism, metallurgical variables of creep.

CHARACTERISTICS OF MATERIALS

Castability, machinability, formability and weldability of engineering materials such as steel, cast iron, alloy steels, brass, bronze and Al alloys. Composite materials fabrication techniques, materials for high temperature. Cryogenic wear, corrosion, fatigue, creep and oxidation resistance application.

SELECTION OF MATERIALS

Criteria of selecting materials for automotive components viz cylinder block, Cylinder head, piston, piston ring, Gudgeon pin, connecting rod, crank shaft, crank case, cam, cam shaft, engine valve, gear wheel, clutch plate, axle, bearings, chassis, spring, body panel - radiator, brake lining etc. Application of non-metallic materials such as composite, ceramic and polymers in automobile.

HEAT TREATMENT AND SURFACE TREATMENT

Heat treatment of steel - Annealing - Types, normalising, Types, hardening and tempering with specific relevance to automotive components, Induction, flame and chemical hardening, coating of wear and corrosion resistance, Electroplating. Phosphating, Anodizing, hot dipping, thermal spraying, hard facing & thin film coatings.

Text book

1. Khanna.O.P., " Material Science and Metallurgy ", Dhanapal Rai & Sons, 1992

References

1) Kapoor, “Material Science and Processes ", New India Publishing House, 1987.
2) Dieter.G.E., Mechanical Metallurgy, McGraw Hill, New York, 1972.
3) Avner.S.H., Introduction to physical metallurgy, MaGraw Hill, New York., 1982.
4) Raghavan.V., Physical Metallurgy, Principle and Practice, Prentice Hall, 1995.
5) Bawa.H.S., Materials Metallurgy, McGraw-Hill, 1996.
6) Avner S.H". Introduction to Physical Metallurgy" McGraw-Hill, New York, 1982.
7) Dieter, G.E., Mechanical Metallurgy, McGraw-Hill, New York, 1996.

AUT306	**AUTOMOTIVE AERODYNAMICS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**
Prerequisite	Basic knowledge in engineering drawing, Engineering Mechanics, Fluid Mechanics and vehicle body structures.				
Objective(s)	To impart knowledge on the structure, properties, treatment, testing and applications automobile componets and parts				

Course Outcome(s)

CO1	Summarize the flow related parameters and problems around a vehicle
CO2	Interpret the aerodynamic drag around a car
CO3	Explain the ways available to optimize the shape to get an aesthetic and stylish look to a car considering the modifications to be done.
CO4	Analyze the various aerodynamic forces around a vehicle to reduce the drag in commercial vehicles.
CO5	Evaluate the pressure, velocity and other forces around a vehicle using its scale model with the help of wind tunnel testing

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						L			L			
CO2		M		L								
CO3		S			M				L			
CO4		S							L			
CO5	M								L			

Course Topics

INTRODUCTION

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

AERODYNAMIC DRAG OF CARS

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

SHAPE OPTIMIZATION OF CARS

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

VEHICLE HANDLING

The origin of forces and moments on a vechile - side wind 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.

WIND TUNNELS FOR AUTOMOTIVE AERODYNAMIC

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.

Text Book

1) Hucho.W.H., “Aerodynamic of Road vehicles ", Butterworths Co. Ltd., 1997.

References

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

AUT307	AUTOMOTIVE POLLUTION AND CONTROL	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in Automotive Engine and Automobile Engineering Basic knowledge in Automobile Pollution & Control.				
Objective(s)	To study about the Automobile Pollution and its control. It enhances the technical knowledge in controlling and maintaining environment from pollution. It also helps to understand the concepts and devices used for emission and pollution controlling.				

Course Outcome(s)

CO1	Understand the sources and effects of pollutant.
CO2	Apply the chemistry of SI engine fuels after combustion.
CO3	Describe chemistry of CI engine fuels after combustion.
CO4	Choose the control techniques to reduce the formation of pollutants in SI and CI engine.
CO5	Test Procedures, Devices and Standards used to follow pollution control.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L			H	L						M	
CO2	H	H		L	M							
CO3		M			H				L	M	L	
CO4		H		L	M					L		
CO5	H			M					L	L	L	

Course Topics

INTRODUCTION

Pollutants - sources - formation - effects - transient operational effects on pollution.

SI ENGINE COMBUSTION AND POLLUTANT FORMATION

Chemistry of SI engine combustion - HC and CO formation in 4-stoke and 2-stroke SI engines - NO formation in SI engines - Particulate emissions form SI engines - Effects of operating variables on emission formation.

CI ENGINE COMBUSTION AND EMISSIONS

Basics of diesel combustion - Smoke emission in diesel engines - NO emission from diesel engines – Particulate emission in diesel engines. Color and Aldehyde emissions from Diesel engines - Effects of operating variables on emission formation.

CONTROL TECHNIQUES FOR SI AND CI ENGINE EMISSION REDUCTION

Design changes - Optimization of operating factors - Exhaust gas recirculation - Fumigation - Air injection PCV

system - Exhaust treatment in SI engines - Thermal reactors - Catalytic converters - Catalysts - Use of unleaded petrol.

TEST PROCEDURE & INSTRUMENTATION FOR EMISSION MEASUREMENT AND EMISSION STANDARDS

Test procedures - NDIR analyser - Flame ionization detectors - Chemiliuminescent analyser – Gas chromatograph - Smoke meters - Emission - standards.

Text Book

1. Springer and Patterson, Engine Emission, Plenum Press, 1990.

References

1. Ganesan.V., " Internal Combustion Engines ", Tata McGraw Hill Co., 1994.
2. SAE Transactions, " Vechicle emission ", 1982 (3 volums).
3. Obert.E.F., " Internal Combustion Engines ", 1982.
4. Taylor.C.F., " Internal Combustion Engines ", MIT Press, 1972.
5. Heywood.J.B., " Internal Combustion Engine Fundamentals ", McGraw Hill Book Co., 1995.
6. Automoblies and Pollution SAE Transaction, 1995.

AUT310	**VEHICLE BODY ENGINEERING**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**
Prerequisite	Nil				
Objective(s)	The main objective of this course is to impart knowledge in the construction of vehicle, aerodynamic, concept, panelling 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.				

Course Outcome(s)

CO1	Understand various category of vehicle frames
CO2	Explain the various aerodynamic effects of vehicle body under different loading conditions
CO3	Understand various types of bus body frames and their construction
CO4	Understand the Vehicle ergonomics to provide at most comfortable position for driver and passenger
CO5	Describe the various materials and methods used in body constructions and finishing

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	M	L	L				M	L		M
CO2	H	H		M					M	L	M	M
CO3	H		H	M			L	M		M		M
CO4	H						L			M		M
CO5	M								L		L	

Course Topics

CAR BODY

Types: Saloon, convertibles, Limousine, Estate Van, racing and sports car – driver's seat, body mechanisms – window winding, door lock, seat adjustment. driver's visibility, tests for visibility - Methods of improving visibility and space in cars - Safety: safety design. Safety equpiments for cars. Car body construction.

VEHICLE AERODYNAMICS

Objectives - Vehicle drag and types -various types of forces and moments - Effects of forces and moments - Side wind effects - Various body optimization techniques for minimum drag – Wind tunnel testing: Flow visualization techniques, Scale model testing, Component balance to measure forces and moments.

BUS BODY Types: Mini bus, single decker, double decker, two level, split level and articulated bus - Bus body lay out – Floor height - Engine location - Entracne and exit location - Seating dimensions - Constructional details:

Frame construction, Double skin construction - Types of metal section used - Regulations - Conventional and integral type construction.

COMMERCIAL VEHICLE

Types: flat platfor, dropside, fixed side, tipper body, tanker body. LCV body types: pickup van. Dimensions of driver seat in relation to controls and steering angle – driver cab design.

BODY MATERIALS, TRIM AND MECHANISMS

Aluminium alloy sheet, extrusion and casting, stainless steels, alloy steels, metal matrix composites. Strictural timbers – properties. Designing in GRP and high strength composites, thermoplastics, load bearing plastics, semi - rigid PUR foams and sandwich panel construction. Corrosion, anti-corrosion methods. Selection of paint and painting process – body trims items.

Text Book:

1) Powloski.J., " Vehicle Body Engineering ", Business Books Ltd., 1989

References

1) Giles.J.C. “Body construction and design ", lliffe Books Butterworth & Co., 1971.
2) John Fenton, “Vehicle Body layout and analysis ", Mechanical Engg Publication Ltd., London, 1982.
3) Braithwaite.J.B., " Vehicle Body building and drawing ", Heinemann Educational Books Ltd., London, 1977.

AUT389	MEASUREMENTS AND METROLOGY LABORATORY	L	T	P	C
		0	0	3	2
Prerequisite	Basic knowledge in Mechanical Engineering.				
Objective(s)	To give detail explanation on different machine tools including special machines and CNC machines with their pros and cons. To develop knowledge on quality and importance of measuring systems will be explained.				
Course Outcome(s)					
CO1	Understand the constructional features and working principle of machine tool with its limitation.				
CO2	Analyze the utilization and limitation of computer numerical control machines for engineers.				
CO3	Known about the importance of robot and its limitations in engineering field.				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	H		M							H
CO2	L	H										M
CO3	M		L							M		L

Course Topics

1) Use of precision measuring instruments like micrometer, vernier height and depth gauges, surface plate etc.,
2) Checking dimensions of a part using slip gauge
3) Use of sine bar for measuring angles and tapers
4) Calibration of plug and dial gauge, micrometer
5) Measurement of tooth thickness by gear tooth vernier
6) Testing squareness of a try square using slip gauges
7) Checking straightness of s surface plate using autocollimator
8) Measurement of thread parameters using floating carriage micrometer
9) Gear inspection using profile projector
10) Use of electronic and mechanical comparator
11) Measurement of taper angle using tool maker’s microscope
12) Study and use of coordinate measuring machine

MEC383	DYNAMICS AND VIBRATION LABORATORY	L	T	P	C
		0	0	3	2
Prerequisite	Basic knowledge in kinematics of Machines, forces acting on the machines, basic of vibrations.				
Objective(s)	To study various forces acting on the machines and elements, balancing of machining components and elements of mechanical vibrations.				

Course Outcome(s)

CO1	Students will be able to know about the forces involved in the components and balancing those forces
CO2	Students will be able to acquire knowledge in the field of dynamics characteristic of machining elements.
CO3	Students will able to know about analysis of vibrations.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	H		H							L
CO2		M								L		L
CO3	H				H							L

Course Topics

1) Moment of inertia on flywheel and connecting rod
2) Governor-Porter, Proell and Hartnell - determination of speed and sensitivity
3) Whirling speed of shaft – determination of critical speed
4) Transverse vibration – determination of deflection
5) Undamped free vibration spring mass system
6) Forced vibration system – single and multi degree of freedom
7) Vibration analyzer
8) Cam study - jump phenomenon –determination of critical speeds
9) Vibrating Table – determination of transmissibility ratio
10) Compound Pendulum – determination of torsional and natural frequencies – system with lumped moment of inertia.

SEMESTER VII

AUT401	VEHICLE DYNAMICS	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in Automotive Chassis and Automobile Engineering Fundamentals of kinematics, dynamics, vector analysis and matrix theory.				
Objective(s)	This course aims to give general knowledge about the concept of mechanical vibrations in various components of a vehicle. In detail the suspension and tyre related vibrations are studied. The various topics covered in this course are the stability of the vehicles in normal, curve and slope areas, load distribution under all conditions.				

Course Outcome(s)

CO1	Understand the basic of mechanical vibration under free, forced and damped conditions
CO2	Estimate the multi degree of freedom systems for reducing vibration in vehicles.
CO3	Identify, check and test the suspension and tyre characteristics
CO4	Apply the concept of vehicle handling system.
CO5	Explain the concepts of load distribution in vehicles and stability of the vehicles.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L			H	L						M	
CO2	H	H		L	M							
CO3		M			H				L	M	L	
CO4		H		L	M					L		
CO5	H			M					L	L	L	

Course Topics

INTRODUCTION

Fundamental of vibration, Mechanical vibrating systems. Modelling and Simulation - Model of an automobile - Single, two, multi degrees of freedom systems - Free, forced and damped vibrations. Mangnification factor - Transmissibility - Vibration absorber.

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MULTI DEGREE OF FREEDOM SYSTEMS

Closed coupled system - Eigen valve problems - Far coupled Systems - Orthogonality of mode shapes – Modal analysis - Forced vibration by matrix inversion. Approximate methods for fundamental frequency - Dunkerley's lower bound - Rayleigh's upper bound - Hozler method for close coupled systems and branched systems.

SUSPENSION AND TYRES

Requirements. Sprung mass frequency. Wheel hop, wheel wobble, wheel shimmy. Choice of suspension spring rate. Calculation of effective spring rate. Vehicle suspension in fore and apt directions. Ride characteristics of tyre - Effect of driving and braking torque - Gough's tyre characteristics.

VEHICLE HANDLING

Oversteer, under steer, steady state cornering. Effect of braking, driving torques on steering. Effect of camber, transient effects in cornering. Directional stability of vehicles.

STABILITY OF VEHICLES

Load distribution. Calculation of Tractive effort and reactions for different drives - Stabiliy of a vehicle on a slope, on a curve and a banked road.

Text Books

1. Gillespie.T.D., " Fundamental of vehicle dynamic society of Automotive Engineers ", Ic USA, 1992.

References

1. Heldt.P.M. " Automotive Chassis ", Chilton Co., New York, 1992.
2. Ellis.J.R., " Vehicle Dynamics ", Business Books Ltd., London, 1991.
3. Giles.J.G. Steering, " Suspension and Tyres ", llliffe Books Ltd, London, 1998.
4. Giri.N.K., " Automobile Mechanics ", Khanna Publishers. New Delhi, 1986.
5. Rao.J.S. & Gupta.K., " Theory and Practice of Mechanical Vibrations ", Wiley Eastern Ltd., New Delhi, 1999.

MEC481	SIMULATION LABORATORY	L	T	P	C
		0	0	3	2
Prerequisite	Finite Element Analysis, Basis of CAD software				
Objective(s)	To develop skill to use CAD software to create 2D drawings.				

Course Outcome(s)

CO1	Students able to understand the system concept and apply functional modeling method to model the components.
CO2	Simulate the operation of static, dynamic and thermal systems and make improvement according to the simulation results.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	H		L						H	
CO2		H	H		H			L		M	M	

Course Topics

A. SIMULATION

1) Simulation of air conditioning system with condenser temperature and evaporator temperatures as input to get COP using C /MAT Laboratory.
2) Simulation of Hydraulic / Pneumatic cylinder using C / MAT Laboratory.
3) Simulation of cam and follower mechanism using C / MAT Laboratory.

B. ANALYSIS (SIMPLE TREATMENT ONLY)

1) Stress analysis of a plate with a circular hole.
2) Stress analysis of rectangular L - bracket
3) Stress analysis of an axi-symmetric component
4) Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
5) Mode frequency analysis of a 2D component
6) Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
7) Harmonic analysis of a 2D component
8) Thermal stress analysis of a 2D component
9) Conductive heat transfer analysis of a 2D component
10) Convective heat transfer analysis of a 2D component

DEPARTMENT ELECTIVE

AUT305	AUTOMOTIVE ELECTRONICS	L	T	P	C
		3	1	0	4
Prerequisite					
Objective(s)	To impart knowledge to the students in the principles of operation and constructional details of various automotive electronic systems like charging system, ignition system, lighting system and dash board instruments.				

Course Outcome(s)

CO1	Distinguish the various basic electrical and electronics systems of an automobile.
CO2	Recognize and understand the different wiring diagrams used in automobile manuals.
CO3	Able to recognize the working of various electronics and accessories system.
CO4	To analyze engine control system, ignition system and emission characteristics.
CO5	To acquire knowledge in electromagnetic interference suspension

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	L	M					L			
CO2	L	H		H					M		M	
CO3	H			M					M		L	
CO4	L	M	L	M					H			
CO5		H		M					H		M	

Course Topics

FUNDAMENTAL OF AUTOMOTIVE ELECTRONICS

Current trends in mordern Automoblies, Open loop and closed loop systems - Components for electronic engine management. Electronic management of chassis system - Vehicle motion control.

SENSORS AND ACTUATORS

Introduction, basic sensor arrangement, types of sensors such as - oxygen sensors, Crank angle position sensors - Fuel metering / vehicle speed sensor and detonation sensor - Altitude sensor, flow sensor. Throttle position sensors, solenoids, stepper motors, relays.

ELECTRONIC FUEL INJECTION AND IGNITION SYSTEMS

Introduction, Feed back carburettor systems (FBC) Throttle body injection and muli port or point fuel injection, Fuel injection systems, injection system controls. Advantages of electronic ignition systems. Types of solid state ignition systems and their principle of operation, Contactless electronic ignition system, Electronic spark timing control.

DIGITAL ENGINE CONTROL SYSTEM

Open loop and closed loop control systems - Engine cranking and warm up control - Accleration enrichment - Deceleration leaning and idle speed control. Distributorless ignition - Integrated engine control system, Exhaust emission control engineering.

ELECTROMAGNETIC INTERFERENCE SUSPENSION

Electromangetic compatibility - Electronic dash board instruments - Onboard diagnosis system. security and warning system.

Text Books

1. William B.Riddens, “Understanding Automotive Electronics ", 5th Edition, Butterworth, Heinemann Woburn, 1998.
2. Tom Weather Jr and Cland C.Hunter, “Automotive Computers and Control System ". Prentice Hall Inc., New Jersey.

References

1. Young. A.P. and Griffths.L. “Automobile Electrical Equipment ", English Language Book Society and New Press.
2. Crouse. W.H., “Automobile Electrical equipment ", McGraw Hill Book Co Inc., New York, 1955.
3. Robert N Brady, “Automotive Computers and Digital Instrumentation ". A reston Book. Prentice Hall, Eagle Wood Cliffs, New Jersey, 1988.
4. Bechtold., " Understanding Automotive Electronic ", SAE, 1998.

AUT308	ALTERNATE FUELS AND ENERGY SYSTEMS	L	T	P	C
		3	0	0	3

Prerequisite	Basic knowledge in IC Engines and Fuels and Lubricants
Objective(s)	To acquire knowledge of alternate fuels To understand the changes in the engine design for handling To understand various energy systems for use in the automobiles.

Course Outcome(s)

CO1	To identify the alternatives to conventional gasoline and diesel fuels
CO2	Performance investigation and comparison of alternate fuels
CO3	To analyze the working of multi fuel engine.
CO4	To recognize when and what information is needed, locate and obtain it from a range of sources and evaluate, use and share it with others.
CO5	To apply numerical and spatial concepts and techniques.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L			M								
CO2	M	M										
CO3					M						M	
CO4			M								M	
CO5	H								M			

Course Topics

INTRODUCTION

Estimation of petroleum reserve - Need for alternate fuel - Availability and properties of alternate fuels - general use of alcohols - LPG - Hydrogen - Ammonia, CNG, and LNG - Vegetable oils and Biogas - Merits and demerits of various alternate fuels.

ALCOHOLS

Properties as engine fuel, alcohols and gasolene blends, performance in SI engine. Methanol and gasoline blends - Combustion characteristics in engines - emission characteristics.

NATURAL GAS, LPG, HYDROGEN AND BIOGAS

Availability of CNG, properties, modification required to use in engines - performance and emission characteristics of CNG using LPG in SI & CI engines. Performance and emission for LPG - Hydrogen - Storage and handling, perforamance and safety aspects.

VEGETABLE OILS

Various vegetable oils for engines - Esterification - Performance in engines - erformance and emission characteristics

ELECTRIC AND SOLAR POWERED VEHICLES

Layout of an electric vehicle - Advantage and limitations - Specifications - System component. Electronic control system - High energy and power density batteries - Hybrid vehicle - Solar powered vehicles.

Text Book

1) Nagpal, “Power Plant Engineering", Khanna Publishers, 1991.

References

1) Maheswar Dayal, “Energy today & tomorrow ", I & B Horishr India, 1982.
2) Nagpal, “Power Plant Engineering ", Khanna Publishers, 1991.
3) “Alcohols and motor fuels progess in technology ", Series No.19, SAE Publication USA 1980.

4) SAE Paper Nos. 840367, 841156, 841333, 841334.
5) "The properties and performance of modern alternate fuels" - SAE Paper No.841210.
6) Bechtold. R.L., " Alternative Fuels Guide Book ", SAE, 1997.

AUT309	COMBUSTION AND HEAT TRANSFER	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in IC engines				
Objective(s)	To give a basic idea of combustion process, heat transfer and knocking in S.I engine. To make student to understand P-Q diagram in SI and CI engines.				

Course Outcome(s)

CO1	To categorize combustion process and diffusion flames in engines
CO2	To differentiate normal-abnormal combustion and flam propagation.
CO3	To quantify spray combustion, delay period, diesel knock and peak pressure.
CO4	To extrapolate convective heat transfer temperature distribution and thermal stresses in engines
CO5	To investigate combustion process and P-Q diagram in SI and CI engines.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M			M								
CO2	H						M					
CO3					H					L		
CO4				H					L			
CO5			M				L				H	

Course Topics

INTRODUCTION TO COMBUSTION PROCESSES

Combustion in premixed and diffusion flames - Combustion process in IC engines.

NORMAL, ABNORMAL COMBUSTION IN SI ENGINES

Stages of combustion - Flame propagation - Rate of pressure rise - Cycle to cycle variation – Abnormal combustion - Theories of detonation - Effect of engine operating variables on combustion.

COMBUSTION AND KNOCK IN CI ENGINES

Droplet and spray combustion theory - stages of combustion - delay period - peak pressure - Heat release – Gas temperature - Diesel knock.

HEAT TRANSFER IN IC ENGINES

Basic definitions - Convective heat transfer - Radiative heat transfer - Heat transfer, temperature distribution and thermal stresses in piston - Cylinder liner - Cylinder head - fins and values.

EXPERIMENTAL INVESTIGATION OF COMBUSTION AND HEAT TRANSFER IN IC ENGINES

Photographic studies of combustion processes - P-Q diagram in SI and CI engines. Anemometry – Temperature measurement in piston - cylinder liner - cylinder head and engine valves.

Text Books

1) SPALDING.D.B., " Some fundamental of Combustion ", Butterworth Science Publishcations, London, 1985.

References:

1) Lewis.B., Pease.R.N. and Taylor.H.S., " Combustion Process High Speed Gas dynamics and Jet Propulsion Series", Princeton University Press, Princeton, New Jersey, 1976.
2) Taylor.E.F. "The Internal Combustion Engines ", International Text Book Co., Pennsylvania, 1982.
3) Ganesan.V. " Internal Combustion Engines ", Tata McGraw Hill Co., 1994.

AUT312	MICROPROCESSOR APPLICATION IN AUTOMOBILES	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in electronics.				
Objective(s)	To make student to understand the operations of microprocessor and its language programming, interfacing devices,				

Course Outcome(s)

CO1	To recognize different types of microprocessor and its architecture.
CO2	To understand the function of 8085 MPU-T-STATE instruction set.
CO3	To acquire knowledge in microprocessor language programming.
CO4	To appraise various type of interrupt data transfer schemes.
CO5	To dramatize temperature control, stepper motor control in automotive applications.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H											
CO2	L	M										
CO3					L							
CO4										L		
CO5									M		H	

Course Topics

ARCHITECTURE

General 8 bit microprocessor and its architecture 8085, Z-80 and MC 6800 MPU and its pin function - Architecture - Function of different sections.

INSTRUCTION SET

Instruction format - addressing modes - instruction set of 8085 MPU-T-STATE - Machine cycle and instruction cycles - Timing diagrams - Different machine cylces - Fetch and execute operations - estimation of execution times.

ASSEMBLY LANGUAGE PROGRAMMIMG

Construct of the language programming - Assembly format of 8085 - Assembly Directive - Multiple precision addition and subtraction - BCD to Binary and Binary to BCD, Multiplication, Division, Code conversion using look up tables - Stack and subroutines.

DATA TRNSFER SCHEMES

Interrupt structure - Programmed I/O - Interrupt driven I/O, DMA - Serial I/O.

INTERFACING DEVICES

Types of interfacing devices - Input / Output ports 8212, 8255, 8251, 8279. Octal latches and tristate buffers - A/D and D/A converters - Switches, LED's ROM and RAM interfacing.

APPLICATIONS

Data acquisitions - Temperature control - Stepper motor control - Automotive applications Engine control, Suspension system control, Driver information systems), Development of a high speed, high precision learning control system for the engine control.

Text Book

1) Ramesh, Goankar.S. “Microprocessor Architecture Programming and Applications ", Wiley Eastern Ltd., New Delhi, 1986.

References

1) Aditya.P.Mathur, “Introduction to Microprocessors ", III Edition, Tata McGraw-Hill Publishing Co Ltd., New Delhi, 1989.
2) Ahson.S.I. “Microprocessors with Applications in Process Control ", Tata McGraw-Hill, New Delhi, 1986.
3) SAE Transactions, 1986 Sec 3.
4) Jabez Dhinagar.S., “Microprocessor Application in Automoblies ".
5) L.Bianco and A.Labella., "Automotive Micro Electronics ", Elsevier science publishers. 1986.

AUT313	INSTRUMENTATION AND METROLOGY	L	T	P	C
		3	0	0	3
Prerequisite	Engineering Physics				
Objective(s)	To study about the metrology about liner measuring and angular measuring Instruments To know about the various special purpose machine and their operation. To give exposure to various precision measuring instruments.				

Course Outcome(s)	
CO1	Measure the given mechanical elements and assemblies using linear and angular analog /digital measuring instruments.
CO2	Measure and derive important dimensions of various thread forms and gears.
CO3	Explain surface roughness checking instruments and check the dimensions using the gauges
CO4	Apply the concept of measurements in inspecting various parameters.
CO5	Select and measure variables using appropriate sensors and transducers

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H				H							
CO2		H			M			M			M	
CO3			H									H
CO4	L	L				H				M		
CO5	H				H							

Course Topics

LINEAR AND ANGULAR MEASUREMENTS

Errors in measurement & calibration - Length standards - Length measuring instruments - Vernier, micrometers, dial gauges, comparators, Limits, fits, tolerances. Gauges and their types - Angular measuring instruments - bevel protractor, spirit level, sine bar - measurement of straightness anf flatness - Measurement of surface finish.

MEASUREMENT OF SCREW THREAD AND GEAR

Various elements of thread - Two wire & three wire method - thread gauge - Various elements of gears - Various gear tooth measurement methods, composite error measurement.

PRESSURE & FLOW MEASUREMENT

Diaphragm - various elastic elements - Transduction methods - Potentiometric strain gauge, variable reluctance and capacitive device, LVDT type transducer, piezo electric transducers and its application to high speed engine. Farnboro Engine indicator. Low pressure measurement - McLeod gauge, pirani gauge, thermocouple type conductivity gauge.
Classification of flow meters - Orifice plate, venturimeter, flow nozzles, pitot tubes, rotameter, electromagnetic flow meters, anemometers, ultrasonic and magnetic flow meters, alcolck viscous flow meter.

TEMPERATURE MEASUREMENT

Temperature scales - Mechanical temperature sensors - liquid in glass, vapour pressure, bimetal - resistance type temperature sensors and their measuring circuits - Thermistors, thermocouples, laws, types, construction, circuits - Radiation methods - Optical pyrometer

LOAD AND TORQUE MEASUREMENT

Force measuring devices, balances, platform scale weigh bridges, load cells. Torque measurement, prony brake, rope brake. Dynamometers. Electric cradle dynamometer, Eddy current dynamometers. Hydraulic dynamometer, Transmission and chasis dynamometer.

Text Books

1) Jain.R.K., " Engineering Metrology " Khanna Publishers, New Delhi, 1994.
2) Rangan.C.S., Sarma.G.E. and Mani.V.S.V., " Instrumentation Devices and Systems" Tata McGraw Hill Publishing Co., New Delhi, 1990.

References

1) Patranabis.D, “Principles of Industrial Instrumentation", Tata McGraw Hill Publishing Co., New Delhi, 1996.
2) Beckwith.T.G. & Buck.N.L., “Mechanical Measurements", Oxford and IBH Publishing, New Delhi, 1990.

3) Jain.R.K., " Mechanical & Industrial Measurements ", Khanna Publishers, New Delhi, 1990.
4) Gaylor.F.W. and Shotbolt.C.R., " Metrology for Engineers ", ELBS Edition, 1990.
5) Khare and Vajpayee, "Dimensional Metrology ", Oxford IBH Publishing Co, New Delhi, 1990.

AUT315	MODERN VEHICLE TECHNOLOGY	L	T	P	C
		3	0	0	3

Prerequisite	Nil
Objective(s)	To impart knowledge about the latest developments in Vehicle Technology
Course Outcome(s)	
CO1	Understand the recent trends in power plants.
CO2	Explain about recent development in vehicle suspension, Brakes, and Safety in automobiles
CO3	Analyse the various Noise and pollution in automobiles
CO4	Explain the modern Vehicle operation and control using microcontrollers
CO5	Basic knowledge in Vehicle automation systems

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M											
CO2							M					
CO3			H		M							
CO4			H		M							
CO5	M		H				L					

Course Topics

TRENDS IN POWER PLANTS

Hybrid vehicles - Stratified charged / learn burn engines - Hydrogen engines - battery vehicles – Electric propulsion with cables - Magnetic track vehicles.

SUSPENSION BRAKES AND SAFETY

Air suspension - Closed loop suspension - antiskid braking system, Retarders, Regenerative braking safety cage - air bags - crash resistance - passenger comfort.

NOISE & POLLUTION

Reduction of noise - Internal & external pollution control through alternate fuels/power plants – Catalytic converters and filters for particulate emission.

VEHICLE OPERATION AND CONTROL

Computer Control for pollution and noise control and for fuel economy - Transducers and actuators - Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.

VEHICLE AUTOMATED TRACKS

Preparation and maintenance of proper road network - National highway network with automated roads and vehicles - Satellite control of vehicle operation for safe and fast travel.

Text Book

1) "Bosch Hand book ", 3rd Edition, SAE, 1993.

References

1) Beranek.L.L. "Noise Reduction ", McGraw-Hill Book Co., Inc, New York, 1993.

AUT316	OFF ROAD VEHICLES	L	T	P	C
		3	0	0	3
Prerequisite	Nil				
Objective(s)	At the end of the course, the students will be able to understand the various Off road vehicle and their systems and features				

Course Outcome(s)	
CO1	Understand Classification and requirements of off road vehicles
CO2	Describe the concepts of land clearing machinery
CO3	Understand and apply the concept of various earth moving vehicle
CO4	Know the difference of operation of scrappers and graders
CO5	Basic description about shovels and ditchers

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H										M
CO2		H										M
CO3				H	H				M			
CO4		H		H								M
CO5					H							

Course Topics

CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES
Power plants, chassis and transmission, Multi-axle vehicles.

LAND CLEARING MACHINES
Bush cutter, stampers, Tree dozer, Rippers

EARTH MOVING MACHINES
Bulldozers, cable and hydraulic dozers. Crawler track, running and steering gears, scrapers, drag and self-powered types - Dump trucks and dumpers - Loaders, single bucket, multi bucket and rotary types - Power and capacity of earth moving machines

SCRAPERS AND GRADERS
Scrapers, elevating graders, self-powered scrapers and graders.

SHOVELS AND DITCHERS
Power shovel, revolving and stripper shovels - drag lines - ditchers - Capacity of shovels.

Text Book

1) Wang.J.T., " Theory of Grand vehicles ", John Wiley & Sons, New York, 1987.

References

1) Abrosimov. K. Bran berg.A. and Katayer.K., " Road making Machinery ", MIR Publishers, Moscow, 1971.
2) Off the road wheeled and combined traction devices - Ashgate Publishing Co. Ltd. 1998.

AUT317	ENERGY, ECOLOGY, ENVIRONMENT & SOCIETY	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in elementary science and sociology.				
Objective(s)	To instruct the basic scientific knowledge on the environment and human impacts on various elements of environment and assessment tools.				

Course Outcome(s)

CO1	To recognize environmental problems arising due to developmental activities
CO2	To categorize solid waste treatment and its management.
CO3	To Identify the environmental pollutants and abatement devices.
CO4	To provide some basic concepts on ethics and human rights.
CO5	To stress the role of engineer to the society, environment and sustainability.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L		M				S					
CO2									L			
CO3			H									
CO4				L				M				
CO5												L

Course Topics

INTRODUCTION

Introduction of energy scenario, Conventional and non-conventional resources of energy, utility and waste management of thermal, hydral energy. General idea of solar, Wind, Bio-mass, Geothermal, Tidal and Wave energy, Sources and waste management of nuclear power energy. Electromagnetic energy, radio frequency and microwaves, its biological effects.

SOLID WASTE TREATMENT

Global warming, depletion of ozone layer, human activity and meteorology, Genetic and plant bio-diversity, EL-Nino phenomenon and its effects. Solid waste, waste disposal methods, recycling of solid waste and its management.

AIR POLLUTION AND TREATMENTS

Atmosphere - introduction, Structure of the atmosphere, Chemical and Photochemical reactions in the atmosphere, primary air pollutants - Sources, control and harmful effects of CO, NOx, S0x, HC, particulars, sampling techniques, Air pollution from automobiles, Photochemical smog, Acid rain some case studies of air pollution.

WATER POLLUTION AND TREATMENTS

Hydrosphere - Aquatic environment, organic and inorganic water pollutants, Domestic and Industrial waste water treatment, -Aerobic and anaerobic treatment processes, sampling and preservation, some case studies of water pollution.

NOISE POLLUTION

Lithosphere and Noise Pollution - Introduction of Land and Soil pollution, Control and disposal, harmful effects. General introduction of noise pollution and its effects. Sound unwanted form of noise, changes, and Traffic noise. Prediction and control.

Text Book

1) Richard Wilson, “Energy, Ecology and the Environment”, Academic press, 1974.

AUT318	VEHICLE MAINTENANCE	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in Automobile engineering				
Objective(s)	To understand the vehicle conserving records, schedules, auxiliaries system, chassis and engine management.				

Course Outcome(s)	
CO1	To maintain record and schedule of vehicle.
CO2	To capable to inspect fuel system, lubrication system, engine oil and other auxiliaries system.
CO3	Able to repair and overhauling of engine by using special tools.
CO4	Ability to service the automotive chassis and its sub systems.
CO5	To repair of vehicle body, tinkering of body and servicing of door locks.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M								L			
CO2		M			M							
CO3		M	M									
CO4												
CO5				L							H	

Course Topics

RECORDS AND SCHEDULE

Maintenance Records and Schedule: Importance of maintenance, scheduled and unscheduled maintenance, preventive maintenance details, breakdown maintenance details vehicle log books, maintenance record forms, different service garages & its layout.

AUXILIARIES MAINTENANCE

Maintenance, Servicing of Auxiliaries: Cooling system service, radiator, water pump service aspect, anti corrosion additives, anti freezing solutions Petrol fuel and diesel fuel system maintenance, lubrication system service, engine oil change, engine oil topping up, oil filters maintenance, oil relief valve Chassis lubrication, lubrication charts, head light focusing and adjustment.

ENGINE MAINTENANCE

Maintenance, Repair and Overhauling of Engine: Dismantling of engine, cleaning, and checking of components visually and dimensionally, reconditioning methods of engine components, engine tune-ups, assembly of engine components, special tools used for maintenance, repair and overhauling of engine.

CHASSIS MAINTENANCE

Maintenance, Repair and Overhauling of Chassis Drive-line Components: Servicing, repair & maintenance of clutch, maintenance, repair and servicing of gear box, servicing of propeller shaft, servicing and maintenance aspects of differential unit, servicing of front axle and rear axle, suspension system of both rigid and independent types, servicing of brake systems, hydraulic, air systems, brake bleeding and brakes adjustments, maintenance and servicing of steering system, wheel balancing, wheel alignment, maintenance of tyres, tyre rotation.

VEHICLE BODY MAINTENANCE

Maintenance and Repair of Vehicle Body: Special tools used for body repair, minor body panel beating, tinkering of body works, polishing and painting of new and old vehicle body, servicing of door locks, passenger seat maintenance

Text Book

1) W. Steed, "Mechanics of Road Vehicles", llefe Books Ltd. London

References

1) P. M. Heldt, "Automotive Chassis", Chilton Co. NK
2) A.W. Judge, "Car Maintenance & Repair – Motor Manual".
3) Heisler Hein Z., "Vehicle and Engine Technology", Vol. I, English Language Book Co.
4) John B. Heyhood, "Internal Combustion Engines Fundamentals", McGraw Hill

AUT319	FOUNDRY ENGINEERING	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in manufacturing technology.				
Objective(s)	To introduce foundry, Patterns, pattern allowances, ingredients of moulding sand and melting furnaces and foundry tools and their purposes.				

Course Outcome(s)	
CO1	Able to design and fabricate the pattern for automotive application.
CO2	Capable to perform the melting practice for ferrous and non-ferrous metal alloys.
CO3	Able to approach the casting techniques for particular applications.
CO4	To design gating system, types of risers, directional solidification and shrinkage.
CO5	To extrapolate casting defects, foundry layout, pollution control and safety in foundries.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M			L								
CO2		L										
CO3	M	H							L			
CO4					L		M				H	
CO5		L	M									

Course Topics

PATTERN PREPARATION AND MOULDING

Introduction to foundry operations, patterns - functions, types, allowances, selection of pattern materials, colour codes, core boxes, moulding practice, ingredients of moulding sand and core sand, Testing of Moulding sands. Sand preparation, Sand moulding: green sand moulding, dry sand moulding, skin dry sand moulding, core sand moulding, loam moulding, fluid sand process, shell moulding, pit and floor moulding, carbon-di-oxide process.

MELTING PRACTICE

Melting practice and special precautions for steels, alloy steels, cast irons, aluminium alloys, copper alloys and magnesium alloys, safety considerations, fluxing, degassing and inoculation

CASTING TECHNIQUES

Sand casting, permanent mould casting, die casting, centrifugal casting, plaster mould casting, investment casting, continuous casting, squeeze casting, full mould process.

DESIGN OF CASTINGS AND FOUNDRY METALLURGY

Elements of gating system, types, design of gating system with examples, functions of risers, types of risers, Chvorinov's rule, design and positioning of riser with examples, directional solidification, use of chills, exothermic compounds etc., riser efficiency, yield calculations. Concepts of pouring, solidification and shrinkage, inoculation and modification of cast irons and Al-Si systems.

ETTLING, INSPECTION AND AUTOMATION

Cleaning and repair of castings. Casting defects and remedies. Heat treatment of castings. Inspection of casting. Principles of mechanisation, automation and foundry layout. Pollution control and safety considerations in foundries. Functional design, simplification of foundry practices, metallurgical design

Text Books

1) Heine. R.W., Loper. C.R.,Rosenthal, P.C. "Principles of Metal Casting", Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 1995.
2) Jain.P.L., "Principles of Foundry Technology", Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 1995.

References

1) Ramana Rao.T.V. "Metal Casting Principles and Practice", New Age Pub. Co., New Delhi, 1996.
2) Beeley.P.R., "Foundry Technology", Butterworths, London, 1982.
3) Srinivasan.N.K, "Foundry Engineering", Khanna Tech Publications, New Delhi, 1994.
4) ASM Metals hand Book. Vol. 15. "Casting", ASM International, 10th Edition, 1991

AUT320	COMPUTER SIMULATION OF IC ENGINES PROCESS	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in IC Engines.				
Objective(s)	To introduce new combustion model, replacing the existing one used in the initial program. To provide knowledge in simulation techniques to estimate the performance and emission characteristics of IC engines.				

Course Outcome(s)

CO1	Able to describe all kind of thermodynamic combustion changes in an engine.
CO2	To simulate SI engine with adiabatic combustion, fuel vaporization and full throttle operations.
CO3	To distinguish progressive combustion with gas exchange process and validate pressure crank angle diagram.
CO4	To analyze compression of simulated valves and heat transfer process.
CO5	To calculate simulation of CI engine performance and pollution estimation.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M											
CO2		H		M	M				H			
CO3									M		M	
CO4		M		M						M		
CO5										H		

Course Topics

INTRODUCTION

Introduction - Heat of reaction - Measurement of URP - Measurement of HRP - Adiabatic flame temperature: Complete combustion in C/H/O/N 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 - Problems, SI engine simulation with adiabatic combustion, temperature drop due to fuel vapourisation, full throttle operation - efficiency calculation, part-throttle operation, super charged operation.

PROGRESSIVE COMBUSTION

SI Engines simulation with progressive combustion with gas exchange process, Heat transfer process, friction calculation, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram and other engine performance.

DIESEL ENGINE SIMULATION

Multi zone model for combustion, different heat transfer models, equilibrium calculations, simulation of engine performance, and simulation for pollution estimation.

Text Book

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

References

1) Ramoss.A.L., " Modelling of Internal Combustion Engines Processes ", McGraw Hill Publishing Co., 1992.
2) Ashley Campbel, “Thermodynamic analysis of combustion engines ", John Wiley & Sons, New York, 1986.
3) Benson.R.S., whitehouse.N.D., " Internal Combustion Engines ", Pergamon Press, oxford, 1979.

AUT322	TWO WHEELERS AND THREE WHEELERS	L	T	P	C
		3	0	0	3
Prerequisite	Automotive Engines, Automotive Chassis.				
Objective(s)	To develop the basic knowledge of the students in constructional details of two and three wheelers. To develop the skills of the students in the operating principles.				

Course Outcome(s)

CO1	Understand the working of two and four stroke engines.
CO2	Understand the functioning of clutch and gear box.
CO3	Know the wheels, tyres, suspensions and braking systems.
CO4	Familiarize the latest models of two wheelers.
CO5	Understand the operations of three wheelers and latest models of three wheelers.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		L	H					M		M	
CO2	M	L		H	L				M		M	
CO3	L	H		L					H		M	
CO4	L	L	M								H	
CO5	M	H	L						M			

Course Topics

THE POWER UNIT

Two stroke and four stroke SI engines, merits and demerits. Symmetrical and unsymmetrical port timing diagrams. Types of scavenging processes – merits and demerits. Scavenging efficiency, scavenging pumps, rotary valve engine, fuel system, lubrication system. Magneto coil and battery coil spark ignition system, electronic ignition system, starting system- kick starting system

CHASSIS AND SUB SYSTEMS

Main frame – types. Chassis and shaft drive. Single, multiple plate and centrifugal clutches. Gear box and gear controls. Front and rear suspension systems – shock absorbers. Panel meters and controls on handle bar

BRAKES AND WHEELS

Drum brakes, disc brakes, front and rear brake links layouts. Brake adjustment. Spoked wheel, cast wheel, disc wheel – disc types. Tyre and tube for two and three wheelers

TWO WHEELERS

Case study of major Indian models of scooters, motor cycles and mopeds like Bajaj, Honda, LML scooters, enfield, TVS, Suzuki, Hero, Yamaha. Servicing and maintenance

THREE WHEELERS

Case study of Indian models. Front engine and rear engine auto rickshaws, pickup vans, delivery van and trailer.

Text Book

1) Irving. P. E., “Motor cycle engineering”, Temple press book, London, 1982.

References

1) The motor cycle manual, Temple press ltd., London, 1990
2) Marshall cavensih, Encyclopedia of motor cycling, 20 volumes, New York and London, 1989
3) Bryaut. R. V., Vespa Maintenance and Repair series

MEC321	OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3
Prerequisite	Students should know the subject Engineering Mathematics.				
Objective(s)	This course will focus on mathematical modeling. A strong emphasis will be given to model formulation.				
Course Outcome(s)					
CO1	Understand the basic concept of optimization and how it is used as a tool for decision making.				
CO2	Expose the students to the basic methods of optimization based on linear/nonlinear programming and integer programming				
CO3	Appreciate some of the power of using the mathematical appropriate to optimization problems relevant to engineering.				
CO4	Show logical thinking in problem solving.				
CO5	Develop mathematical optimization models for a range of practical problems.				
CO6	Acquaint the student with hemistich based approaches to solve hand engineering problem using simulated annealing, genetic algorithm.				
CO7	Familiarize the students with state the art tools for solving classical combination optimization problems.				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M				M			M				
CO2	M				L			M				
CO3	H				M			H				
CO4	L				L			M				
CO5	M				M			H				
CO6	H				L			M				
CO7	M							L				L

Course Topics

INTRODUCTION TO OPTIMIZATION

Classification of optimization problems - applications of optimization - concepts of design vector- design constraints - constraint surface - objective function surfaces and multi -level optimization - quadratic programming- non-linear programming – unconstrained optimization techniques- basics of constrained optimization.

UNCONSTRAINED OPTIMIZATION

Steepest-descent method-Newton methods - Quasi-Newton methods- linear/nonlinear conjugate gradient methods-interval reduction methods- line-search methods- trust-region methods-local and global convergence.

NONLINEAR EQUATIONS

Newton's method - modified Newton's methods; Broyden's (quasi-Newton) method-Inexact Newton methods - the bisection method - line-search methods and merit functions- trust - region methods- local and global convergence.

CONSTRAINED OPTIMIZATION

Lagrange multipliers- Karush - Kuhn-Tucker conditions - line-search methods and merit functions-active-set methods (for inequality constraints) - penalty function methods (for equality constraints) - reduced-gradient and gradient-projection methods - augmented Lagrangian and projected Lagrangian methods - Barrier methods (for inequality constraints) - interior-point methods (for inequality constraints) - sequential linearly constrained programming- sequential quadratic programming.

RECENT TECHNIQUES IN OPTIMIZATION

Convexity; linear programming and simplex method- quadratic programming- duality-nonlinear least-squares

problems-variational calculus- nonsmooth optimization-dynamic optimization and the maximum principle of pontryagin- dynamic programming and the hamilton-Jacobi-Bellman equation-neural networks and the backpropagation algorithm- stochastic optimization- simulated annealing- genetic algorithms- neural network based optimization-optimization of fuzzy systems.

Text Book

1. Edwin, K. P., Chong, and Stanislaw, Zak, H., An Introduction to Optimization, Wiley-Interscience, 2nd Edition, 2001.

References

1) Jorge Nocedal and Stephen Wright, Numerical optimization, Springer, New York, Springer Series in Operations Research and Financial Engineering, Second edition, 2006.
2) Numerical methods for unconstrained optimization and nonlinear equations by John E. Dennis and Robert B. Schnabel, Prentice Hall, Englewood Cliffs, NJ, 1988, reprinted by SIAM publications, 1993.
3) Fletcher, R., Practical methods of optimization, John Wiley and Sons, Chichester, New-York, Second edition, 1987.
4) Philip, E Gill., Walter Murray and Margaret, H, Wright, Practical optimization by Academic Press, New York, 1981.
5) David G. Luenberger, Linear and nonlinear programming by, Addison-Wesley Publ. Comp., Reading, Second edition, 1984.
6) Frederic Bonnans, J., Jean Charles Gilbert, Claude Lemarechal, Claudia, A., Sagastizbal Numerical Optimization: Theoretical and Practical Aspects, Springer Series, Universitext, Second edition 2006.

MEC327	HEAT AND MASS TRANSFER	L	T	P	C
		3	0	0	3
Prerequisite	Knowledge of Thermodynamics and Fluid Mechanics (MEC202,MEC203)				
Objective(s)	The course is intended to build up necessary background for understanding the physical behavior of various modes of heat transfer, like, conduction, convection and radiation and to understand the application of various experimental heat transfer correlations in engineering calculations, to learn the thermal analysis and sizing of heat exchangers and also to understand the basic concepts of mass transfer.				

Course Outcome(s)

CO1	To understand the concept of modes of transfer (conduction, convection)
CO2	To identify and analyze the mechanism of heat and mass transfer correctly
CO3	To solve the problems to enable the design and analysis of heat exchanges using LMTD and NTU method.
CO4	To be able to solve the problems in 1-D and 2-D steady state heat conduction in plane wall, composite wall and cylinder
CO5	To discuss the free and forced convection and to perform the calculations.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L			H				M			M
CO2	H	M	M		H		L					M
CO3	H	M	L				L		M			M
CO4	M	L	M				L		M		L	M
CO5	H	L	L		M				M		L	M

Course Topics

CONDUCTION

Conduction – Fourier law of heat conduction, heat generation, pin fins, transient conduction, lumped capacitance model.

CONVECTION

Convection – introduction, governing equations, boundary layer concept, free convection - vertical plate, horizontal cylinder, horizontal plate - forced convection – laminar flow, turbulent flow, Reynolds analogy.

CONVECTIVE PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS

Condensation and boiling – boiling modes, correlations, forced convection boiling, laminar film condensation on a vertical plate, turbulent film condensation - heat exchangers – LMTD and NTU analysis, fouling factor, effectiveness.

RADIATION

Radiation – laws of radiation, black body radiation, shape factor, radiation exchange between gray surfaces, radiosity, irradiation.

MASS TRANSFER

Mass transfer – Ficks law of diffusion, forced convective mass transfer, heat and mass transfer analogies.

Text Book

1) Sachdeva, R.C., Fundamentals of Engineering Heat and Mass Transfer, New Age International, 1995.

References

1) Yadav, R., Heat and Mass Transfer, Central Publishing House, 1995.
2) Ozisik, M.N., Heat Transfer, McGraw-Hill Book Co., 1994.
3) Nag, P.K., Heat Transfer, Tata McGraw-Hill, New Delhi, 2002.
4) Holman, J.P., Heat and Mass Transfer, Tata McGraw-Hill, 2000.
5) Kothandaraman, C.P., Fundamentals of Heat and Mass Transfer, New Age International, New Delhi, 1998.
6) Frank, P., Incropera and David, P. D., Fundamentals of Heat and Mass Transfer, John Wiley and Sons, 1998.

AUT402	ADVANCED THEORY OF IC ENGINES	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge on the IC engines and their working as well as the components of engine				
Objective(s)	To gain knowledge about the working of I.C engines and the phenomena of combustion and modeling.				

Course Outcome(s)

CO1	To gain knowledge on different operating cycles of an IC engine
CO2	Acquire the information on fuels and their properties related to combustion in engine
CO3	To learn about different engines which are specially used on marine and locomotives
CO4	To know about the performance of the IC engines.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S			S		M					
CO2		M	M					S	S			
CO3				S							S	
CO4				L					S	M	S	

Course Topics

CYCLE ANALYSIS

Operating cycles of S.I. and C.I. engines and Gas turbines - Comparison of Air standard cycle - Fuel air cycle and actual cycle.

COMBUSTION OF FUELS

Combustion stoichiometry of petrol, diesel, alcohol and hydrogen fuels - Chemical energy and heating values - Chemical equilibrium and maximum temperature - SI engine combustion - Flame velocity and area of flame front - CI engine combustion. Fuels spray characteristics - droplet size, penetration and atomization.

ADVANCES IN IC ENGINES

Adiabatic and L.H.R. engines - MAN combustion chamber and multifuel engines - Stratified charged and lean burn engines - Locomotive and marine engines.

OPERATION AND PERFORMANCE

Computer control of engine parameters for pollution control and better efficiency - Closed loop control of engine parameters - Hybrid operation - performance maps.

Text Book

1) Ganesan.V., " Internal combustion engines ", Tata McGraw Hill Publishing Co, 1994

References

1) Ganesan.V., " Compute Simulation of Spark Ignition engine process ", Universities Press (India) Ltd, Hyderabad, 1996.
2) John.B., Heywood, “Internal Combustion Engine Fundamentals ", McGraw Hill Publishing Co., New York, 1990.

AUT403	VEHICLE VIBRATION & NOISE CONTROL	L	T	P	C
		3	0	0	3
Prerequisite	Knowledge on the vibration and noise related parameters is required.				
Objective(s)	To acquire the knowledge on the vibration and noise on vehicles and to make modification on the engine to reduce the noise and vibrations.				

Course Outcome(s)

CO1	To know about the various types of vibration at undamped condition
CO2	To gain knowledge in brief about the vibrations under damped condition
CO3	Analyze about the forced vibration system and to reduce the vibrations
CO4	Understand the vibration system with two degree of freedom
CO5	Learn about the sources of noise and methods to reduce it.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S			S							
CO2		S	L			S				M		
CO3		S				L	L		M	S		
CO4						M	L		M			
CO5			L		S				S	S	S	S

Course Topics

UNDAMPED FREE VIBRATION

Introduction, Single degree of freedom System, Undamped free vibration, Natural frequency of free vibration. Raleigh Method stiffness of spring elements, Effect of Spring mass.

DAMPED FREE VIBRATION

Introduction, Single degree of freedom system, Different type of damping. Concepts of critical damping and its importance, response study of viscous damped system for case of under damping. Critical damping and over damping Logarithmic decrement.

FORCED VIBRATIONS

Single degree of freedom system, Steady state solution with viscous damping due to harmonic force. Solution by complex algebra, Concept of response reciprocating and rotating unbalance vibration Isolation, Transmissibility ration, Energy dissipated by damping, Equivalent viscous damping, Structural damping, Sharpness of resonance, Base excitation.
Vibration measuring instruments, Accelerometer and vibrometer, Whirling of shafts with and without damping, discussion of speeds above and below critical speeds.

SYSTEM WITH TWO DEGREE OF FREEDOM SYSTEM

Introduction, Principle modes and normal modes coordinate coupling, generalized and principle coordinates. Free vibrations in terms of initial conditions, geared systems.
Forced oscillations- Harmonic excitation. Applications-Vehicle suspension. Dynamic vibration absorber, Dynamics of reciprocating engines.

NOISE CONTROL

Noise and Noise Control-Sound, Noise Decibel scale, Pressure and density level, addition of levels, Overall Noise from different frequency Ranges, Sound Level meters, Perceived Noise level, Traffic Noise Index, NC curves, Building Acoustics, Effect of Noise on people, Noise reduction, Noise due to industrial equipments, Important I.S. Codes related to Noise.

Text Book

1) Singiresu S.Rao, Mechanical Vibrations, Pearson Education, New Delhi, 2004.

References

1) Kewal Pujara, Vibrations and Noise for Engineers, Dhanpat Rai and Sons, 1992.
2) Bernard Challen and Rodica Baranescu, Diesel Engine Reference Book, SAE International, Second edition, 1999.
3) Julian Happian and Smith, An Introduction to Modern Vehicle Design, Butterworth - Heinemann, 2004.
4) John Fenton, Handbook of Automotive body Construction and Design Analysis - Professional Engineering Publishing, 1998.

AUT404	TRACTOR AND FARM EQUIPMENTS	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in function of Tractors and Farm Equipment as well as their operation and control techniques.				
Objective(s)	To understand the trends in the tractors and farm equipments, their suspension, cooling system, lubrication system etc.				

Course Outcome(s)

CO1	To gain knowledge on the tractor classification and its components
CO2	To acquire skills about the control of tractor and operation of its engine.
CO3	To know about the engine frame of tractor and the tractor mechanism
CO4	To understand about the cooling, lubrication and fuel system of a Tractor as well as farm equipment
CO5	To learn about the farm equipment construction and applications.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S							S			
CO2				S			M		M			
CO3			M	S	M				S		S	M
CO4							M		S	M	S	S
CO5		S								S	S	S

Course Topics

GENERAL DESIGN OF TRACTORS

Classification of tractors - Main components of tractor - Safety rules.

CONTROL OF THE TRACTOR AND FUNDAMENTALS OF ENGINE OPERATION

Tractor controls and the starting of the tractor engines - Basic notions and definition - Engine cycles – Operation of multicylinder engines - General engine design - Basic engine performance characteristics.

ENGINE FRAME WORK AND VALVE MECHANISM OF TRACTOR

Cylinder and pistons - Connecting rods and crankshafts - Engine balancing - Construction and operation of the valve mechanism - Valve mechanism components - Valve mechanism troubles.

COOLING SYSTEM, LUBRICATION SYSTEM AND FUEL SYSTEM OF A TRACTOR

Cooling system - Classification - Liquid cooling system - Components, Lubricating system servicing and troubles - Air cleaner and turbo charger - Fuel tanks and filters - Fuel pumps.

FARM EQUIPMENTS

Working attachment of tractors - Farm equipment - Classification - Auxiliary equipment - Trailers and body tipping mechanism.

Text Book

1) Rodichev and G.Rodicheva, " Tractor and Automobiles ", MIR Publishers, 1987.

References

1) Kolchin.A., and V.Demidov " Design of Automotive engines for tractor ", MIR Publishers, 1972.

AUT405	PRODUCTION PROCESSES FOR AUTOMOTIVE COMPONENTS	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in manufacturing technology and automotive components production				
Objective(s)	To provide knowledge about design of automotive components To understand about the technologies incorporated in the production of the automotive component.				

Course Outcome(s)

CO1	To understand about the concept behind the metallurgy
CO2	To Acquire the skills and knowledge in the forming process and their application in the automotive sector.
CO3	To learn about the casting process and how the automotive components are made with machining process
CO4	To gain knowledge about the gear manufacturing process.
CO5	Understanding about the recent trends in the manufacturing of automotive components

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		L										
CO2				S					M			
CO3				S								
CO4				S			S		S	M		
CO5		M	L		M				S		S	

Course Topics

POWER METALLURGY

Process flow chart - Production of metal powders and their raw materials - Manufacture of friction lining materials for clutches and brakes - Testing and inspection of PM parts.

FORMING PROCESS

Forging - process flow chart, forging of valves, connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, foot brake linkage, steering knuckles, Extrusions: Basic process steps, extrusion of transmission shaft, steering worm blanks, brake anchor pins, rear axle drive shaft, axle housing spindles, piston pin and valve tappets. Hydroforming: Process, hydro forming of manifold and comparison with conventional methods- Hydro forming of tail lamp housing. Stretch forming - Process, stretch forming of auto body panels - Super plastic alloys for auto body panels.

CASTING AND MACHINING

Sand casting of cylinder block and liners - Centrifugal casting of flywheel, piston rings, bearing bushes, andliners, permanent mould casting of piston, pressure die casting of carburettor other small auto parts.Machining of connecting rods - crank shafts - cam shafts - pistons - piston pins - piston rings - valves - front andrear axle housings - fly wheel - Honing of cylinder bores - Copy turning and profile grinding machines.

GEAR MANUFACTURING

Gear milling, Hobbing and shaping - Gear finishing and inspection.

RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS

Powder injection moulding - Shotpeen hardening of gears - Production of aluminium MMC liners for engineblocks - Plasma spray coated engine blocks and valves - Recent developments in auto body panel forming - Squeeze casting of pistons - aluminimum composite brake rotors

Text Book

1) Heldt.P.M., " High Speed Combustion Engines ", Oxford Publishing Co., New York, 1990.

References

1) Haslehurst.S.E., " Manufacturing Technology ", ELBS, London, 1990.
2) Rusinoff, “Forging and Forming of metals ", D.B. Taraporevala Son & Co. Pvt Ltd., Mumbai, 1995.
3) Sabroff.A.M. & Others, “Forging Materials & Processes ", Reinhold Book Corporation, New York, 1988.
4) Upton, “Pressure Die Casting ", pergamon Press, 1985.
5) High Velocity " Forming of Metals ", ASTME, prentice Hall of India (P) Ltd., New Delhi, 1990.

AUT406	COMPUTER AIDED VEHICLE DESIGN	L	T	P	C
		3	0	0	3
Prerequisite	Knowledge on design of automotive components such as transmission, clutch and suspension in detail				
Objective(s)	To make the students understand the basic principles involved in the computer aided vehicle design and apply the same for the optimum designing of the vehicle components.				

Course Outcome(s)

CO1	Utilization of computer tools to design the vehicle frame and suspension system
CO2	Development of model of vehicle axle and the steering system with computer aided design
CO3	Creating computer aided design for the clutch and its components.
CO4	To learn about the design of Gear system with modeling in computer
CO5	Computer aided design of the propeller shaft and the rear axle housing are created

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M				S		L
CO2			M	S		L			L	S		M
CO3	S		M						L	M	S	
CO4	M	S								L	S	
CO5				S		L				M		M

Course Topics

VEHICLE FRAME AND SUSPENSION

Study of loads - moments and stresses on frame members. Computer aided design of frame for passenger and commercial vehicle - Computer aided design of leaf springs - Coil springs and torsion bar springs.

FRONT AXLE AND STEERING SYSTEMS

Analysis of loads - moments and stresses at different sections of front axle. Determination of bearing loads at Kingpin bearings. Wheel spindle bearings. Choice of bearings. Determination of optimum dimensions and proportions for steering linkages ensuring minimum error in steering.

CLUTCH

Torque capacity of clutch. Computer aided design of clutch components, Design details of roller and sprag type of clutches

GEAR BOX

Computer aided design of three speed and four speed gear boxes.

DRIVE LINE AND READ AXLE

Computer aided design of propeller shaft. Design details of final drive gearing. Design details of full floating. semi-floating and three quarter floating rear shafts and rear axle housings.

Text Books

1) Dean Averns, "Automobile Chassis Design ", llliffe Books Ltd, 1992.

References

1) Heldt.P.M., "Automotive Chassis ", Chilton Co., New York, 1992.
2) Steeds.W., "Mechanics of Road vehicles ", llliffe Books Ltd., London, 1990.
3) Giles.J.G., Steering, "Suspension and tyres ", llliffe Books Ltd., London, 1988.
4) Newton, Steeds & Garret, "Motor vehicle ", llliffe Books Ltd., London, 1982.
5) Heldt.P.M., "Torque converter ", Chilton Book Co., New York, 1982.
6) Giri.N.K. "Automobile Mechanics ", Khanna Publisher, New Delhi, 1996.

AUT407	TRANSPORT MANAGEMENT	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in the motor vehicle act, insurance, taxation and transport operation.				
Objective(s)	To study & fill up the forms required as per Motor Vehicle Act. To enabling him to work in different state transport organizations and private organization				

Course Outcome(s)

CO1	To know the motor vehicle act framed by the government and to understand its necessity
CO2	To learn about the taxation for the vehicles and various tax to be paid for a vehicle.
CO3	To acquire some knowledge about operating the passenger transport service.
CO4	To acquire the skill to maintain a self-owned goods transportation service.
CO5	To understand about the traffic maintenance system

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			S					S				
CO2			S				M	S				
CO3		M				S		L			S	S
CO4		M				S		L			S	S
CO5		M					L	S	M		S	

Course Topics

MOTOR VEHICLE ACT

Short titles & definitions, Laws governing to use of motor vehicle & vehicle transport, Licensing of drivers & conductors, Registration of vehicle, State & interstate permits, Traffic rules, Signals & controls, Accidents, Causes & analysis, Liabilities & preventive measures, Design of road complex, Responsibility of driver, Public & public authorities, Offences, penalties & procedures, Different types of forms. Government administration structure, Personnel, Authorities & duties, Rules & regulations, Rules regarding construction of motor vehicles

TAXATION

Objectives, Structure & methods of laving taxation, One time tax, Tax exemption & tax renewal Insurance : Insurance types & significance, Comprehensive, Third party insurance, Furnishing of particulars of vehicles involved in accident, Award of the claims tribunal, MACT (Motor Accident Claims Tribunal), Solatium Fund, Hit & Run case, Duty of driver in case of accident, Surveyor & Loss Assessor, Surveyor's report

PASSENGER TRANSPORT OPERATION

Structure of passenger transport organizations, Typical depot layouts, requirements, Problems on fleet management, Fleet maintenance, Planning - Scheduling operation & control, personal & training-training for drivers & conductors, Public relations, Propaganda, publicity, passenger amenities, Advertisement work, Parcel traffic. Theory of fares, Basic principles of fare charging ,Differential rates for different types of services, Depreciation & debt charges, operation cost, Revenues, Economics & records.

GOODS TRANSPORT OPERATION

Structure of goods transport organizations, scheduling of goods transport, Management Information System (MIS) in passenger goods transport operation, storage & transportation of petroleum products.

ADVANCE TECHNIQUES IN TRAFFIC MANAGEMENT

Traffic navigation, global positioning System

Text Book

1) Santosh Sharma, "Productivity in Road Transport", 2nd Edition, Association of State Road Transport Undertakings, New Delhi.

References

1) Motor Vehicle Act - Govt. of India Publications.
2) P.G.Patankar, "Road Passenger Transport in India", CIRT, Pune.
3) S.K. Shrivastava, "Economics of Transport"
4) "Transport Development in India", S. Chand & Co. Pvt. Ltd., New Delhi.

AUT408	AUTOMOTIVE SAFETY	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in the vehicle components and safety equipment of a vehicle				
Objective(s)	To know about the construction and working of various safety equipment equipped in a vehicle for the safety of the driver, passenger and the pedestrians				

Course Outcome(s)

CO1	To know about the traffic light warning signs and the vehicle sign indication.
CO2	To learn about the risks in violating the safety symbols and devices
CO3	To understand the importance of the crash test and to know the risk involved on it
CO4	Analyze the results of the crash test and to predict the hazardous components
CO5	To develop the vehicle with high safety and less hazard to environment.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S						L				
CO2		M						L				
CO3		L					M		S			
CO4							M		M	S		
CO5			S	S					S	M	S	S

Course Topics

LEARNING THE BASICS

Understanding Regulatory and Warning Signs - Guide and International Signs - Understanding the Purpose of Pavement Markings - Responding to Traffic Control Signals -Building Math Skills - Basic Operating Procedures: Automatic Transmission - Basic Operating Procedures: Standard Transmission - Acceleration, Deceleration, and Speed - Learning How to Steer the Car
Building Map Skills.

RISK EVALUATION

Basic trilogy – Decision models -Balancing risks – Combining risks – Biological risk assessments –Human error analysis – Illustrative errors – Acceptable errors – Preventive measures.

CRASH TESTING

Introduction – Volunteer testing – Cadaver testing – Dummies. Crashworthiness – Compliance testing – Component testing – Competitive race testing – Proving ground testing – In field testing.

ANALYSIS AND RECONSTRUCTION

Vehicle Crush – Crash event sequence –Black box data – Momentum and energy – Injury Classifications – Isolation – Reputation - Bullet proof office on wheels –Pedestriants

FUTURE VEHICLE SAFTEY

Human interaction – Distractions – Compensatory actions – Universal design – Precautionary principle – Dealer choice and restrictions –Local issues – Display integration – Adaptive head lights – Global warming and emissions –Design safety research

Text Book

1) "Automotive vehicle safety" by Barbara J. Peters, CRC Press, USA.

Reference book

1) "Automotive safety" By Boy Scouts, USA, 1962
2) "Automotive handbookby Robert Bosch GmbH ".

AUT409	THEORY AND DESIGN OF JIGS AND FIXTURES	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge about the concepts in design of jigs and fixtures.				
Objective(s)	To impart the knowledge on Jigs and Fixtures To learn about design methodology of the jigs and fixtures				

Course Outcome(s)

CO1	To understand the principles, functions and design practices of Jigs, Fixtures and dies for press working
CO2	To understand the Principles of jigs and fixtures design, locating principles, locating elements and clamping Devices.
CO3	To understand the loading and unloading problems in the jigs and fixtures.
CO4	To know about the various types of the bushes employed in design of the jigs and fixtures.
CO5	To study about the design principles of the jigs and the fixtures.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S				M				S	S		
CO2				S						S		
CO3		S		M	S							
CO4				M								
CO5	S				S					S		

Course Topics

INTRODUCTION

Definitions of Jigs and Fixtures - Principles of Jigs and Fixtures design - Preliminary analysis and planning of jigs and fixture parts and their materials - Basic steps in the design of jigs and fixtures - Advantages of Jigs & Fixtures.

LOCATION AND CLAMPING

Degrees of freedom - 3-2-1 location principle - Radial location and diamond pin location - Principle of pin location - location from plane surfaces - location from a profile - location from a cylinder - Circular location - Jamming and remedies - V location - Adjustable locators - Redundant locators - Fool proofing – Adjustable supports and centralizers Strap clamp - cam clamps - screw clamping - latch clamps - wedge clamps – pivoted clamps - eccentric operator clamp - power clamps quick acting clamps - equalizers.

LOADING AND UNLOADING PROBLEMS

Loading - Entering, locating and clamping symmetric consideration. Unloading - Bur clearance, ejectors, receivers, chip problems, relief and projection, shields and seals.

CUTTER GUIDANCE

various types of setting blocks - Press fit bushes - Renewable bushes - Slip bushes - Threaded bushes – Special bushes - Drills with attached bushing for small holes.

DESIGN OF JIGS AND FIXTURES

Three construction principles - Builtup type, casting and weldment Practising the various types of jigs - Practising the various types of milling fixtures - broaching fixtures - function of broaching fixtures - Internal and external broaching fixtures.

Text Book

1) Kempster., M.H.A., " Introduction to jig and tool design ", ELBS Edition, 1990.

References

1) Henriksen, Erik.K., " Jigs and Fixtures ", Design Manual Industrial Press Inc., Madison Avenue, New York, 1983.
2) Donaldson.G.H., Lecain, Gould.V.V., " Tool design ", TMH Edition, 1990.
3) ASTME, " Fundamental of Tool design ", Prentice Hall, 1989.

4) 4. Joshi.P.H. " Jigs and Fixtures ", Tata McGraw-Hill, 1988.

AUT410	RENEWABLE SOURCES OF ENERGY	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge about the renewable energy and nonrenewable energy				
Objective(s)	To provide the knowledge about the different sources of renewable energy that are easily available and their applications on the automobile				

Course Outcome(s)

CO1	To learn about the conversion of the solar energy into the mechanical energy that in terms drives the vehicle.
CO2	To understand about the wind energy and the utilization of wind energy for different environmental works.
CO3	To gain skills about converting the bio-mass into the useful source of energy.
CO4	To understand about the tidal energy, geo thermal energy and wave energy as well as converting them into a useful form of energy.
CO5	To learn about the application of the electrical energy in the automobile.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S							S		M	
CO2		M		M			M			L	M	
CO3		M	S								S	
CO4		L	S	S								
CO5		S		M			M		S	S	S	

Course Topics

SOLAR ENERGY

Conversion of solar energy to electrical energy - availability - advantages and limitations - Power systems.

WIND ENERGY

Wind mapping - location of wind generators - types of wind mills and generators - Induction and synchronous systems.

BIO-MASS

Sources of bio-mass energy - Wood and agricultural waste - Municipal waste - Animal waste – Energy conversion systems - Biogas generation from animal waste - Wood gasification - Downdraft and fluidized bed systems - Alcohol fuels.

OTHER SOURCES

Wave energy - Scope and simple systems for power generation - tidal power - scope and applications. OTEC scope fundamental principles and operating systems for power generation. Geo thermal energy - Principle and simple systems for power generation.

AUTOMOTIVE APPLICATIONS

Electric car operation with energy stored in battery - Energy converted to hydrogen engine operation – Hydrogen conversion and storage system - Relative merits - Direct operation of vehicle by biomass fuels like wood chips, rice husk and alcohol.

Text Book

1) T.Nejat Veziroyqlu., "Alternative energy sources - III "Hemisphere Publishing Co., 1989.

References:
1) F.S.Seiler., "Alternate energy vehicle information ", Wind Book Inc., 1977.
2) Barbara Keiler., "Energy Alternatives", Luscent books, 1990.
3) David Hafemeister, Henry Kelly, Barbara G.Levi, American Institute of Physics, 1985.

AUT411	APPLIED NUMERICAL TECHNIQUES AND COMPUTING	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in Partial Differential equations, differentiation and integration, Laplace equations, matrix.				
Objective(s)	To understand the basic numerical methods to solve partial differential equations To analyze the error for a particular numerical method and appreciate the efficiency in implementation of numerical algorithms To obtain numerical solutions of simple PDEs with the help of MATLAB				

Course Outcome(s)

CO1	Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
CO2	Apply numerical methods to obtain approximate solutions to mathematical problems.
CO3	Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
CO4	Analyze and evaluate the accuracy of common numerical methods.
CO5	Implement numerical methods in Matlab.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L		L	M							
CO2	H		M	M	M							
CO3	H		M	M								
CO4	H	L		M	M							
CO5	M		M	H	H		M			M		H

Course Topics

ERRORS IN NUMERICAL CALCULATIONS
Introduction, Number and their accuracy, Absolute, relative and percentage errors and their analysis, General error formula

INTERPOLATION AND CURVE FITTING
Taylor series and calculation of functions, Introduction to interpolation, Lagrange approximation, Newton Polynomials, Chebyshev Poloynomials, Least squares Line, Curve fitting, Interpolation by Spline functions.

NUMERICAL DIFFERENTIATION AND INTERGERATION
Approximating the derivatives, Numerical diffrentiation formulas, Introduction to numericalquadrature, newton-Cotes formula, Gaussian Quadrature.

SOLUTION OF NON-LINEAR EQUARTIONS
Bracketing methods for locating a root, Initial approximations and convergence criteria, Newton – Raphson and Secant methods, Solution of Problems through a structural programming language such as C++ or Pascal

PARTIAL DIFFERENTIAL EQUATIONS, EIGENVALUES AND EIGENVECTORS
Solution of hyperbolic, Parabolic and elliptic equations, the eigenvalue problem, the power method and the Jacobi method for eigen value problems, Solution of problems through a structural programming language such as C++

or Pascal

Text Books

1) Jhon H.Mathews , "Numerical Methods for Mathematics"., PHI New Delhi.
2) Carnahan B.H., "Applied Numerical Methods", New York

References

1) M.K.Jain, "Numerical Solution of Differential Equations". Wiley Eastern, New York
2) S.D.Sastry., "Introductory Methods of Numerical Analysis", Prentice Hall, India

AUT412	FLEET MANAGEMENT	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge about the management of transportation of public and transportation of goods system.				
Objective(s)	To learn about maintaining record of vehicle operation and maintenance, service schedules, overhauling and repairing procedures.				

Course Outcome(s)

CO1	To acquire skill in supervising and managing of the drivers and garage.
CO2	To impart knowledge related to maintenance of vehicles.
CO3	To know about the data processing in the vehicle parts supply and management.
CO4	To gain knowledge in the fare structure and the scheduling of the transportation system
CO5	To know the motor vehicle act framed by the government and to understand its necessity

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M					S	M
CO2		S					S					
CO3			M		L					S		
CO4			S			S	M					
CO5			S				L	S				

Course Topics

MANAGEMENT TRAINING AND OPERATIONS

Basic principles of supervising. Organising time and people. Job instruction training - Training devices and techniques - Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing - Vehicle operation and types of operations

VEHICLE MAINTENACE

Scheduled and unscheduled maintenace - Planning and scope - Evaluation of PMI programme – Work scheduling - Overtime - Breakdown analysis - Control of repair backlogs - Cost of options.

VEHICLE PARTS, SUPPLY MANAGEMENT AND BUDGET

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. Model - Computer controlling of fleet activity - Energy management

SCHEDULING AND FARE STRUCTURE

Route planning - Scheduling of transport vehicles - Preparation of timetable, Costs, fare structure - Methods of fare collection - Preparation of fare table.

MOTOR VEHICLE ACT

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

Text Book

1) John Dolu, “Fleet management", McGraw-Hill Co., 1984.

References

1) Goverment Publication, “The Motor vehicle Act ", 1989.
2) Kitchin.L.D., " Bus operation ", llliffe and Sons Ltd., London, III Edition, 1992.
3) Kadiyali.L.R., " Traffic engineering and Transport Planning ".

AUT413	HYDROGEN AND FUEL CELLS	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in alternate source of energy and fuel cell vehicles.				
Objective(s)	To impart knowledge to the students about the hydrogen fuel and the fuel cell vehicles as well as the handling of the hydrogen fuel				

Course Outcome(s)

CO1	To learn about the production of the hydrogen through electrolysis process.
CO2	To gain knowledge about the conversion of the hydrogen from gas to liquid and its storage techniques.
CO3	To know about the fuel cells and their working
CO4	To understand about the different types of fuel cells and their function in the vehicles.
CO5	To know about the different fuel system in different vehicles.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				L			M	L	S			
CO2	M			S								
CO3		M									L	
CO4							M					
CO5											S	S

Course Topics

PRODUCTION OF HYDROGEN

Steam reforming – partial oxidation – water electrolysis: reverse fuel cell operation – Gasification and woody biomass conversion – Biological hydrogen production – Photodissociation – Direct thermal or catalytic splitting of water.

HYDROGEN CONVERSION AND STORAGE

Uses as an energy carrier – energy storage medium – Combustion uses – Stationary fuel cell – Compressed gas storage – Liquid hydrogen storage - Hybrid storage – Cryo absorbed gas storage in carbon materials – Other Chemical storage options –Comparison

INTRODUCTION TO FUEL CELLS

Electrochemistry and thermodynamics of fuel cells – Modelling aspects – Quantum chemistry approaches – Application to water splitting – Flow and diffusion modelling – temperature factor

FUEL CELLS

Molten carbonate cells – Solid oxide cells – Acid and alkaline cells – Proton \exchange membrane cells – Biofuel cells – Problems

SYSTEMS

Passenger cars – Bus, lorry – Ships, trains and airplanes – Power plants including stand –a lone systems – Building integrated systems- Portable and other small – scale systems – Problems

Text book

1) “Hydrogen and Fuel cells “Bent Sorensen, Elsevier Academic Press, 2000.

References

1) Hydrogen--hot stuff, cool science By Rex A. Ewing
2) Larminie, James (1 May 2003). Fuel Cell Systems Explained, Second Edition. SAE International. ISBN 0768012597.
3) Production of hydrogen for fuel cells by steam reforming of ethanol, DK Liguras, DI Kondarides, XE Verykios - Applied Catalysis B, Environmental, 2003 - Elsevier

AUT414	LEAN MANUFACTURING	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in the manufacturing technology and process planning and cost analysis				
Objective(s)	To train the student in the concept of product costing To enable the student to understand the several aspects of the product development				

Course Outcome(s)

CO1	To provide knowledge in the stages of product development
CO2	To give knowledge about the lean tools in the manufacturing process.
CO3	To impart the skills in the just in time and kaizen manufacturing processes.
CO4	To gain knowledge about the six sigma principles and innovation
CO5	To learn about the manufacturing processes and recent trends in manufacturing

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		L		L					S			
CO3							M					
CO4			S				S		S			
CO5		S									M	M

Course Topics

INTRODUCTION

Course Overview - Traditional Vs Lean Approaches To Factory - Design & Manufacturing - Lean Concepts - Added Value - Forms Of Waste

LEAN TOOLS

Lean Terminology - Load Leveling – Kanban – Andon - Visual Management - Quick Changeover - Producing To Takt - Supply Chain - 5s – Pull system

JUST IN TIME AND KAIZEN

Kaizen Events - Kaizen Project Selection - Planning For Kaizen Project Review -Preparation For Workshop - Lean Manufacturing Workshop - Value Stream Mapping - World Class Manufacturing Systems – Just In Time Manufacturing

SIX SIGMA AND INNOVATION

Set-Up Reduction - Cell Design - Engineering Logbooks - Logbook Review -– Workplace Integration Of Lean Manufacturing And Six Sigma - Creativity And Innovation Management

ADVANCES IN MANUFACTURING

Advanced Input Systems - Buck Knives -Discrete Event System Simulation - Computer Integrated Manufacturing - Artificial Intelligence In Manufacturing – Case study

Text Book

1) “Lean Manufacturing: Tools, Techniques, and How to Use Them” (APICS Series on Resource Management) by William M Feld, St.Lucie Press
2) “The Toyota Way” by Jeffrey Liker, McGraw-Hill, USA, 2004

References

1) Fred E. Meyers (1992).Motion and Time Study. Improving Work Methods and Management. First Edition, Upper Saddle River, NJ: Prentice Hall.
2) Ralph M. Barnes. Motion and Time Study Design and Measurement of Work. Seventh Edition, Quinn-Woodbine, Inc, J. Wiley.
3) Benjamin W. Niebel (1993). Motion and Time Study. Ninth Edition. Irwin Publishers.

AUT415	AUTOMOTIVE AIR-CONDITIONING	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in Refrigeration and air conditioning and the temperature control techniques				
Objective(s)	To enable the students to know about the components of the automotive air conditioning system and to understand its working and necessity.				

Course Outcome(s)

CO1	To identify and describe the principles of the air conditioning system.
CO2	To apply the concept of heating in the air conditioning system.
CO3	To describe the working principles refrigeration system
CO4	To identify the components of the temperature control devices in an automobile.
CO5	To maintain and service the air conditioner of an automobile in case of a failure.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	L		S								
CO2							S		S			
CO3		S										
CO4							M		S			
CO5			S								S	S

Course Topics

AIRCONDITIONING FUNDAMENTALS

Basic air conditioning system - Location of air conditioning components in a car - Schematic layout of a refrigeration system. Compressor components - Condenser and high pressure service ports. Thermostatic expansion value - Expansion value calibration - Controlling evaporator temperature - Evaporator pressure regulator - Evaporator temperature regulator

AIR CONDITIONER - HEATING SYSTEM

Automotive heaters - Manually controlled air conditioner - Heater system - Ford automatically controlled air conditioner and heater systems - Automatic temperature control - Air conditioning protection – Engine protection

REFRIGERANT

Containers - Handling refrigerants - Tapping into the refrigerant container - Refrigeration system diagnosis - Diagnostic procedure - Ambient conditions affecting system pressures.

AIR ROUTING & TEMPERATURE CONTROL

Objectives - Evaporator care air flow through the Dash recirculating unit - Automatic temperature control – Duct system - Controlling flow - Vacuum reserve - Testing the air control and handling systems.

AIR CONDITIONING SERVICE

Air conditioner maintenance and service - Servicing heater system Removing and replacing components. Trouble shooting of air controlling system - Compressor service.

Text book

1) 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 Ind., 1989.

2) Paul Weiser, “Automotive Air Conditioning ", Reston Publishing Co Inc., 1990.
3) MacDonald, K.L., “Automotive Air Conditioning ", Theodore Audel series, 1978.
4) Goings. L.F., Automotive Air Conditioning ", American Technical services, 1974.

MEC412	MICRO ELECTRO MECHANICAL SYSTEMS	L	T	P	C
		3	0	0	3
Prerequisite	Basics in Mechanics and various Manufacturing processes.				
Objective(s)	The course aims to introduce the need of MEMS and their applications. The Course introduces the consideration in the design process of Micro Electro Mechanical Systems with their Machining and Fabrication techniques and the control methods of these processes.				

Course Outcome(s)

CO1	An overview of Micro Electrical Mechanical Systems (MEMS).
CO2	To describe the various fabrication processes of MEMS.
CO3	A review on micro machining process.
CO4	To describe the process design for MEMS
CO5	An overview of reliability and process control for systems.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		H	H									
CO2				M	M							
CO3			M	M								
CO4	H	H	H									
CO5				M			M					

Course Topics

FUNDAMENTALS OF MEMS

Introduction, history, development and need of micro-electro - mechanical systems -overview of MEMS technology.

MATERIALS AND FABRICATION PROCESSES

Different electro-physical processes used for machining - dealing with MEMS materials - relevant non - conventional processes - IC fabrication processes used for MEMS - MEMS sensors and actuators.

MICRO MACHINING

Mechanical process techniques and process models for micro-machining- Fabrication processes and design of the process sequences

DESIGN CONSIDERATION

Design consideration –process design-mechanical design –design of silicon die-design of micro fluidic net work systems-capillary electrophoresis network system.

RELIABILITY AND PROCESS CONTROL

Reliability and process control of micro manufacturing processes.

Text Book

1. Tai Ran Hsu, MEMS and MICRO SYSTEMS Design and Manufacture, TMH, New Delhi, 2001.

References

1. Vijay K Varadan, Micro Sensors, MEMS, and Smart Devices, John Wiley and sons, 2001.
2. Marc Madou, Fundamentals of micro Fabrication, CRC Press,1997.

MEC418	RAPID PROTOTYPING	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge about Rapid prototyping.				
Objective(s)	Obtain a solid understand of Rapid Prototyping, including its applications, advantages and limitations.				

Course Outcome(s)

CO1	To know the existing technologies of rapid prototyping
CO2	To explain the product development, conceptual design, prototype tooling etc.
CO3	To prepare the cad processes, solid modeling and modify desired format.
CO4	To identify the applications, advantages of rapid prototyping. To explain all types of rpt process (SLS, FDM).
CO5	To compare the LOM process, FDM process, direct shell producing, casting process between them. To know the ADV application.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		H										
CO2	H	H	H	H								
CO3					H							
CO4	M				M							
CO5		M						L				

Course Topics

INTRODUCTION

Introduction - basic concept - overview of existing technologies of proto type tooling - need for speed design to market operations.

BASICS OF TOOLING

Product development - state of the technology- conceptual design - prototype tooling - engineering pilot - limitations.

DEVELOPMENT OF DATA REPRESENTATION

CAD Processes - data requirements for solid modeling - data representation - part orientation and support - STL format - slicing – post processing.

RPT PROCESS

Rapid prototyping systems - selective laser sintering - working principles - advantages and limitations - sterolithography - working principles - applications, advantages and limitations.

OTHER SYSTEMS

Laminated object modeling - waving principles, applications - advantages and limitations – fused deposition, modeling - direct shell production casting - applications.

Text Book

1. Soenen, R., and Olling, Advanced CAD/ CAM Systems, Narosa Publishing house, 1995.

References

1. Duvvent, W. R, The Lithography Hand book, Narosa Publishing house, 1995.
2. Rapind News, University of Warwick, UK, 1995.

MEC420	INDUSTRIAL ENGINEERING	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge of industrial concepts in engineering fields				
Objective(s)	Develop, implement, and improve integrated systems that include people, materials, formation, equipment, and energy using appropriate analytical, computational and experimental practices. Apply information technologies to the practice of industrial engineering. Conduct themselves in a professional and ethical manner. Work and communicate effectively with colleagues at every level in the organization				

Course Outcome(s)

CO1	Ability to apply knowledge in industries
CO2	Ability to function on multi-disciplinary teams.
CO3	Ability to identify, formulates, and solves engineering problems.
CO4	Understanding of professional and ethical responsibility.
CO5	Ability to communicate effectively.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M		L		M			M				
CO2	M		H		L			H				
CO3	M		L		H			L				
CO4	M		M					M				
CO5	M		L					H				

Course Topics

PLANT LAYOUT AND MATERIALS HANDLING

Plant location, - classification of layout – layout design procedures - CRAFT, ALDEP, CORELAP - materials handling systems – principles - classification of materials handing equipments - production and operation decisions.

PRODUCTIVITY MANAGEMENT AND WORK STUDY

Introduction, productivity models, organizational transformation, re-engineering, process improvement models, re-engineering tools and implementation, reverse engineering - work study - time study - method study - tools – methods.

RELIABILITY ENGINEERING

Reliability concept - reliability data analysis - prediction models - reliability management - risk assessment.

ERGONOMICS OF MANUFACTURING

Introduction - human performance - work space design - design of equipments - design of environment.

PROJECT MANAGEMENT

Phases of project management – network constructions – CPM – PERT – crashing – resource leveling - resource allocation.

TEXT BOOKS

1. ILO, Introduction to work study, Geneva, 1974.
2. Richard Francis L. and John A.White, Facilities layout and location an analytical approach, Prentice Hall Inc,1984.

REFERENCES

1. Barnes, raeph.M, Motion and time study -design and measurement work, John wiley, Newyork, 1990
2. Khanna, O.P., Industrial Engineering and Management, Dhanpatrai Publication, 2004.
3. Gopalakrishnan, P., and Banerji, A.K., Maintenance and Spare Parts Management, Prentice Hall Of India, New Delhi, 1991.
4. Edosomwan, J.A., Organisational Transformation and Process Re-engineering, British

Library Cataloging In Pub. Data, 1996.
5. Rastogi, P.N., Re-Engineering and Re-Inventing the Enterprise, Wheeler Publications, New Delhi, 1995.
6. Fiegenbarum, A.V., Total Quality Control, Mcgraw-Hill, Inc., 1991.
7. Modarres, Reliability and Risk Analysis, Maral Dekker Inc., 1993.
8. James Apple, M.., Plant Layout and Material Handling, John Wiley, 1977.
9. Lee J Krajewski, Larry P Ritaman, Operations Managements, Addison-Wesley, 2000.
10. Prasannachandra, Project management, Tata Mcgraw Hill, 1986.

MINOR ELECTIVE

CHE325	COMPUTATIONAL FLUID DYNAMICS	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in Numerical methods, Fluid mechanics and Heat transfer.				
Objective(s)	The course introduces the various methods to solve the complex fluid and heat flow problems.				
Course Outcome(s)					
CO1	Understanding the theory of computational fluid dynamics which portray different types of flow, boundary conditions and governing equation for different fluid flow.				
CO2	Understand the importance of finite difference method and application of finite difference methods in real time applications.				
CO3	Be able to synthesize the diverse approaches of finite volume methods and its Applications				
CO4	To gain knowledge in finite element methods and applications. Be able to recognize and articulate the interplay between finite element, finite volume and finite difference methods				
CO5	To gain experience in the application of CFD analysis to real engineering designs and to build up the skills in the actual implementation of CFD methods in using commercial CFD codes				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H									
CO2	H	H	H	H								
CO3	H	H	H	H								
CO4	H	H	H									L
CO5	H	H	H									

Course Topics

CLASSIFICATION OF PARTIAL DIFFERENTIAL EQUATIONS

Classification of partial differential equations - Discretization methods, finite difference and finite volume formulations – classification of PDES.

NUMERICAL SOLUTION OF ELLIPTICAL EQUATIONS

Numerical solution of elliptical equations - linear system of algebraic equations – iterative solution of system of linear equation.

MODEL EQUATIONS

Model equations – wave equations, numerical solution of parabolic equations, stability analysis – advanced shock capturing schemes.

DIFFUSION EQUATION

Solutions of convection, diffusion equation – conservative and non-conservative schemes – concept of artificial viscosity and numerical diffusion.

NAVIER, STOKES EQUATIONS AND ALGORITHMS

Navier, Stokes equations and algorithms - basics of grid generation, numerical solution of hyperbolic equations, burgers equation generation.

Text Books

1) Anderson Jr., Computational Fluid Dynamics, John Wiley, Singapore, 1995.
2) Chow,C.Y., Introduction to computational fluid dynamics , John Wiley, Singapore 1979.
3) Hirsch,A.A., Introduction to computational fluid dynamics, McGraw Hill, New York, 1989.

References

1) Wirz, H.J, Smeldern, J.J., Numerical methods in fluid dynamics, McGraw-Hill and Co.,New York,1978.
2) Ferziger,J.H,Milovan Peric , Computational Methods for fluid dynamics, Springer Verlag ,London, 2nd Edition,1997.
3) Pozrikidis,C., Introduction to Theoretical and Computational Fluid Dynamics, Oxford University Press,London, 1997.
4) Bose,T.K., Computation Fluid Dynamics , Wiley Eastern Ltd, Singapore, 1988.

CHE326	COMPUTATIONAL HEAT TRANSFER	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge about structure of solids and its types				
Objective(s)	To gain knowledge and understand about the solid state materials , conducting , semiconducting , super conducting , di electric , magnetic , optical materials To learn the latest developments on new engineering materials				
Course Outcome(s)					
CO1	Understand the free electron theories, formation of energy bands, energy distribution and also the electron behavior in solids				
CO2	Know and understand the cooper pair electron behavior, applications of superconducting materials in developing technologies				
CO3	Learn the importance of semiconducting materials in engineering fields by projecting the view of energy bands.				
CO4	Gain the knowledge about various kinds of magnetic materials, their properties and applications in advanced technologies.				
CO5	Gain the knowledge about dielectric materials, their properties and significant applications in advanced technologies.				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M	M			L					
CO2	M		M									
CO3	M		M				L					
CO4	M		M	M								
CO5	M		M				L					

Course Topics

INTRODUCTION

Physical phenomena governing differential equation, energy equation, momentum equation, nature of coordinates, Discretization methods.

PARABOLIC EQUATIONS

Parabolic equations - explicit, implicit and Crank Nicholson Methods - Cartesian and Polar Coordinates - mixed boundary condition - Jacobi - Gauss, siedel and SOR Methods.

HEAT CONDITION AND CONVECTION

Heat condition and convection - control volume approach - steady and unsteady one dimensional conduction - two and three dimensional - power law scheme - simpler algorithm.

GENERAL APPLICABILITY OF THE METHOD

General applicability of the method - approximate analytical solution - Raleigh's Method- Galerkin Method, solution methods.

CONDUCTION AND DIFFUSION EQUATIONS

Isoparametric element formulations conduction and diffusion equations, heat transfer Packages, Heat 2, HEATAX, RADIAT, ANSYS.

Text Books

1) Muralidhar, K., Sundararajan, T., Computational fluid flow and heat transfer ,Narosa publishing house, New Delhi,2nd edition,2003.
2) Anderson,D.A., Tannehill,J.C and Pletcher,R.H., Computational fluid mechanics and heat transfer, Hemisphere publishing corporation ,New York,1984.

References

1) Mitchell,A.R, Grifths,D.F., Finite Difference Method in Partial Differential Equations , John Wiley and Sons,Singapore,1980.
2) Suhas Patankar., Numerical Heat Transfer and Fluid Flow, (Hemisphere Series on Computational Methods in Mechanics and Thermal Science), Taylor and Francis,1st Edition ,1980.
3) Jaluria and Torrance, Computational Heat Transfer, Hemisphere Publishing Corporation, New York, 1986.

CIV425	DISASTER MANAGEMENT AND THERMODYNAMICS	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge about the Disaster management and thermal engineering				
Objective(s)	To familiarize about the Disaster, Geology and topography, Weather and climate, Ecosystems, Human factors				
Course Outcome(s)					
CO1	Able to improve the knowledge and understanding of the disaster phenomenon and, its factors.				
CO2	Understand the relationship of hazard, risk and vulnerability				
CO3	Able to obtain the skills in role of education and training in disaster prevention.				
CO4	Able to ensure skills in post disaster management activities				
CO5	Able to get the knowledge in understanding various prone zones in India				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					M	H	M	M				
CO2	L						M	L				M
CO3	M					M	L					

CO4							H	H	L		M	
CO5				L					M			S

Course Topics

ESSENTIAL COMPONENTS AND CO-ORDINATION IN DISASTER RESPONSE

Disaster Response Plan - Communication, Participation and Activation of Emergency - Preparedness Plans - Search, Rescue, Evacuation and other logistic management - Needs and Damage Assessment; Types and Technique - Disaster Response: Central, State, District and Local Administration - Armed Forces in Disaster Response: Role and Responsibility - Disaster Response: Police and Other organizations - Role of Multiple stakeholders in Disaster Response

HUMAN BEHAVIOR AND RESPONSE MANAGEMENT

Psychological Response and Psychological Rehabilitation - · Trauma and Stress Management - Rumour and Panic Management - Medical and Health Response to Different Disasters - Role of Information and Communication Technology in Response Management

RELIEF MEASURES

Minimum Standard of Relief - · Relief Management- essential components - · Funding Relief - short term and long term - · Disaster Site Management - Recovery

ENERGY AND IRREVERSIBILITY

Review of fundamental concepts and definitions - Review of first and thermodynamics – entropy - properties of substances - quality of energy, maximum work in a reversible process – reversible work by an open system exchanging heat only with surroundings - useful work - dead state – availability - irreversibility and Gouy-Stodala Theorem - Mathematical conditions for exact differential - Maxwell's equation - Tds equation - Thompson coefficient and Inversion curve - coefficient of volume expansion

GAS POWER CYCLES AND GAS COMPRESSORS Gas power cycles: Carnot cycle - Stirling cycle - Ericsson cycle - Air standard cycles - Otto cycle - Diesel cycle - Limited pressure cycle or Dual cycle - comparison of Otto, Diesel and Dual cycles - Brayton cycle - Aircraft propulsion - Brayton-Rankine combined cycle Gas compressors: Compression processes - work of compression - single stage reciprocating air compressor - volumetric efficiency - multi stage compression - air motors - rotary compressors - blowers and fans

Text Books

1) Jagbir Singh, Disaster Management: Future Challenges and Opportunities, I K International Publishing House Pvt. Ltd, 2007.
2) Kapoor Mukesh, Disaster Management Paperback, Saurabh Publishing House, 2010
3) Tushar Bhattacharya, Disaster Science and Management Paperback, McGraw Hill Education (India) Private Limited, 2012
4) Engineering thermodynamics by Jones and Dugans, PHI Learning Pvt. Ltd.
5) Gas turbine Theory & Practice, by Cohen & Rogers, Addison Weslay Longman Ltd.

References

1) Taori, K (2005) Disaster Management through Panchayati Raj, Concept Publishing Company, New Delhi.
2) Fundamentals of thermodynamics by Sonntag, Wiley India
3) 3. Fundamentals of Classical Thermodynamics by Van Wylen, John Wiley and Sons.

CSE314	DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

Prerequisite	Basic understanding about mathematical transforms and partial differential equations.
Objective(s)	To understand the theoretical knowledge of digital image processing techniques and applications

Course Outcome(s)

CO1	Acquire the fundamental concepts of a digital image processing system.
CO2	Learn different image transforms techniques
CO3	Apply image enhancement techniques.
CO4	Understand the concept of restoration techniques.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	L		L							
CO2			M	L								
CO3		M										
CO4			H		L							M

Course Topics

REVIEW OF IMAGE FUNDAMENTALS

The fast Fourier transform - other separable image transforms. Image Enhancement: Background - Enhancement by point processing -spatial filtering - Enhancement in the frequency Domain - generation of spatial masks from frequency domain specifications - color image processing.

IMAGE RESTORATION

Degradation model - Diagonalisation of circulant and Block Circulant Matrices - Algebraic approach to Restoration - Inverse filtering Least mean square filter - Constrained Least Squares Restoration - Interactive Restoration - Restoration in the spatial domain - Geometric Transformation.

IMAGE COMPRESSION

Fundamentals - Image Compression Models - Elements of Information theory - Error Free Compression - Lossy Compression - Compression Standards.

IMAGE SEGMENTATION

Detection of Discontinuities - Edge linking and Boundary Detection - Threshold - Region Oriented segmentation - The use of motion in segmentation.

IMAGE REPRESENTATION AND DESCRIPTION REPRESENTATION SCHEMES

Boundary Descriptors - Regional Descriptors - Morphology - Relational Descriptors Recognition and Interpretation - Elements of Image Analysis - Patterns and Pattern Classes - Decision - Theoretic Methods - Structural Methods - Interpretation.

Text Book

1) Rafael C., Gonzalez and Richard. E., Woods, Digital Image Processing, Addison Wesley, 1992.

References

1) Pratt, Digital Image Processing, Tata McGraw Hill, 1991.
2) Anil K. Jain, Fundamentals of Digital Image processing, Prentice Hall of India, 1st Edition, 1998.

EEE306	SPECIAL ELECTRICAL MACHINES	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in electrical machines				
Objective(s)	To expose the students to concepts of D.C. Machines, transformers and their applications. To impart industry oriented learning.				

Course Outcome(s)

CO1	Analyze and describe aspects of the construction and principles of synchronous machines
CO2	Describe the construction, application and operation of transformer
CO3	Describe the construction, application, operation and speed control of D.C.Motors
CO4	Explain the working and application of special machines like stepper motor and universal motor
CO5	Design an electronic system using appropriate electronic machines

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H			H								
CO2	H			H								
CO3	H											
CO4				M								
CO5			H									M

Course Topics

SYNCHRONOUS RELUCTANCE MOTORS

Constructional features – types – axial and radial air gap motors – operating principle – reluctance – Phasor diagram - characteristics – Vernier motor.

STEPPING MOTORS

Constructional features – principle of operation – variable reluctance motor – hybrid motor – single and multi stack configurations – theory of torque predictions – linear and non-linear analysis – characteristics – drive circuits.

SWITCHED RELUCTANCE MOTORS

Constructional features – principle of operation – torque prediction – power controllers – non-linear analysis – microprocessor based control - characteristics – computer control.

PERMANENT MAGNET BRUSHLESS D.C. MOTORS AND INDUCTION MACHINES

Principle of operation – types – magnetic circuit analysis – EMF and torque equations – power controllers – motor characteristics and control - Induction voltage regulator -Synchronous induction motor - power selsyn - position selsyn - linear motors.

PERMANENT MAGNET SYNCHRONOUS MOTORS

Principle of operation – EMF and torque equations – reactance – Phasor diagram – power controllers - converter - volt-ampere requirements – torque speed characteristics - microprocessor based control.

Text Book

1) Miller T.J.E., Brushless Permanent Magnet and Reluctance Motor Drives, Clarendon Press, Oxford, 1989.
2) Aearnley P., Stepping Motors – A Guide to Motor Theory and Practice, Peter Perengrinus, London, 1982.

References

1) Kenjo, T., Stepping Motors and Their Microprocessor Controls, Clarendon Press London, 1984.
2) Kenjo,T., and Nagamori,S., Permanent Magnet and Brushless DC Motors, Clarendon Press, London, 1988.

EEE410	NEURAL NETWORK AND FUZZY LOGIC	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in networks				
Objective(s)	The main objective of this course is to provide the students with the basic understanding of neural networks and fuzzy logic fundamentals program the related algorithms and design the required and related systems.				
Course Outcome(s)					
CO1	Expose the students to the concepts of biological neural systems and mathematical model of neural systems				
CO2	Expose the students the concepts of feed forward neural networks and provide adequate knowledge about feedback neural networks				
CO3	Teach about the concept of fuzziness involved in various systems and adequate knowledge about Fuzzy set theory.				
CO4	Apply neuro fuzzy model for classification, regression and clustering				
CO5	Apply hybrid algorithms to identify and describe soft computing techniques and their rolls in building intelligent machines in various applications				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H		H								M
CO2	M	L		H								L
CO3	H											
CO4	M	L										
CO5	H	L		H								L

Course Topics

INTRODUCTION TO NEURAL NETWORKS

Overview of biological Neuro-system - mathematical models of neurons - learning rules - learning paradigms – supervised - unsupervised and reinforcement learning.

FEEDFORWARD AND FEEDBACK NETWORKS

Perceptron networks - training rules – multilayer perceptron - back propagation algorithm - associative memories - Hopfield networks - Boltzman machine – self organizing map.

FUZZY LOGIC

Overview of classical sets - introduction to fuzzy logic - membership function - fuzzy rule generation - operations on fuzzy sets – compliment – intersections – unions - combinations of operations- fuzzy if-then rule - fuzzy inferencing – Mamdani, TSK –defuzzification.

NEURO FUZZY SYSTEM

Adaptive Neuro Fuzzy Inference Systems (ANFIS) – architecture - hybrid learning algorithm - Parameter identification-Rule base structure identification – input selection -input space partitioning – Neuro-Fuzzy control.

APPLICATIONS

Applications of neural network – pattern recognition - fuzzy logic control – inverted pendulum – image processing – home heating system – biomedical applications – applications of neuro-fuzzy system - character recognition - channel equalization-noise cancellation.

Text Books

1. Jang .J.S.R., Sun. C.T., E. Mizutani, Neuro-Fuzzy and Soft Computing, Prentice Hall of India Pvt. Ltd, New Delhi,2005
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Tata McGraw Hill, 1997.

References

1. Laurance Fausett, Englewood cliffs, N.J., Fundamentals of Neural Networks, Pearson Education, 1992.
2. Zimmermann .H.J., Fuzzy Set Theory and its Applications, Allied Publication Ltd., 1996.
3. John Yen and Reza Langari, Fuzzy Logic – Intelligence Control and Information, Pearson Education, New Delhi, 2003

MEC315	DESIGN FOR MANUFACTURE	L	T	P	C
		3	0	0	3
Prerequisite	**Basic knowledge in Mechanical Engineering**				
Objective(s)	To give detail explanation on different machine including special machines and CNC machines. To develop knowledge on quality and importance of measuring systems will be explained				

Course Outcome(s)	
CO1	Understand the constructional features of limitation and tolerances.
CO2	Analyze the utilization of materials choice for different machine.
CO3	Known about the importance of component design and machining consideration.
CO4	Known about the importance of component design and casting consideration.
CO5	Have knowledge about redesign for manufacture

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M											
CO2							M					
CO3			H		M							
CO4			H		M							
CO5	M		H				L					

Course Topics

INTRODUCTION

General design - principles for manufacturability, strength and mechanical factors, mechanisms selection, evaluation method - process capability - feature tolerances - geometric tolerances - assembly limits – datum features - tolerance stacks.

FACTORS INFLUENCING FORM DESIGN

Working principle - material, manufacture, design - possible solutions - materials choice- influence of materials on form design of welded members, forgings and castings.

COMPONENT DESIGN –MACHINING CONSIDERATION

Design features to facilitate machining - drills, milling cutters, keyways - doweling procedures - counter sunk screws - reduction of machined area - simplification by separation - simplification by amalgamation - design for machinability - design for economy - design for clampability - design for accessibility - design for assembly.

COMPONENT DESIGN – CASTING CONSIDERATIONS

Redesign of castings based on parting line considerations - minimizing core requirements, machined holes, redesign of cast members to obviate cores.

REDESIGN FOR MANUFACTURE AND CASE STUDIES

Identification of uneconomical design - modifying the design - group technology - computer applications for DFMA.

Text Book

1) Harry Peck, Design for Manufacture, Pittman Publication, 1983.

References

1) Robert Matousek, Engineering Design - A systematic approach, Blackie and sons Ltd., 1963.
2) James G. Bralla, Hand Book of Product Design for Manufacturing, McGraw Hill Co., 1986.
3) Swift, K.G., Knowledge based design for manufacture, Kogan Page Ltd., 1987.

MEC317	TRIBOLOGY	L	T	P	C
		3	0	0	3

Prerequisite	Fundamentals of mathematics, Engineering Mechanics and Fluid Mechanics
Objective(s)	Apply the basic theories of friction, wear and lubrication to predictions about the frictional behavior of commonly encountered sliding interfaces. Characterize features of rough surface and liquid lubricants as they pertain to interface sliding. Interpret the latest research on new topics in tribology including its application to nanoscale devices and biological systems

Course Outcome(s)

CO1	To describe the basic principles and types of friction and wear
CO2	To understand the necessity of lubrication and to study the theory
CO3	Design and performance analysis of fluid film bearings
CO4	To evaluate the load, stress and life capacity of rolling element bearings

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H										M
CO2	M	M										
CO3	M		H		H					L		
CO4	H		H	H								M

Course Topics

SURFACE FRICTION AND WEAR

Topography of the surfaces - surface features - surface interaction - theory of friction - sliding and rolling friction, friction properties of metallic and non-metallic materials, friction in extreme conditions - wear- types of wear - mechanism of wear - wear resistance materials - surface treatment - surface modifications - surface coatings.

LUBRICATION THEORY

Lubricants-physical properties, lubricants standards, lubrication regimes - hydrodynamic lubrication - Reynolds equation - thermal, inertia and turbulent effects - elasto hydrodynamic, plasto hydrodynamic and magneto hydrodynamic lubrication - hydro static lubrication - gas lubrication.

DESIGN OF FLUID FILM BEARINGS

Design and performance analysis of thrust and journal bearings - full, partial, fixed and pivoted journal bearings design - lubricant flow and delivery - power loss, heat and temperature, rotating loads and dynamic loads in journal bearings - special bearings - hydrostatic bearing design.

ROLLING ELEMENT BEARING

Geometry and kinematics - materials and manufacturing processes - contact stresses - hertzian stress equation, - load divisions - stresses and deflection - axial loads and rotational effects - bearing life capacity.

Text Book

1) Sahoo, Engineering Tribology, PHI, New Delhi, 2007.

References

1) Kragelsky, I.V., and Alisin, V.V., Tribology- lubrication, wear and lubrication, Professional Engineering Publishing, 2001.
2) Basu, S.K., Senguta, S.N., Fundamentals of Tribology, PHI, New Delhi, 2006.
3) Cameron, A., Basic Lubrication Theory, Ellis Herward Ltd., UK, 1981.
4) Hulling, J., Principles of Tribology, MacMillan , 1984.
5) Williams, J.A., Engineering Tribology, Oxford Univ. Press, 1995.

MEC323	MATERIALS MANAGEMENT	L	T	P	C
		3	0	0	3
Prerequisite	Knowledge in management aspects and also various tools applied in management, basic production process and flow of cash				
Objective(s)	To famiiarize in the area of materials flow inside the industries and give wide knowledge on JIT				

Course Outcome(s)

CO1	To possess a sound knowledge of the key subject areas of materials management.
CO2	To developed the skills of knowledge acquisition of purchase management in industrial sectors.
CO3	To plan, execute and report on store activities and also able to manage inventory by using various analysis.
CO4	To learn about JIT, MRP I, MRP II, vender evaluation, etc.
CO5	

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M		L					M				L
CO2	M		M		M			H			L	
CO3	M	L	L		H			M				
CO4	H		L		M			M				L
CO5												

Course Topics

FUNCTIONS OF MATERIALS MANAGEMENT

Introduction - objectives - organizations - functions - administration - integrated approach - relationship with other department.

PURCHASING MANAGEMENT

Purchasing policies and procedures - legal aspects - selection of sources of supply - forms and records - methods of purchasing - capital purchasing ethics.

STORES MANAGEMENT

Store function - location - layout - materials handling and movement -stock taking-procedures and records – ABC and VED system of stock control.

INVENTORY MANAGEMENT

EOQ - inventory systems - periodic - deterministic and probabilistic models - static inventory model – reorder point – lead time analysis – safety stocks

VALUE ANALYSIS

Standardization - variety reduction - JIT - MRP I, MRP II - vender evaluation and rating - inventory audit and information systems.

Text Book

1) Lamer Lee and Donald W Dobler, Purchasing and Materials Management, Tata McGraw-Hill, New Delhi, 1996.

References

1) Gopalakrishnan, P., Purchasing and Materials Management, Tata McGraw Hill Publishing Co. Ltd. New Delhi,1996.
2) Gopalakrishnan, P.,Handbook of Materials Management, Prentice Hall of India, New Delhi, 1996.
3) Starr and Miller, Inventory Control Theory and Practice, Prentice Hall of India, NewDelhi, 1989.
4) Ahuja, K.K., Material Management, CBS Pub., New Delhi, l992.
5) Spencer B.S., Computer Based Production and Inventory Control, Prentice Hall, 2002.

6) Joseph S.M., Production and Operations Management, John wiley and sons, 1999.
7) Datta, A.K., Integrated Materials Management: A Functional Approach, Prentice Hall of India Ltd., New Delhi, 1998.

MEC327	HEAT AND MASS TRANSFER	L	T	P	C
		3	0	0	3
Prerequisite	Knowledge of Thermodynamics and Fluid Mechanics				
Objective(s)	The course is intended to build up necessary background for understanding the physical behavior of various modes of heat transfer, like, conduction, convection and radiation and to understand the application of various experimental heat transfer correlations in engineering calculations, to learn the thermal analysis and sizing of heat exchangers and also to understand the basic concepts of mass transfer.				
Course Outcome(s)					
CO1	To understand the concept of modes of transfer (conduction , convection and radiation)				
CO2	To identify and analyze the mechanism of heat and mass transfer correctly which is occurring in a range of context.				
CO3	To be able to solve the problems in 1-D and 2-D steady state heat conduction in plane wall, composite wall and cylinder.				
CO4	To discuss the free and forced convection and to perform the calculations for convection.				
CO5	To apply their knowledge and develop, test heat / mass transfer systems.				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M		M	H	H					L		
CO2	H	H			M				L		M	
CO3	L	H					L				H	
CO4	L		H					M		L		
CO5	H	H	H		M						H	M

Course Topics

PRODUCT DESIGN PROCESS

The design process - morphology of design - design drawings - computer aided engineering - designing of standards - concurrent engineering – product life cycle - technological forecasting – market identification - competition bench marking - systems engineering - life cycle engineering - human factors in design industrial design.

CONCEPTUAL DESIGN

Creativity and problem solving - product design specifications - conceptual design - decision theory embodiment design - detail design.

MODELLING AND OPIMIZATION

Mathematical modeling - simulation - geometric modeling - finite element modeling - optimization - search methods - geometric programming - structural and shape optimization.

MATERIAL SELECTION AND DESIGN FOR ASSEMBLY

Material selection process - economics - cost Vs performance - weighted property index - value analysis role of processing and design - classification of manufacturing processes - design for manufacture - design for assembly - design for castings, forging, metal forming, machining and welding - residual stresses – fatigue.

QUALITY IN DESIGN

Total quality concept - quality assurance - statistics process control - Taguchi methods - robust design - failure model effect analysis.

Text Book

1) Dieter George, E., Engineering Design - A Materials and Processing Approach, McGraw Hill, International Edition Mechanical Engg. Series, 1991.

References

1) Karl, T., Ulrich and Steven, Product Design and Development ,McGraw Hill, 2000.
2) Palh, G., and Beitz, W., Engineering Design, Springer - Verlag , New York, 1985.
3) Ray, M.S., Elements of Engineering Design, Prentice Hall Inc, 1985.
4) Suh, N.P., The Principle of Design, Oxford University Press, New York, 1990.

MEC410	MECHANICAL BEHAVIOUR OF MATERIALS	L	T	P	C
		3	0	0	3
Prerequisite	Fundamental knowledge in material science				
Objective(s)	To consider a wide range of topics, including mechanical testing to determine material properties, plasticity needed for FEM analysis of automobile crashes, means of altering mechanical properties and treatment of several modes of failure.				

Course Outcome(s)

CO1	Capable to understand of plastic-elastic deformation and stress-strain relationship of materials
CO2	Ability to understand the material plasticity, dislocation, work hardening and strain hardening mechanism.
CO3	Able to know about testing and tensile properties of engineering materials.
CO4	To gain experience in various hardness testing techniques.
CO5	Acquire the knowledge of mechanical properties in torsion and torsional stresses

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									M			
CO2					M		L					
CO3	S			S		M				S		
CO4		M		M								
CO5											M	

Course Topics

DEFORMATION

Elastic and plastic deformation -Stress-strain relationship, plastic deformation of metallic materials - Mohr's circle - Yielding criterion - Von Mises and maximum shear stress, tresca yielding criterion -Failure criteria under combined stresses

THEORY OF PLASTICITY

Elements of theory of plasticity - dislocation theory, properties of dislocation, stress fields around dislocations, elementary dislocation interactions - application of dislocation theory to work hardening and strengthening mechanisms.

TENSILE PROPERTIES

Engineering stress-strain curve - true stress- strain curve - instability in tension, stress distribution at the neck, ductility measurement, effect of strain rate and temperature on flow properties, testing machines - tensile properties of important materials.

HARDNESS TESTING

Introduction - Brinell, Vickers, Rock well and Meyer hardness test, analysis of indentation by an indenter - Relationship between hardness and the flow curve – micro hardness tests- hardness conversion, hardness at elevated temperatures.

TORSION

Introduction - mechanical properties in torsion, torsional stresses for large plastic strains- types of torsion failures - torsion test vs. tension test - hot torsion testing.

Text Book

1) Thomas H. Courtney, Mechanical Behavior of Materials, Waveland Pr Inc; 2nd edition, 2005.

References

1) Dieter, G. E., Mechanical Metallurgy, McGraw Hill Publications, 3rd Edition,1988.
2) Suryanarayana, Testing of Metallic Materials, Prentice Hall India, New Delhi, 1979.
3) Rose, R.M., Shepard, L.A., Wulff, J., Structure and Properties of Materials, Volume III, John Wiley, 4th

Edition, 1984.
4) Honeycombe, R.W.K., Plastic Deformation of Materials, Edward Arnold Publishers, 1984.

MEC421	NON-DESTRUCTIVE EXAMINATION	L	T	P	C
		3	0	0	3

Prerequisite	Basic knowledge in mechanical testing, material characterization and defects
Objective(s)	By the end of this course you should become familiar with a wide variety of nondestructive testing techniques for use in design, manufacturing and industrial service. You will able to know how each technique works, how you can apply it, when and where it can be used and the technique's capabilities and limitations.

Course Outcome(s)

CO1	To identify the errors in the technical background.
CO2	To examine the cracks, surface damages in the components.
CO3	To examine the defects using X- ray source.
CO4	To analyze the defectors without causing any environmental effects.
CO5	To categorize the latest trends and equipments in NDT.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M		L		L							
CO2	M		H									
CO3	L		H		H							
CO4	M		L									
CO5	M		M		M							

Course Topics

PLANT LAYOUT AND MATERIALS HANDLING

Plant location, - classification of layout – layout design procedures - CRAFT, ALDEP, CORELAP - materials handling systems – principles - classification of materials handing equipments - production and operation decisions.

PRODUCTIVITY MANAGEMENT AND WORK STUDY

Introduction, productivity models, organizational transformation, re-engineering, process improvement models, re-engineering tools and implementation, reverse engineering - work study - time study - method study - tools – methods.

RELIABILITY ENGINEERING

Reliability concept - reliability data analysis - prediction models - reliability management - risk assessment.

ERGONOMICS OF MANUFACTURING

Introduction - human performance - work space design - design of equipments - design of environment.

PROJECT MANAGEMENT

Phases of project management – network constructions – CPM – PERT – crashing – resource leveling - resource allocation.

Text Book

1) ILO, Introduction to work study, Geneva, 1974.
2) Richard Francis L. and John A.White, Facilities layout and location an analytical approach, Prentice Hall Inc,1984.

References

1) Barnes, raeph.M, Motion and time study -design and measurement work, John wiley, Newyork, 1990
2) Khanna, O.P., Industrial Engineering and Management, Dhanpatrai Publication, 2004.
3) Gopalakrishnan, P., and Banerji, A.K., Maintenance and Spare Parts Management, Prentice Hall Of India, New Delhi, 1991.
4) Edosomwan, J.A., Organisational Transformation and Process Re-engineering, British Library Cataloging In Pub. Data, 1996.
5) Rastogi, P.N., Re-Engineering and Re-Inventing the Enterprise, Wheeler Publications, New Delhi, 1995.

6) Fiegenbarum, A.V., Total Quality Control, Mcgraw-Hill, Inc., 1991.
7) Modarres, Reliability and Risk Analysis, Maral Dekker Inc., 1993.
8) James Apple, M.., Plant Layout and Material Handling, John Wiley, 1977.
9) Lee J Krajewski, Larry P Ritaman, Operations Managements, Addison-Wesley, 2000.
10) Prasannachandra, Project management, Tata Mcgraw Hill, 1986.

MEC424	INDUSTRIAL AUTOMATION AND ROBOTICS	L	T	P	C
		3	0	0	3
Prerequisite	Introduces and familiarizes students with the basis automation problems and the technologies used in automated production and robotic systems. Various components and systems and their applications to industrial automation will be discussed				
Objective(s)	To produce engineering graduates who are competent and able to apply principles of science and engineering for solving current problems related to industrial automation and robotics.				

Course Outcome(s)

CO1	To know about the production concept & strategies of automation .
CO2	To describe the CIM architecture & FMS.
CO3	To analyze the details flow lines & line balancing methods.
CO4	To select the mechanical handling systems & injections methods.
CO5	To manipulate the robot structure & application in industries.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M				H			H				
CO2	L				L			M				
CO3	H				M			M				
CO4	M				H			M				
CO5	H				M			H				

Course Topics

INTRODUCTION TO AUTOMATION

Classification of Manufacturing Industries – Types of Production – Functions in Manufacturing – Organization and Information processing in Manufacturing – production concepts and mathematical models – concepts, definition, objective, arguments
and strategies of automation.

CIM AND FMS

Nature role and development of CIM Architecture- computers in CIM-simulation software - Group technology-part families-parts classification and coding-Production Flow analysis-cellular manufacturing cell design-benefits MRP I and II -computer aided quality control.
Definitions – classifications – flexibility – typical configurations – computer control systems – planning the FMS – analysis methods for flexible manufacturing systems – applications and benefits.

AUTOMATED FLOW LINES AND ASSEMBLY SYSTEMS

General terminology – analysis of transfer lines with and without storage buffers – partial automation – computer simulation of automated flow lines – assembly systems and line balancing – methods of line balancing – computerized line balancing methods.

AUTOMATED MATERIALS HANDLING AND STORAGE SYSTEMS

Functions – types of equipment, analysis and design of conveyor systems and automated guided vehicle systems, automated storage/retrieval systems, carousel storage systems, work-inprogress storage, interfacing handling and storage with manufacturing - Inspection - Principles and methods – sensor technologies – coordinate measuring machines, contact and noncontact inspection methods – machine vision.

INDUSTRIAL ROBOTICS

Robot definition and types – Robot anatomy - Mobile Robot and its advantages – Case studies – pick and place robot –

automatic camera – washing machine – Application of robots in industries.

Text Books

1) Mikell. P. Groover, Automation Production Systems, and Computer Integrated Manufacturing, Prentice Hall of India Ltd., New Delhi, 1998.

References

1) D. M. Considine and G. D. Considine, Standard Hand Book of Industrial Automation, Chapman and Hall, NJ, 1986.
2) Radhakrishnan and S. Subramaniyan, CAD/CAM/CIM, New Age International (P) Limited, New Delhi, 1998.
3) Deb, Robotics Technology and Flexible Automation, Tata McGraw Hill, New Delhi, (1994).

FREE ELECTIVES

FREE ELECTIVES
(BASIC SCIENCE AND MATHEMATICS)

BPY503 NON-LINEAR OPTICS	Credits			
	L	T	P	Total
	4	1	0	4
Course Category: Free Electives (Basic Science And Mathematics)				

Course Objective(s)

This paper deals with physics of non-linearity and their applications.

Course Outcome (s)

CO1: At the end of the course, students should be able to:
Get the basic ideas on information in light.

CO2: Get the basic ideas on the electromagnetic phenomena

CO3: Acquire the knowledge on photophysical phenomena

CO4: Find out the applications in non linear optics

CO5: Get the ideas on Fiber optics

Course Topics

Unit 1 Information in Light

Semiconductors for optoelectronics - Optoelectronic semiconductor devices - Bright light from cool solids - Seeing The Light- The human eye - Color vision - Color blindness - Polarization sensitivity - Speed of response - Optical illusions - Contemporary Optics- Waveguides - Optical fibres - Optical amplification - Conveying sound by light - The long and the short of optical communication.

Unit 2 Fundamental Tools

Electromagnetic Phenomena - Gauss' Law - Gauss Law For Magnetic Fields - Faraday's Law - Ampere's Law - Maxwell's Adjustment To Ampere's Law - Polarization of Materials - Plane Wave Solutions To The Wave Equation - Complex Plane Waves - Real And Complex Indices of Refraction - The Lorentz Model of Dielectrics - Poynting's Theorem - Irradiance of A Plane Wave - Energy Density of Electric And Magnetic Fields.

Unit 3 Photophysical Phenomena

Optical Propagation in Media - Diffraction and Dispersion effects - Wave Propagation in Homogeneous Linear Isotropic Media - Anisotropic media - The Origin and Modeling of Optical Nonlinearity - A Simple Physical Model for Optical Nonlinearity - Physical Effects of Nonlinear Polarization - Mathematical Modeling of Optical Nonlinearities - An Alternative Approach For Reflection And Refraction:-Refraction at an Interface - The Fresnel Coefficients' - Reflectance - Transmittance - Double-Interface Problem Solved Using Fresnel Coefficients' - Beyond Critical Angle: Tunneling of Evanescent Waves - Multiple Interfaces - Multilayer Coatings.

Unit 4 Physics of Non-Linearities

The Physics of Second Harmonic Generation - SHG in Crystals - Frequency Doubling and
Mixing - Optical Parametric Generation Amplification - Oscillation - Mathematical Formulation - Phase Matching in Anisotropic Crystal – Nonlinear Transverse Effects in Second Harmonic Generation - Self-Refraction of Optical/Gaussian Beams - Optical Bistability phenomena - Optical Phase conjugation effects.

Optical Communication Today

Components - Fabrication And Materials - Light Sources – Coupling- Micro Components Tapers - Splices/Connectors - Characteristics of optical fibers - Diameter Control And Measurement - Attenuation - NLO Properties In Media - Fiber-Optic Solitons - Magnetic Solitons - Optical Shocks And Self-Steepening Of Pulses - Two-Wave Mixing In Photorefractive Materials - Four-Wave Mixing And Phase Conjugation In Photorefractive Materials - Self-Phase Conjugation And Edge Enhancement - Non-Linearities In Nematic Liquid Crystals - Photonic Bandgap Structures

Text Books

1. Richard L Sutherland, *Handbook of Nonlinear Optics, 2nd Edition (Revised and Expanded),* Marcel Dekker, Inc, 2003.

2. Newell, Alan C., and Jerome V. Moloney, *Nonlinear optics,* Addison-Wesley, 1992.

References

1. Justin Peatross and Michael Ware, *Physics of Light and Optics,* 2013.

2. David A. Boas, Constantinos Pitris and Nimmi Ramanujam, *Handbook of Biomedical Optics,* CRC Press, Taylor and Francis Group, 2011.

3. David Greene, *Light and Dark* Institute of Physics Publishing Ltd, 2003.

4. Goure P and Verrier I, *Optical Fibre Devices Series in Optics and Optoelectronics,* Institute of Physics Publishing Ltd, 2002.

BMA331 COMBINATORICS	Credits			
	L	T	P	Total
	3	0	0	3
Course Category: Free Electives (Basic Science And Mathematics)				

Course Objective(s)

This paper deals with physics of non-linearity and their applications.

Course Outcome (s)

CO1: At the end of the course, students should be able to:
Get the basic ideas on information in light.

CO2: Get the basic ideas on the electromagnetic phenomena

CO3: Acquire the knowledge on photophysical phenomena

CO4: Find out the applications in non linear optics

CO5: Get the ideas on Fiber optics

Course Topics

Unit I Basic Combinatorial Numbers – Stirling Numbers of the First Kind – Stirling Numbers of the Second Kind.

Unit II Generating Functions and Recurrence Relations – Symmetric Functions.

Unit III Multinomials – Multinomial Theorem – Inclusion and Exclusion Principle.

Unit IV Euler Function – Permutations with Forbidden Positions – The 'Menage' Problem – Problem of Fibonacci.

Unit V Polya Theory – Necklace Problem and Burnside's Lemma – Cycle Index of a Permutation Group – Polya's theorems and their Immediate Applications.

Text Book:

1. Kenneth P. Boggart, Introductory Combinatorics, Pitman Books Ltd, 1983.

Reference Books:

1. V. Krishnamurthy, Combinatorics Theory and Applications, East –West Press, 1989.
2. V.K. Balakrishnan, Theory and Problems of combinatorics, Schaums outline series – McGraw Hill, 1994.
3. Ian Anderson, Combinatorics of finite sets, Oxford Science Publication, 2011.

BMA332 MATHEMATICAL MODELLING	Credits			
	L	T	P	Total
	3	0	0	3
Course Category: Free Electives (Basic Science And Mathematics)				

Course Objective(s)

This paper deals with physics of non-linearity and their applications.

Course Outcome (s)

CO1: At the end of the course, students should be able to:
Get the basic ideas on information in light.

CO2: Get the basic ideas on the electromagnetic phenomena

CO3: Acquire the knowledge on photophysical phenomena

CO4: Find out the applications in non linear optics

CO5: Get the ideas on Fiber optics

Course Topics

UNIT I

Mathematical Modeling through Ordinary Differential Equations of First order: Linear Growth and Decay Models – Non-Linear Growth and Decay Models – Compartment Models – Dynamic problems – Geometrical problems.

UNIT II

Mathematical Modeling through Systems of Ordinary Differential Equations of First Order: Population Dynamics – Epidemics – Compartment Models –Economics – Medicine, Arms Race, Battles and International Trade – Dynamics.

UNIT III

Mathematical Modeling through Ordinary Differential Equations of Second Order: Planetary Motions – Circular Motion and Motion of Satellites –Mathematical Modeling through Linear Differential Equations of Second Order –Miscellaneous Mathematical Models.

UNIT IV

Mathematical Modeling through Difference Equations: Simple Models – Basic Theory of Linear Difference Equations with Constant Coefficients – Economics and Finance – Population Dynamics and Genetics – Probability Theory.

UNIT V

Mathematical Modeling through Graphs: Solutions that can be Modelled Through Graphs – Mathematical Modeling in Terms of Directed Graphs, Signed Graphs, Weighted Digraphs and Unoriented Graphs.

Text Book:

1. Mathematical Modeling, J.N. Kapur, Wiley Eastern Limited, New Delhi, 1988.

Reference:

J.N. Kapur, Mathematical Models in biology and Medicine, EWP, New Delhi,1985.

BCY501	NANO CHEMISTRY	L	T	P	C
		3	0	0	3
Objective(s)	Educate them in synthesis and characterization of nano materials				

Course Outcome(s)

CO1	Summarize the basis of nano technology
CO2	Compare the properties of nanomaterials with micro and macro materials
CO3	Sketch the synthesis of nanomaterials
CO4	Illustrate the synthesis techniques of nanomaterials
CO5	Choose best technologies for characterization of nanomaterials

Unit-I: Basics of Nano chemistry

Basics of nanomaterials: Properties of nanomaterials, quantum confinement effect, surface to volume ratio, surface properties of nanoparticles. Classification of the nano materials – zero dimensional, one dimensional, two dimensional and three dimensional nanostructures.

Unit-II: Properties of Nanomaterials

Mechanical, optical, electronic, magnetic, thermal and chemical properties of nanomaterials. Size dependent properties-size dependent absorption spectra

Unit-III: Synthetic Techniques

Chemical methods: sol-gel synthesis, solvothermal synthesis, thermolysis route. Physical methods: Pulsed laser deposition- Magnetron sputtering

Unit-IV: Applications of Nanomaterials

Catalysis on nanoparticles, semiconductors, sensors, and electronic devices, photochemistry and nanophotonics, applications of CNTs, nanomaterials in biology and medicine.

Unit-V: Characterization Techniques

X-ray diffraction- Electron microscopes – scanning electron microscopes (SEM) – transmission electron microscopes (TEM) – scanning probe microscopy – atomic force microscopy (AFM) – scanning tunneling electron microscope (STEM) – basic principles only.

Reference Books:

1. S.Shanmugam, Nanotechnology, , MJP Publishers, Chennai (2010).
2. Patrick Salomon , A Handbook on Nanochemistry,, Dominant Publishers and Distributers, New Delhi.
3. S. Balaji , Nanobiotechnology, MJP Publishers, Chennai (2010).
4. CNR Rao The Chemistry of Nanomaterial: Synthesis, Properties and Applications, Vol. I and II, Springer (2006).
5. Nanotechnology: Basic Science and Emerging Technologies, Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse, Overseas Press, (2005).
6. G. B. Segreev, Nanochemistry, , Elsevier, Science, New York, (2006).
7. C. N. R. Rao, A. Mu¨ller, A. K. Cheetham, "The Chemistry of Nanomaterials:Synthesis, Properties and Applications" WILEY-VCH Verlag GmbH & Co. KGaA, weinheim, 2004
8. C.N.R. Rao, G.U. Kulkarni, P.J. Thomas, Nanocrystals: Synthesis, Properties and Applications" Springer Series in materials science-95, Springer-Verlag Berlin Heidelberg 2007
9. Znong Lin Wang, "Characterization of nanophase materials" WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, 2000.

BCY504	APPLIED CHEMISTRY	L	T	P	C
		3	0	0	3
Objective(s)	Awareness about recent technologies in applied chemistry				

Course Outcome(s)

CO1	Solve water related problems
CO2	Illustrate electrochemical concepts
CO3	Employ corrosion prevention methodologies
CO4	Develop innovative fuels
CO5	Formulate novel polymers

Unit-I: Water Treatment

Brief introduction regarding sources, impurities in water. Hardness of water, types, determination of hardness using EDTA method. Brief discussion and chemistry involved in the process of sedimentation, coagulation, filtration and sterilization, UV, Ozone, chlorination including break point chlorination. Softening of Water: (i) Lime-soda, process: Principles in hot, cold, lime-soda process. (ii) Zeolite softener, demineralization by synthetic ion exchange resins, Comparison between lime-soda, Zeolite and ion exchange process.

Unit-II: Electrochemistry

Introduction, Arrhenius ionic theory, Debye-Huckel theory of strong electrolytes, Activity and Activity coefficient, Conductivity of electrolytes, Kohlrausch's law of independent migration of ions, Oswald's dilution law, Acids and Bases, Concept of pH and pOH , Buffer solutions, Solubility product, common ion effect, Hydrolysis of salts, Conductometric titrations, transport number. Potentiometric titrations.

Unit-III: Corrosion of Metals and Alloys

Definition and classification of corrosion. Electrochemical corrosion- General revision of concept of electrode potential, galvanic cells, electrochemical and galvanic series, causes of corrosion, mechanism of direct chemical attack, pilling- Bed worth rule, concentration cells. Differential aeration theory of corrosion, types of corrosion, pitting corrosion, intergranular stress, waterline and microbial corrosion. Corrosion prevention : (a) Design and material selection, (b) Anodic and Cathodic inhibitors, (c) Cathodic and Anodic protection, (d) Protective coatings- types of surface, coatings and its application.

Unit-IV: Fuels

Introduction, Classification of fuels, Calorific value, Characteristics of a good fuel, comparison between solid, liquid and gaseous fuels. Bomb calorimeter. Calorific value of a gaseous fuel, Theoretical calculation of calorific value of a fuel, Wood, Coal, Classification of coal, selection of coal , analysis of coal, Types of carbonization of coal. Diesel engine fuel, Petroleum, synthetic petrol. LPG as a fuel. Non petroleum fuels, Natural gas, Coal gas, water gas. Non conventional sources of energy-bio mass, biogas, wind energy, solar.

Unit-V: Polymers

Introduction, Nomenclature and functionality of polymers, Classification of polymers, Types of polymersation. Methods of polymerization, Characteristics of polymers, structure and properties of polymers. Plastics, Inorganic polymers, Silicones, Rubbers, vulcanization of rubbers, synthetic rubber or elastomers, Application of rubber, Conducting polymers and bio polymers.

Reference Books:

1. S.S. Dara, A Text Book of Engineering Chemistry, S.Chand & Co. New Delhi, first Edition, 1985.
2. P.C.Jain and Monika Jain, Engineering Chemistry, Dhanpat Rai & Sons, New Delhi, Fifteenth Edition,2009.
3. Fontana and Green , Corrosion Engineering, Tata McGraw Hill International Book Co. 2nd edition, 2005.
4. V.R.Gowariker, N.V.Viswanathan, Jayadev sreedhar, Polymer Science, New Age International publishers, (1986) Reprint 2010.

BCY505	INSTRUMENTAL METHODS OF ANALYSIS	L	T	P	C
		3	0	0	3
Objective(s)	Educate them in operating analytical instruments				

Course Outcome(s)

CO1	Summarize chromatographic techniques
CO2	Interpret spectroscopic data
CO3	Compute the spectral results
CO4	Employ gas chromatography in separating mixture of compounds
CO5	Identification of elements using microscopic analysis

Unit-I: Chromatography

Introduction – solvent extraction (basic concepts only) – ion exchange (basic concepts only) – electrophoresis (basic concepts only) – column and thin layer chromatography - Principles, instrumentation, theory and applications of GC and HPLC.

Unit-II: Qualitative Optical Spectroscopy

Introduction-Principles, instrumentation, theory and applications of Infrared spectroscopy, Raman spectroscopy, Nuclear Magnetic Resonance (NMR) spectroscopy and X-ray diffraction methods.

Unit-III: Quantitative Optical Spectroscopy

Introduction - Principles, instrumentation, theory and applications of Atomic absorption spectroscopy(AAS)– Inductively coupled plasma atomic emission spectroscopy- Inductively coupled plasma mass spectrometry - Atomic fluorescence spectroscopy-
X-ray fluorescence spectroscopy – Ultraviolet (UV)-visible spectroscopy.

Unit-IV: Mass Spectrometry

Introduction-Principles, instrumentation, theory and applications of Gas chromatography mass spectrometry (GCMS) – High performance liquid chromatography electrospray ionization mass spectrometry (LC-ESI-MS) – Laser mass spectrometry (MALDI).

Unit-V: Microscopic and Surface Analysis

Introduction-Principles, instrumentation, theory and applications of Atomic force microscopy (AFM)–Auger electron spectroscopy-X-ray photoelectron spectroscopy (XPS)- Scanning electron microscopy (SEM)– Transmission electron microscopy (TEM).

Reference Books:

1. Frank A.Settle (Editor), Handbook of instrumental techniques for analytical chemistry, Prentice-Hall Inc., New Jersey, 1997.
2. Vogel's Textbook of quantitative chemical analysis, G.H.Jefferey, J Bassett, J Mendham, and R C Denney, Longman scientific and technical publishers, London
3. D.A.Skoog, F.J.Holler, S.R.Crouch, Instrumental Analysis, Cengage Learning, New Delhi, 2007.
4. H.H. Willard, L.L.Merritt, and J.A.Dean, Instrumental Methods of Analysis, 6th Edition (1986),CBS Publishers & Distributors, Shahdara, Delhi.

BCY506	ENVIRONMENTAL CHEMISTRY	L	T	P	C
		3	0	0	3
Objective(s)	Demonstrate the analysis of environmental degradation				

Course Outcome(s)

CO1	Examine various water quality parameters
CO2	Model instrumental methods of water analysis
CO3	Identify gaseous pollutants and its effects
CO4	Point out degradation of atmosphere by electromagnetic radiation
CO5	Categorize various soil pollutants

Course Topics

Unit-I: Environmental Chemistry of Water

The principles and application of aqueous chemistry to the environmental systems. Unique properties of water, Water Quality Parameters: physico-chemical, biological, bacteriological; Water Quality Criteria and Standards; Water quality monitoring and management aspects, Chemical methods involved in treating water and wastewater, Removal of dissolved organics and inorganics, Heavy metal pollution and its abatement.

Unit-II: Water and Wastewater Analysis

Basic concepts and Instrumental methods of analysis; Determination of major parameters of water such as pH, acidity, alkalinity, hardness, BOD, COD, solids, fluoride, nitrogen, iron, manganese, sulphate, phosphate, volatile acids and trace contaminants.

Unit-III: Atmospheric Chemistry

Structure and properties of atmosphere, Classification and chemistry of major air pollutants and their control. Types and sources of air pollution-natural, Combustion and other combustion sources.

Atmospheric Composition & Behaviour: Gaseous & particulate constituents of the atmosphere, Temperature and pressure profile of atmosphere, General circulation of atmosphere.

Unit-IV: Atmospheric Photochemistry

Electromagnetic radiations, Kinetics of thermal and photochemical processes, Reactions in the upper atmosphere, Photo processes in the troposphere, Photochemical smog, Photosynthesis, Ozone chemistry.

Unit-V: Soil Chemistry

The nature and importance of soil; Soil in the natural and man-made environment, Soil properties; Acid-Base and Ion-exchange reactions in soils. Macro and Micronutrients; Fertilisers and other soil amendments.

Waste and pollutants in soil, Heavy metals and radio-nuclides in soil. Colloidal chemistry of inorganic constituents, clays, OM and soil humus; Absorption in soils - forces and isotherms; Soil as cation and anion exchanger; Degradation of natural substances; Remediation of metal contaminated soil.

Reference Books:

1. T.G. Spiro and W.M.Stigliani, Chemistry of the Environment, 2nd ed., Tsinghua University Press, 2003.
2. V.Snoeyink and D.Jenkins, Water Chemistry, J.Wiley and Sons, 1980.
3. Shugui Dai, Environmental Chemistry, (ed.), Higher Education Press, 1997.
4. C.N. Sawyer, P.L. McCarty, G. F. Parkin, Chemistry for Environmental Engineering, McGraw Hill, 4th edition, 2002.
5. L.D. Bene_eld, J. F. Judkins and B. L. Weand, Process Chemistry for Water and Wastewater Treatment, Prentice Hall, 1982.
6. R.A. Bailey, H. M. Clark, J. P. Ferris, S. Krause, R. L. Strong, Chemistry of the Environment, Academic Press Second Edition, 2002.

BPY502	LASER PHYSICS	L	T	P	C
		3	0	0	3
Objective(s)	Demonstrate the analysis of environmental degradation				

Course Outcome(s)

CO1	Examine various water quality parameters
CO2	Model instrumental methods of water analysis
CO3	Identify gaseous pollutants and its effects
CO4	Point out degradation of atmosphere by electromagnetic radiation
CO5	Categorize various soil pollutants

Course Topics

Unit 1 - Fundamentals of LASER

Spontaneous emission – stimulated emission – meta stable state – Population inversion – pumping – Laser Characteristics

Unit 2 - Production of LASER

Helium – Neon Laser – Ruby Laser – CO2 Laser – Semiconductor Laser

Unit 3 - Industrial Applications of LASER

Laser cutting – welding – drilling – Hologram – Recording and reconstruction of hologram

Unit 4 - Lasers in Medicine:

Lasers in Surgery – Lasers in ophthalmology – Lasers in cancertreatment

Unit 5 - Lasers in Communication

Optic fibre communication- Total internal reflection – Block diagram of fibre optic communication system – Advantages of fibre optic communication

Text Books

1. Laser fundamentals – William T. Silfvast Cambridge University Press – Published in South Asia by foundation books, 23, Ansari Road, New Delhi , 2008
2. An introduction to LASERS – N. Avadhanulu, S. Chand & Company, 2001.

References

1. LASER Theory and Application – K. Thyagarajan and A.K. Ghatak, Mac millan, India Ltd., 1981.
2. Lasers and non-linear optics, B. B. Laud, New Age International (P) Ltd., IIIrd Edn., 2011

BPY504	RADIATION PHYSICS	L	T	P	C
		3	0	0	3
Objective(s)	This paper deals with the detailed theoretical and experimental concepts on radiation physics.				

Course Outcome(s)

CO1	At the end of the course, students should be able to: Gain knowledge on the concepts of radiation
CO2	Get the basic ideas on the x-rays
CO3	Acquire the knowledge on radiation therapy
CO4	Get the knowledge on instrumentation techniques in radiation therapy
CO5	Gain the knowledge on clinical radiation therapy

Course Topics

STRUCTURE OF MATTER, NUCLEAR TRANSFORMATION AND X-RAYS

Elementary particles - Electromagnetic radiation-wave model and quantum model. Nuclear Transformation - Nuclear transformation-radioactivity - Decay constant – Activity - Radioactive series - Radioactive equilibrium -Activation of nuclides.X-Rays-Production of X-rays - X-ray tube - X-ray circuit - voltage rectification - Physics of X-ray production - X-ray energy spectra - Operating characteristics.

Clinical Radiation Generators

Kilo-voltage units- Grenz-ray therapy - Contact therapy - Superficial therapy - Orthovoltage therapy or deep therapy - Super voltage therapy - Resonant transformer units - Megavoltage therapy - Van de graff generator - Linear accelerator - Betatron - Cyclotron - Microtron - Machines using radionuclides-Cobalt-60 unit - Heavy particle beams.

Ionizing Radiation, Quality of X-Ray Beams, Measurement of Absorbed Dose

Ionizing Radiation - Interaction of ionizing radiation-Ionization - Photon beam description - Photon beam attenuation - Attenuation coefficient - Energy transfer - energy absorption coefficient - Interaction of photons with matter - Coherent scattering - The Roentgen - Free air ionization chamber - String electrometer - Ion collection-Saturation and collection efficiency - Measurement of exposure. Quality of X-Ray Beams- Half value layer and its measurement - Peak voltage-Direct indirect measurement - Effective energy. measurement of Absorbed Dose- Radiation absorbed dose - Relation between Kerma - Exposure - Absorbed dose.

Classical Radiation Therapy

Dose distribution and scatter analysis-Phantoms - Depth dose distribution - percentage depth dose-Dependence on beam quality and depth - Tissue air ratio (TAR)-relationship between TAR and percent depth dose- Dose calculation parameters- Collimator Scatter Factor - Phantom Scatter Factor - Tissue-Phantom and Tissue-Maximum Ratios - Scatter-Maximum Ratio- Practical Applications - Accelerator Calculations- SSD Technique - Cobalt 60 Calculations. Treatment planning-Acquisition of Patient Data- Internal Structures- Computed Tomography - Magnetic Resonance Imaging-Ultrasound. Skin Dose. Electron beam therapy - Brachytherapy.

Modern Radiation Therapy, Dosimetry and Radiation Protection

Modern Radiation Therapy-Image-Guided Radiation Therapy - Proton Beam Therapy. Dosimetry-Dosimeter - Film badge dosimeter - Pocket dosimeter. Radiation Protection-Radiation Protection - Dose Equivalent - Effective Dose Equivalent - Background Radiation - Low-Level Radiation Effects - Effective Dose-Equivalent Limits- Occupational and Public Dose Limits.

Text Books

1. Meredith W.J. and J.B. Massey, *Fundamental Physics of Radiology*, A. John Wright and Sons Ltd.,3rd Edition, 1983.

2. William.R.Hendee, Geoffery.S.Ibbott and Eric.G.Hendee, *Radiation Therapy Physics*, A.John Wiley and Sons.,Inc, 3rd Edition, 2005.

References

1. Smith F.A., *A Primer in Applied Radiation Physics*, World scientific publishing Co., 2000.
2. Podgarsak E.B., *Radiation Physics for Medical Physicists*, Springer, 2006.
3. Evans R. D., *Atomic Nucleu*s, Textbook Publications, 2003.
4. Fiaz.M.Khan, *The Physics of Radiation Therapy*, Lippincott Williams and Wilkins, 4th Edition, 2010.

BPY506	NUCLEAR PHYSICS	L	T	P	C
		3	0	0	3
Objective(s)	This paper deals with the detailed theoretical and experimental concepts on radioactivity and elementary particles				

Course Outcome(s)

CO1	At the end of the course, students should be able to: Gain knowledge on nucleus and nuclear models.
CO2	Get the basic ideas on the nuclear reactions
CO3	Acquire the knowledge on fundamentals in elementary particles
CO4	Carry out research in nuclear physics
CO5	Acquire the knowledge on Radioactive materials

Course Topics

Nucleus and nuclear models

Introduction to nucleus- classification of nuclei – general properties of nucleus – charge, mass, spin , magnetic moment, quadruple moment – mass defect - binding energy- models of nuclear structure - liquid drop model – shell model.

Radioactivity

Introduction – discovery of radioactivity - natural radioactivity - alpha, beta and gamma rays - properties of the rays - experimental measurement of the range of alpha particles – beta ray spectra – origin of the line and continuous spectrum – the neutrino theory of beta decay.

Nuclear Reactions

Soddy Fajan's displacement law - law of radioactive disintegration - the mean life - measurements of decay constants - units of radioactivity - law of successive disintegration - radioactive dating -nuclear reactions - energy balance in nuclear reactions - threshold energy of an endoergic reaction- applications of radio isotopes.

Particle accelerators, detectors, Cosmic rays

GM Counter - Wilson cloud chamber - bubble chamber – cyclotron – synchrotron –synchrocyclotron - betatron – Cosmic rays: introduction – discovery of cosmic rays –cosmic showers –origin of cosmic radiation.

Elementary particles

Introduction – fundamental interactions - elementary particle quantum numbers – quark model.

Text Book

1. Modern Physics by R. Murugesan and Kiruthiga Sivaprasath, S.Chand & Co., 2005.

References

1. Atomic and Nuclear Physics by Shatendra Sharma, Dorling Kindersley India, 2005.
2. Nuclear Physics by D.C. Tayal, Himalaya Publishing House, reprint 2007.
3. Nuclear Physics, An introduction by S.B.Patel, New Age international(P) Ltd., (reprint 2003)

BPY507	SPACE PHYSICS	L	T	P	C
		3	0	0	3
Objective(s)	This paper deals with the detailed concepts on space science.				

Course Outcome(s)

CO1	At the end of the course, students should be able to: Know about the earth's atmosphere.
CO2	Get the basic ideas on the interplanetary medium
CO3	Acquire the knowledge on planets
CO4	Carry out the research work on space physics
CO5	Acquire the knowledge on sun atmosphere

Course Topics

Unit I - The Earth's Upper Atmosphere

Variations of atmospheric densities and temperature. Formation and structure of Ionosphere. Studies of ionosphere by ground based and space techniques. The radiation belts. Auroras. Lyman glow of the night sky. The geo-corona and airglow studies.

Unit I - Sun

Structure of solar atmosphere. Solar convection and differential rotation. Large scale and small scale magnetic fields. Solar granulation and super granulation. Sunspots. Solar flares.

Unit III - Interplanetary Medium

Xray and g-ray studies of sun. Solar X-ray and radio bursts. Solar wind. Interaction with planetary atmosphere. Structure of bow shocks. Magnetosphere. Ring Current. Radiation belts and interplanetary magnetic field.

Unit - IV Moon

Origin of Moon. Solar and Lunar eclipses. Lunar ranging experiments. Studies of lunar surface from various space missions and their results. Satellites of other planets of the solar system.

Unit - V Planets

Infrared spectroscopy of planetary atmospheres. Principal results of the Mariner, Venera and Viking Space Missions to Mars and Venus. Voyager space mission studies of outer planets and their satellites and rings. Comparative studies of planetary atmospheres. Planetary ionospheres. Extra-solar system planets.

Text Books

1. Sun, Earth and radio: An Introduction to the Ionosphere and Magnetosphere, J.A.Ratcliffe, 1970, Littlehampton Book Services Ltd
2. An Intoduction to Planetary Physics: The Terrestrial Plants, Kaula. W.M, 1969, John Wiley & Sons Inc.
3. Harold Zirin: Astrophysics of the Sun, 1988, Cambridge University Press

References

1. W.N.Hess and G.Mead(Ed): Introduction to Space Science, 1965, Gorden and Breach,
2. V.Bumba and Kleczek, Basic Mechanism of Solar Activity, 1976.
3. W. J. Kaufmann, Exploration of the Solar System, Mac Millan, 1978, New york.

HUMANITIES ELECTIVES

HSS001	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

Prerequisite	Basics of ethics and management
Objective(s)	To impart knowledge on the quality management process and key quality management activities. Comprehend the concepts of customer's value. To understand the quality management philosophies by various quality gurus. Compare and contrast the various tools used in quality management and to apply it. Discuss the emerging tendencies toward global competitiveness, understand different perspectives on quality.

Course Outcome(s)

CO1	Determine the impact of quality on profitability and to learn the basic principles and practices of TQM.
CO2	Develop an understanding on quality management philosophies and frame work.
CO3	Develop in-depth knowledge in various tools and techniques of quality management
CO4	Communicate the importance of customer focused in TQM.
CO5	Learn how to achieve world –class status in manufacturing and service through TQM and bench marking.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M					M				M		
CO2		M					M	M	M		H	M
CO3	M				H		L	M				L
CO4						L	M	M		H	M	M
CO5						M			M	M	H	L

Course Topic(s)

INTRODUCTION TO QUALITY MANAGEMENT

Definitions – TOM framework, benefits, awareness and obstacles. Quality – vision, mission and policy statements. Customer Focus – customer perception of quality, Translating needs into requirements, customer retention. Dimensions of product and service quality. Cost of quality. **PRINCIPLES AND PHILOSOPHIES OF QUALITY MANAGEMENT**

Overview of the contributions of Deming, Juran Crosby, Masaaki Imai, Feigenbaum, Ishikawa, Taguchi, Shingeo and Walter Shewhart. Concepts of Quality circle, Japanese 5S principles and 8D methodology.

STATISTICAL PROCESS CONTROL AND PROCESS CAPABILITY

Meaning and significance of statistical process control (SPC) – construction of control charts for variables and attributed. Process capability – meaning, significance and measurement – Six sigma concepts of process capability. Reliability concepts – definitions, reliability in series and parallel, product life characteristics curve. Business process re-engineering (BPR) – principles, applications, reengineering process, benefits and limitations.

TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT

Quality functions development (QFD) – Benefits, Voice of customer, information organization, House of quality (HOQ), building a HOQ, QFD process. Failure mode effect analysis (FMEA) – requirements of reliability, failure rate, FMEA stages, design, process and documentation. **TAGUCHI TECHNIQUES**

Taguchi techniques – introduction, loss function, parameter and tolerance design, signal to noise ratio. Seven old (statistical) tools. Seven new management tools. Bench marking and POKA YOKE.

REFERENCES:

1. Dale H.Besterfield et al, Total Quality Management, Thrid edition, Pearson Education (First Indian Reprints 2004).

2. ShridharaBhat K, Total Quality Management – Text and Cases, Himalaya Publishing House, First Edition 2002.
3. William J.Kolarii, Creating quality, Mcgraw Hill, 1995
4. PoornimaM.Charantimath., Total quality management, Pearson Education, First Indian Reprint 2003

HSS002	ENGINEERING MANAGEMENT	L	T	P	C
		3	0	0	3
Prerequisite	Basic ideas Engineering economics, total quality management				
Objective(s)	On completion of this course the student will have clear idea about the demand and revenue analysis, forms and business and function, human resource, financial development, global environment.				

Course Outcome(s)

CO1	At the end of the course the student must be able to know various aspects of demand and revenue analysis.
CO2	Ability to understand different types of business organizations and function.
CO3	Understanding human resources and time management.
CO4	Able to understand the concept of product development and operation management
CO5	Understanding the business strategy of global environment

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				L		M	L					M
CO2						M		L	L	M		M
CO3							M	M	H		H	M
CO4											M	M
CO5						M	M	M	M	M		M

Course Topic(s)

INTRODUCTION

Demand and Revenue Analysis - Demand Forecasting - Production Analysis - Cost and Supply Analysis, Price and output Determination - Investment Analysis - Plant Location - Economic Optimization.

FORMS OF BUSINESS AND FUNCTIONS

Types of Business Organisation, Forms - Planning - Organizing - Designing effective organisations – Coordination

HUMAN RESOURCE DEVELOPMENT

Motivating individuals and workgroups - Leadership for Managerial Effectiveness - Team working and Creativity - Managerial Communication - Personal Management – Time Management - Stores Management - Career Planning.

FINANCIAL MANAGEMENT

Product development - Management techniques in product development - Nature of controlling - Operations Management - Just-in-Time.

GLOBAL ENVIRONMENT

Managing World Economic Change - The global environment - Multinational Strategies - Economic Cycles and Director Investment - Change and Organisation Development - Managerial Ethics and Social responsibilities.

REFERENCES

1. Harold Koontz& Heinz Weihrich, Essentials of Management, Tata McGraw Hill publishing company Ltd.
2. Koontz, Weihrich&Aryasri, Principles of Management, Tata McGraw Hill publishing company Ltd.
3. Tripathi& Reddy, Principles of Management, Tata McGraw Hill publishing company Ltd.

HSS003	INDIAN ECONOMIC DEVELOPMENT	L	T	P	C
		3	0	0	3

Prerequisite	Basic knowledge about business, economics, financial management and global environment For basic knowledge on current concepts on business and students need to read news papers and business magazines.
Objective(s)	To create awareness on the Economic areas of the management. To explore the ideas related to business development.

Course Outcome(s)

CO1	Understanding of Indian economics and its effect on economic development and labour force.
CO2	Ability to understand Indian Economic Planning.
CO3	Analyze the Industrial development during the planning period&Role of Public sector enterprises
CO4	Understanding the Role of foreign trade.
CO5	Learn the Issues of Poverty and inequality, Unemployment, Rising prices and Industrial relations.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								M		M		L
CO2		L						M	M	M		M
CO3		M			L	M	M	M	H	M	M	
CO4								M	H	H	M	L
CO5		M		M	L	M	M	M		H		M

Course Topic(s)

INDIAN ECONOMIC SCENARIO

Indian economy before and after Independence - National income trends and compositions. Sources of capital formation and savings - Sectoral growth. Demographic trends in India and its effect on economic development - Occupational structure of the labour force.

ECONOMIC PLANNING AND POLICY

Indian Economic Planning, fiscal policy, Monetary Policy, Unemployment in India and other economic policies

INDUSTRIAL DEVELOPMENT

Industry: Industrial development during the planning period - Industrial policies Industrial licensing policy – MRTP Act, FERA and FEMA - Growth and problems of small-scale industries - Role of Public sector enterprises in India's industrialization. Impact of economic reforms on Indian industrial sector after 1991.

FOREIGN TRADE

External Sector - Role of foreign trade. Trends in exports and imports - Composition and direction of India's foreign trade - Balance of payments crisis and the New Economic Reforms – Export promotion measures and the new trade policies - Foreign capital – FDI, aid: Multinational corporations in India

ISSUES

Important Areas of Concern - Poverty and inequality. Unemployment. Rising prices. Industrial relations. Industrial structure and causes of industrial backwardness.

REFERENCES

1. Agrawal, A.N. Indian Economy Problems of Developmental Planning, Wiley Eastern Ltd., Calcutta, latest edition.
2. Ahluwalia, I.J. and I.M.D. Little (eds.), India's Economic Reforms and Development, Essays in honour of Manmohan Singh, Oxford University Press, New Delhi, 1999.
3. Alam, K., Agricultural Development in North East India: Constraints and Prospects, Deep & Deep Publications, New Delhi, 1993.

4. Choudhuri, Pramit. Aspects of Indian Economic Development, Lord George Allen & Unwin Ltd., London, 1975.
5. Dutt, R.C., The Economic History of India Under Early British Rule, Low Price Publications, Delhi, 1950.
6. Dutt, Ruddar and K.P.M. Sundaram, Indian Economy, S. Chand & Co. Ltd., New Delhi, 2001

HSS004	INDUSTRIAL PSYCHOLOGY	L	T	P	C
		3	0	0	3
Prerequisite	Basic idea about an organization and its functions.				
Objective(s)	To develop an awareness of the major perspectives underlying the field of Industrial Psychology. To develop an understanding of how theory in Industrial Psychology is applied in work settings. To develop an understanding for the potential Industrial Psychology has for society and organizations now and in the future.				

Course Outcome(s)

CO1	Understanding of key concepts, theoretical perspectives, and trends in industrial psychology.
CO2	Evaluate thorough and systematic competency model
CO3	Analyze the environment and design a job
CO4	Create a better work environment for better performance
CO5	Design a performance appraisal process and form

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		M						M	M			M
CO2			M			M					H	
CO3	L				M	M			M		H	M
CO4			M						M	M	M	
CO5				M		M	M					M

Course Topic(s)

INTRODUCTION

The role of the psychologist in industry, the field of occupational Psychology - Study of behavior in work situation and applications of Psychological principles to problems of selection, Placement, Counseling and training

DESIGN OF WORK ENVIRONMENTS

Human engineering and physical environment techniques of job analysis, Social environment- Group dynamics in Industry Personal psychology - Selection, training, placement, promotion, counseling, job motivations, job satisfaction .Special Study of problem of fatigue, boredom and accidents.

UNDERSTANDING CONSUMER BEHAVIOUR

Consumer behavior; study of consumer preference, effects of advertising, Industrial morale - the nature and scope of engineering psychology, its application to industry

WORK METHODS

Efficiency at work, the concept of efficiency, the work curve, its characteristics - The work methods; hours of work, nature of work, fatigue and boredom, rest pauses. The personal factors; age abilities, interest, job satisfaction The working environment - noise, illumination atmospheric conditions - Increasing efficiency at work; improving the work methods, Time and motion study, its contribution and failure resistance to time and motion studies, need for allowances in time and motion study.

WORK AND EQUIPMENT DESIGN

Criteria in evaluation of job-related factor, job design, human factors, Engineering information, input processes, mediation processes, action processes, methods design, work space and its arrangement, human

factors in job design. Accident and Safety -The human and economic costs of accidents, accident record and statistics, the causes of accidents situational and individual factors related to accident reduction

REFERENCES

1. Tiffin,J and McCormic E.J., Industrial Psychology, Prentice Hall, 6th Edn., 1975.
2. McCormic E.J., Human Factors engineering and design, McGraw Hill, 4th Edn.,1976.
3. Mair, N.R.F., Principles of Human relations
4. Gilmer, Industrial Psychology
5. Ghiselli& Brown, Personnel and Industrial Psychology.
6. Myer, Industrial Psychology.
7. Dunnete, M.D., Handbook of Industrial and Organizational Psychology.
8. Blum & Taylor, Industrial Psychology

HSS006	PROFESSIONAL ETHICS	L	T	P	C
		3	0	0	3

Prerequisite	Basic idea about management principles.
Objective(s)	To create an awareness on Engineering Ethics and Human values. To study the moral issues and decisions confronting individuals and organizations engaged in engineering profession. To study the related issues about the moral ideals, character, policies, and relationships of people and corporations involved in technological activity

Course Outcome(s)

CO1	Understand the engineering code of ethics and be able to apply them as necessary.
CO2	Understand moral complexities in many engineering activities and decision- making processes
CO3	Understand some of the contemporary issues in the engineering professions
CO4	Effectively communicate their knowledge and understanding of engineering ethics
CO5	Learn the moral issues and moral problems in engineering and how to find the solution to those problems.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M		H	M		M	M
CO2		M				M		H	L		M	M
CO3		M				M		M			M	L
CO4						M		H	M		M	
CO5						M		H	M			L

Course Topic(s)

ENGINEERING ETHICS

Functions of Being a Manager – Stock holder and stakeholder management - Ethical treatment of employees - ethical treatment of customers- supply chain management and other issues. **ENGINEERING AS SOCIAL EXPERIMENTATION**

Senses of Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional ideals and virtues – Theories about right action – Self-interest – Customs and religion – Use of Ethical Theories.

ENGINEER RESPONSIBILTY FOR SAFETY

Corporate social responsibility - Collegiality and loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Discrimination.

RESPONSIBILITY AND RIGHTS

Moral imagination, stake holder theory and systems thinking - One approach to management Decision – making Leadership.

GLOBAL ISSUES

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

REFERENCES

1. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill, New York, 1996.
2. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 1999.
3. Laura Schlesinger, How Could You Do That: The Abdication of Character, Courage, and C onscience, Harper Collins, New York, 1996.
4. Stephen Carter, Integrity, Basic Books, New York, 1996.
5. Tom Rusk, The Power of Ethical Persuasion: From Conflict to Partnership at Work and in Private Life, Viking, New York, 1993.

HSS008	BASICS OF ECONOMICS	L	T	P	C
		3	0	0	3
Prerequisite	Knowledge on Economic Activities and different economic systems.				
Objective(s)	To learn, understand and apply economic theories of International Trade, political economy of International Trade and central issues in International Macro Economics.				

Course Outcome(s)

CO1	Understand the scope and microeconomics in relation.
CO2	Understand the law of demand.
CO3	Evaluate strategy of market demand and supply schedule.
CO4	Explain the effectiveness of macro-economic policy.
CO5	Analyze the balance of payments.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1											M	L
CO2											M	L
CO3		M			M					M	M	M
CO4							L				M	M
CO5	M	L			L							M

Course Topic(s)

DEFINITION AND SCOPE OF ECONOMICS

Definitions by A. Smith, A. Marshal and L. Robbins, P.Samuelson and their critical examination - Nature and scope of Economics - Micro-economics in relation to other branches of Economics.

LAW OF DEMAND

Elasticity of demand - price, income and cross, concepts and measurement - Marshallian theory of consumers' behaviour and its critical examination - Indifference curve analysis - Price, income and substitution effects - Giffen goods- Engel curve.

MARKET STRUCTURE

Definition of market. Concepts of product and factor markets. Different types of market: perfect competition, monopoly, imperfect competition, monopolistic, competition and oligopoly. Demand and Supply schedules. Price determination under perfect competition in long and short run. Price determination under monopoly. Discriminating monopoly.

MACRO-ECONOMICS

Meaning, Macro-economic Policy and Its Objectives and Instruments - National Income and Social Accounting - Concepts, components, and measurement - Basic circular flow of income model, Unemployment, trade cycle, Inflation - causes, types, effects and control.

COMMERCIAL AND CENTRAL BANKS

Credit creation, monetary policy and tools - Balance of payments - Items in the balance of payments account, equilibrium in the balance of payments

References

1. Ackley, G., Macroeconomics: Theory and Policy, Macmillan Publishing Company, New York, 1978
2. Gupta, S.B., Monetary Economics, S. Chand & Co., New Delhi, 1994.
3. RuddarDatt and K.P.M.Sundharam, Indian Economy, S.Chand& Company Ltd., New Delhi, 2003.
4. Kindleberger, C.P., R.D. Irwin, International Economics, Home Wood, 1973.
5. Lewis, M.K. and P.D. Mizan, Monetary Economics, Oxford University Press, New Delhi, 2000.
6. Ahuja H.L., Economic Environment of Business, Macroeconomic analysis, S.Chand& Company Ltd., New Delhi, 2005.
7. Gupta, G.S. Macroeconomics, Theory and Applications, Tata McGraw-Hill publishing company Ltd., New Delhi, 2001.
8. D.N.Dewedi, Macroeconomic – Theory and policy, Tata McGraw-Hill publishing company Ltd., New Delhi, 2001.
9. K.P.M.Sundaram, Money Banking and international Trade, Himalaya Publishing House

HSS010	INTERNATIONAL TRADE AND FINANCE	L	T	P	C
		3	0	0	3
Prerequisite	Basic Understanding of Functions of Trade and Finance				
Objective(s)	The Objective of the course is to teach the basic International Trade and Finance how an organization manages its people effectively.				

Course Outcome(s)

CO1	Evaluate the International Trade and Economic Growth
CO2	Understanding the export and import policies.
CO3	Understand the Exchange rates and functions.
CO4	The student able to understand various documentation and standards for international trade.
CO5	Understand the export schemes of the government.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M		M				H
CO2						M		M				H
CO3		M				M		M		L	M	M
CO4								M		H		H
CO5						M		M		M		H

Course Topic(s)

INTERNATIONAL TRADE

International Trade – Meaning and Benefits – Basis of International Trade – Foreign Trade and Economic Growth – Balance of Trade – Balance of Payment – Current Trends in India – Barriers to International Trade – WTO – Indian EXIM Policy.

EXPORT AND IMPORT FINANCE

Special need for Finance in International Trade – INCO Terms (FOB, CIF, etc.,) – Payment Terms – Letters of Credit – Pre Shipment and Post Shipment Finance – Forfeiting – Deferred Payment Terms – EXIM Bank – ECGC and its schemes – Import Licensing – Financing methods for import of Capital goods.

FOREX MANAGEMENT

Foreign Exchange Markets – Spot Prices and Forward Prices – Factors influencing Exchange rates – The effects of Exchange rates in Foreign Trade – Tools for hedging against Exchange rate variations – Forward, Futures and Currency options – FEMA – Determination of Foreign Exchange rate and Forecasting.

DOCUMENTATION IN INTERNATIONAL TRADE

Export Trade Documents - Financial Documents – Bill of Exchange- Type- Commercial Documents - Performa, Commercial, Consular, Customs, Legalized Invoice, Certification of Origin Certificate Value, Packing List, Weight Certificate, Certificate of Analysis and Quality, Certificate of Inspection, Health certificate. Transport Documents - Bill of Landing, Airway Bill, Postal Receipt, Multimodal Transport Document. Risk Covering Document: Insurance Policy, Insurance Cover Note. Official Document: Export Declaration Forms, GR Form, PP From, COD Form, Softer Forms, Export Certification, Certification of Origin, GSPS – UPCDC Norms

EXPORT PROMOTION SCHEMES

Government Organizations Promoting Exports – Export Incentives : Duty Exemption – IT Concession – Marketing Assistance – EPCG, DEPB – Advance License – Other efforts I Export Promotion – EPZ – EQU – SEZ and Export House.

REFERENCES

1. Apte P.G., International Financial Management, Tata McGraw Hill.
2. Larceny & Bhattacharya, International Marketing, Sultan Chand & Sons.
3. B.M.Wali and AB Kalkumdrikas, Export Management, Sterling Publishers Pvt., Ltd.
4. Websites of WTO, World Bank, IMF, Ministry of Commerce, ECGC and EXIM Bank.

HSS011	INFORMATION SYSTEMS FOR MANAGERIAL DECISION MAKING	L	T	P	C
		3	0	0	3
Prerequisite	Basic Understanding of principles of management.				
Objective(s)	The Objective of the course is to teach the basics about information systems and how an organization manages its people effectively and decision making				
Course Outcome(s)					
CO1	Understanding the framework&information system architecture				
CO2	Understanding the Functional areas, Finance, marketing, production				
CO3	Understand the system development life cycle &structured methodologies				
CO4	Able to implement and control of information system.				
CO5	Evaluate the software engineering qualities.				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						L			M	M		
CO2							M	M			H	
CO3	M				H		M				L	M
CO4	M					H	M		H		M	
CO5	M				M				H		L	H

Course Topic(s)

INTRODUCTION

Information system – establishing the framework – business model – information system architecture – evolution of information systems.

INFORMATION SYSTEM

Functional areas, Finance, marketing, production, personnel – levels, Concepts of DSS, EIS, ES – comparison, concepts and knowledge representation – managing international information system.

SYSTEM DEVELOPMENT

Modern information system – system development life cycle – structured methodologies – designing computer based method, procedures control, designing structured programs.

IMPLEMENTATION AND CONTROL

Testing security – coding techniques – detection of error – validation – cost benefits analysis – assessing the value and risk information systems.

SOFTWARE ENGINEERING

Software engineering qualities – and software quality assurance – software life cycle models – verification and validation.

REFERENCES

1. Kenneth C. Laudon and Jane Price Laudon, Management Information systems Managing the digital firm, Pearson Education, Asia.
2. Gordon B.Davis, Management Information system: Conceptual Foundations, Structure and Development, McGraw Hill, 1974.
3. Joyce J. Elam, Case series for Management Information System, Silmon and Schuster, Custom Publishing, 1996.
4. Steven Alter, Information system – A Management Perspective, AddisonWesley, 1999.
5. James AN O' Brein, Management Information Systems, Tata McGraw Hill, New Delhi, 1999.
6. Turban Mc Lean, Wetherbe, Information Technology Management making connection for strategic advantage, John Wiley, 1999.
7. Ralph M.Stair and George W.Reynolds, Principles of Information Systems – A Managerial Approach Learning, 2001.

HSS013	COST ANALYSIS AND CONTROL	L	T	P	C
		3	0	0	3
Prerequisite	Basic idea about Process Planning and Cost Estimation (MEC319)				
Objective(s)	The Objective of the course is to teach cost estimation in Industrial.				

Course Outcome(s)

CO1	Understanding the concepts of costing.
CO2	Analysis the profit and marginal costing
CO3	Ability to understand Budgeting and Budgetary control
CO4	Understand standard costing principles.
CO5	Evaluate the overall costing based on activities.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1											H	M
CO2	M		M		M					M		
CO3	M			M	M			H	L	M		
CO4											L	M
CO5	M			M	L			L		M		

Course Topic(s)

INTRODUCTION TO COSTING

Costing, Elements of costing, Types of cost, Preparation of cost sheet.

COST ANALYSIS

Marginal costing, Cost - volume – Profit analysis, Break-Even-Analysis, Break – Even-Chart, Applications.

CONTROL TECHNIQUES

Budgeting and Budgetary control, Types of Budgets , Preparation of purchase Budget, Flexible budgets, Cash Budget, Sales Budget, Materials Budget, Master Budget, Zero based Budgeting.

STANDARD COSTING

Types of Standards, Setting up of standards, Advantages and Criticism of Standard Costing – Control through variances.

ACTIVITY BASED COSTING

Transfer Pricing, Target costing, Life Style Costing, Activity Based Costing (only theory).

REFERENCES

1. K.Saxena& C.D. Vashist, Advanced Cost Accounting and Cost Systems, V.Sultan Chand & Sons Publishers.
2. S.P. Jain & K. L. Narang, Advances Cost Accounting Kalyani Publishers.
3. Cost Management, The Institute of Charted Accountants of India.
4. J. Blocher, K. H. Chen, G. Cokins and T. W. Lin., Cost Management: A Strategic Emphasis, Irwin/McGraw-Hill, 3d edition, 2005
5. J. Sha, Cases in Cost Management: a Strategic Emphasis by Second Edition. South- Western, 2001
6. BhabatoshBangerjee, Financial Policy & management ,Prentice Hall
7. Anthony.Dearden&Vancil, Management Control Systems, Irwin

HSS014	MARKETING MANAGEMENT	L	T	P	C
		3	0	0	3
Prerequisite	Fundamentals of marketing, principles of management, consumer behavior.				
Objective(s)	This course is designed to provide students with a basic understanding of the fundamental principles of Marketing.				
Course Outcome(s)					
CO1	Understanding analysis of marketing decisions, consumer behavior and marketing research methods.				
CO2	Creativity to product planning and product development.				
CO3	Ability to understand the concept of different pricing methods and its objectives.				
CO4	Understanding the types of marketing distribution.				
CO5	Develop transferable intellectual and study skills which will encourage a positive attitude to continuing personal development and lifelong learning.				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M					M	
CO2							H	L			L	
CO3	M					L		H	M		H	M
CO4							L		H	H		
CO5						L					M	L

Course Topic(s)

MARKETING

Meaning -concept -functions -marketing Planning & implementation marketing Programmes - Marketing environment – Market Segmentation and consumer behaviour – Influencing factors, Decision process – Marketing mix – Marketing department.

PRODUCT

Meaning - Product planning - policies - positioning - New product development Product life cycle – BCG Matrix-branding. Packing, labeling.

PRICING

Pricing objectives – Setting and modifying the price – Different pricing method Product line pricing and new product pricing

DISTRIBUTION

Nature of Marketing channels - Types of Channel flows - Channel functions - Channel co- operation, conflict and competition - Direct Marketing Telemarketing, Internet shopping. **PROMOTION**

Promotion Mix - Advertisement - Message - copy writing – Advertisement budgeting - Measuring advertisement effectiveness - Media strategy - sales promotion - Personal selling, publicity and direct marketing

REFERENCE BOOKS

1. Philip Kotler, Marketing Management- Analysis Planning and Control, Prentice Hall of India, New Delhi.
2. Cundiff, Still &Govoni, Fundamentals of Modern Marketing, Prentice Hall of India, New Delhi.
3. Ramaswamy. V S &Namakumari. S, Marketing Management-Planning Implementation and Control, Macmillan Business Books, 2002.
4. Jobber, Principles and Practice of Marketing, McGraw-Hill.

HSS015	MANAGEMENT CONCEPTS AND TECHNIQUES	L	T	P	C
		3	0	0	3
Prerequisite	Basic Knowledge about managerial information.				
Objective(s)	This course introduces students to the basic role of the manager in modern business. Among the topics discussed are: paradigm shifts; environmental factors affecting decision-making; ethics/social responsibility; and planning organizing, motivating and controlling organizational resources.				
Course Outcome(s)					
CO1	Identify environmental issues as they impact management and develop strategies to adapt to these environments and also it clearly describes and discusses about the elements of effective management.				
CO2	Identify and explain issues involved in managing a diverse workforce and conduct necessary research to address these issues, then apply the planning, organizing and control processes wherever necessary.				
CO3	Identify, discuss and/or describe various theories related to the development of leadership skills, motivation techniques, teamwork and effective communication				
CO4	Communicate effectively through both oral and written presentations and Conduct more researches and then analyze information by using both human and technological resources				
CO5	Work effectively as a team member through group projects, case studies and problem analysis.				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						L	H	L			H	
CO2						H	H		M		M	
CO3						L		L	H	M	H	
CO4										H		
CO5						L	M		H		L	

Course Topic(s)

DEVELOPMENT OF MANAGEMENT THOUGHT

Scientific Management Movement, Administrative Movement, Human- Relations Movement, Decision-Science Movement, Behavioral Movement, Systems Movement, Contingency Movement

ESSENTIALS OF PLANNING

Objectives, goals, Programmed Decisions and Un programmed Decisions; Decision-Making, Creativity in Decision-Making, Forecasting and Strategy to Formulation.

EFFECTIVE ORGANIZING

Span of Control, Departmentation, Authority; Responsibility, Bureaucracy and Adhocracy; Group Dynamics

REALITIES OF ORGANIZATIONAL LIFE

Organizational Politics, Organizational Power, Organizational Conflict

COMMUNICATION & CONTROL

Communication Process Evaluation, Control Process, Qualities of a Good Control System, Management Audit, Human – Offset Accounting, Cost Benefit Analysis.

REFERENCE BOOKS

1. Harold Koontz & Heinz Weihrich, Essentials of Management, Tata McGraw Hill publishing company Ltd.
2. Koontz, Weihrich&Aryasri, Principles of Management, Tata McGraw Hill publishing company Ltd.
3. Tripathi& Reddy, Principles of Management, Tata McGraw Hill publishing company Ltd.
4. Hampton, Management, Tata McGraw Hill publishing company Ltd.
5. L.M.Prasad, Principles of Management.

HSS016	**ORGANIZATIONAL PSYCOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Prerequisite	Basic Functions and Principles of Management.				
Objective(s)	To introduce students to psychology theories and research at individual, group and organizational levels To help students understand organizational behavior and management practices by examining psychological principles To Improve your ability to work with and through other people. Improve your ability to work effectively with people who have different values, backgrounds or areas of expertise				
Course Outcome(s)					
CO1	Understanding of personnel assessment and selection, training effectiveness and how organizational identity and culture can affect employee and organizational functioning.				
CO2	Analyze the theories of Organizational Behaviour and personality factors.				
CO3	Analyze these theories and empirical evidence help to understand contemporary organizational issues.				
CO4	Apply theories to practical problems in organizations in a critical manner				
CO5					

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L						M		L		H	
CO2		L						H	M		M	
CO3		L						M			H	L
CO4							M		L		M	H
CO5												

Course Topic(s)

FOCUS AND PURPOSE

Definition, need and importance of organizational Behaviour – nature and scope – frame work.

INDIVIDUAL BEHAVIOUR

Personality – types – factors influencing personality – theories – learning – types of learners – learning theories – organizational Behaviour modification. Attitudes – characteristics – components – formation – measurement. Perceptions – importance – factors influencing perception – interpersonal perception.

GROUP BEHAVIOUR

Organization structure – formation – groups in organizations – influence – group dynamics – emergence of informal leaders and working norms – group decision making techniques – interpersonal relations – communication – control.

POWER

Leadership styles – theories – leaders Vs managers – sources of power – power centers – power and politics.

DYNAMICS OF ORGANIZATIONAL BEHAVIOURS

Organizational climate – factors affecting organizational climate – importance. Job satisfaction – determinants – measurements – influence on behavior. Organizational change – importance – stability Vs change – proactive Vs reaction change – the change process – resistance to change – managing change. Organizational development – characteristics – objectives – team building. Organizational effectiveness – perspective – effectiveness Vs efficiency – approaches – the time dimension – achieving organizational effectiveness.

REFERENCES

1. Stephen P.Robins, Organisational Behavior, Prentice Hall of India, 9th edition, 2001.
2. Hellriegel, Slocum and Woodman, Organisational Behavior, South-Western, Thomson Learning, 9th edition, 2001.
3. Schermerhorn, hunt and Osborn, Organisational behavior, John Wiley, 7th edition, 2001.
4. JitS.Chand, Organisational Behavior, Vikas publishing House Pvt. Ltd. 2nd edition, 2001.
5. Fred Luthans, Organisational Behavior, McGraw Hill Book Co., 1998.
6. New Strom & Davis, Organisationalbehaviour, McGraw Hill, 2001.
7. Jaffa Harris and Sandra Hartman, OrganisationalBehaviour, Jaico, 2002.

HSS017	INTERNATIONAL ECONOMICS	L	T	P	C
		3	0	0	3
Prerequisite	Knowledge on Economic Activities in India Knowledge on Influence of Government influence in controlling economic effects. Knowledge on different economic systems.				
Objective(s)	To learn, understand and apply economic theories of International Trade To understand the political economy of International Trade To learn and understand the central issues in International Macro Economics				
Course Outcome(s)					
CO1	Understand trade laws, and the national and international institutions central to trade.				
CO2	Evaluate economic integration and conflicts across countries.				
CO3	Evaluate strategic trade policies from the perspective of nations and companies.				
CO4	Explain how exchange rate is determined in the long run and the short run.				
CO5	Analyze interpret a nation's balance of payments and related accounts.				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						H		M				H

CO2						M	L	H				
CO3							L				L	
CO4								M		L		
CO5	L						H				M	H

Course Topic(s)

INTRODUCTION

The Traditional Theory of International Trade, The Basic Trade Model, Heckscher-Ohlin- Samuelson Model, Effects of Tariffs & Quotas, Theory of Factor Movements - New Theories of International Trade and Industrial Policies.

EXCHANGE RATE & BALANCE OF PAYMENT

The Balance of Payments and National Accounts, Determinants of Exchange Rates The Exchange-Rate Regime Choice and a Common Currency Area, International Debt and Currency Crises.

INTERNATIONAL REGULATORY AUTHORITY

Political Economy of Trade Disputes, the FTA and the WTO -The role of the IMF and other International Financial Organizations. Reasons for Protection World Trade, International Movements of Capital - The Balance of Trade and Other Measures of International Transactions. Export and import policies.

INTERNATIONAL MACROECONOMICS

European Monetary Unification and the Euro - Preferential Trading Arrangements and the NAFTA International Policies for Economic Development, Trade Outsourcing and Off shoring

REFERENCE BOOKS

1. N. Bhagwati, A. Panagariya and T. N. Srinivasan, Lectures on International Trade, MIT Press, 2nd edition, 1998.
2. M. Obstfeld and K. Rogoff, Foundation of International Macroeconomics, McGraw-Hill, 1996.
3. Romer, D., Advanced Macroeconomics, McGraw Hill, 1996.

HSS018	**COMMUNICATION SKILLS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Prerequisite	English Technical communication –II(HSS102)				
Objective(s)	The objective of this course is to improve the communication skills.				
Course Outcome(s)					
CO1	Demonstrate ability to apply communication concepts and theories to address everyday dilemmas within dimensions (ethical, social, legal, technological, relational, andcultural) central to the student's major focus.				
CO2	Demonstrate oral and written communication skills expected of a future professional inthe field.				
CO3	Demonstrate communication research skills expected of a future professional in the field.				
CO4	Demonstrate understanding of ethical values central to the communication discipline.				
CO5	Demonstrate the ability to integrate communication and business scholarship for application in work settings.				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M				H	M	
CO2										H		
CO3										H		L
CO4								H	M	H		
CO5							L			H	M	

Course Topic(s)

COMMUNICATION IN BUSINESS

Systems approach, forms of business communication, management and communication, factors facilitating communication.

COMMUNICATION PROCESS

Interpersonal perception, selective attention, feedback, variables, listening barriers to listening, persuasion, attending and conducting interviews, participating in discussions, debates and conferences, presentation skills, paralinguistic features, oral fluency development.

BUSINESS CORRESPONDENCE

Business letter. Memos, minutes, agendas, enquiries, orders, sales letters, notice, tenders, letters of application, letter of complaints.

TECHNICAL REPORTS

Format, Choice of vocabulary, coherence and cohesion, paragraph writing, organization.

PROJECT REPORTS

Project proposal, project reports, and appraisal reports.

REFERNCES

1. SharanJ.Genrson and Steven M.Gerson, Technical Writing - Process and Product, Pearson Education, 2000.
2. Raymond V.Lesikar, John D. Pettit and Mary E.Flatley, Lesikass Basic Communication, Tata McGraw Will, 8th Edition, 1999.
3. Stevel. E. Pauley, Daniel G.Riordan, Technical Report Writing Today, AITBS Publishing & Distributors, India 5th edition, 2000.
4. Robert L.Shurter, Effective letters in business, Third Ed., 1983.
5. McGraith, Basic Managerial Skills for all Prentice Hall of India, 6th Edition, 2002.
6. Halliday, M.A.KyR.Hasan, Cohesion in English, Longman, London, 1976.

HSS019	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3
Prerequisite	Students should have the logical thinking ability and basic skills in mathematics.				
Objective(s)	This course will focus on mathematical modeling. A strong emphasis will be given to model formulation and solving skill.				
Course Outcome(s)					
CO1	Identify and distinguish the skills to build their own formulations				
CO2	Evaluate to expand existing formulations				
CO3	Analyze and evaluate the critical formulas				
CO4	Understand how to choose an appropriate solution technique for a given formulation.				
CO5	Identify the optimal solution from the given formulation				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		M			M	M		H			L	
CO2		L	H	M	M							
CO3	M	H	M		H							
CO4		M	H	M	H							
CO5	M	H	H	H	H							

Course Topic(s)
INTRODUCTION TO LINEAR PROGRAMMING Introduction to applications of operations research in functional areas of management - Linear Programming - formulation, solution by graphical and simplex methods (Primal - Penalty, Two Phase), Special cases - Dual simplex method. **TRANSPORTATION MODELS AND ASSIGNMENT MODELS** Transportation Models (Minimising and Maximising Cases) – Balanced and unbalanced cases – Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogel's approximation methods - Check for optimality - Solution by MODI / Stepping Stone method - Cases of degeneracy - Transshipment Models - Assignment Models (Minimising and Maximising Cases) – Balanced and Unbalanced Cases - Solution by Hungarian and Branch and Bound Algorithms - Travelling Salesman problem - Crew Assignment Models. **INTEGER LINEAR PROGRAMMING AND GAME THEORY** Solution to pure and mixed integer programming problem by Branch and Bound and cutting plane algorithms - Game Theory - Two person Zero sum games - Saddle point, Dominance Rule, graphical and LP solutions. **REPLACEMENT MODELS AND DECISION THEORY** Replacement Models-Individuals replacement Models (With and without time value of money) – Group Replacement Models - Decision making under risk – Decision trees – Decision making under uncertainty. **PROJECT MANAGEMENT METHOD AND SIMULATION** PERT / CPM – Drawing the network, computation of processing time, floats and critical path. Resource leveling techniques - Application of simulation techniques for decision making.
REFERENCES 1. Kalavathy S, Operations Research, Vikas Publishing House, Second Edition, third Reprint 2004. 2. Paneerselvam R., Operations Research, Prentice Hall of India, Fourth Print, August 2003. 3. Tulsian P.C, Vishal Pandey, Quantitative Techniques (Theory and Problems), Pearson Education, Asia, First Indian Reprint 2002.

HSS020	HUMAN RESOURCE MANAGEMENT	L	T	P	C
		3	0	0	3
Prerequisite	Knowledge on General Management Legal Aspects of Business				
Objective(s)	The Objective of the course is to teach the basic principles of strategic human resource Management—how an organization acquires, rewards, motivates, uses, and generally manages its people effectively.				
Course Outcome(s)					
CO1	Synthesize the role of human resources management as it supports the success of the Organization including the effective development of human capital as an agent for Organizational change				
CO2	Applying the knowledge of laws that impact behavior in relationships between employers and employees that ultimately impact the goals and strategies of the organization				
CO3	Understand the role of employee benefits and compensation as a critical component of Employee performance, productivity and organizational effectiveness.				
CO4	Show evidence of the ability to analyze, manage and problem solve to deal with the challenges and complexities of the practice of collective bargaining				
CO5	Demonstrate knowledge of practical application of training and employee Development as it impacts organizational strategy and competitive advantage				

Mapping of COs with POs												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							L		H	H		M
CO2						H					H	M
CO3							M				M	H
CO4						M			M			M
CO5						L	M				L	M

Course Topic(s)

INTRODUCTION

Functions of a human resources manager - recruitment and selection processes interview methods.

HR- EVALUATION AND DEVELOPMENT

Performance appraisal, Training and development, disciplinary procedures, collective bargainingand employee welfare.

TRENDS IN HRM

The recent methods and trends in HRM with a few case studies in the context of globalization.

STRATEGIC ROLE OF HUMAN RESOURCE MANAGEMENT

Job analysis Personnel planning and recruiting Employee testing and selection, interviewing candidates, Appraising performance

CAREER AND COMPENSATION

Managing careers Compensation Benefits and services Labor relations and collective bargaining

REFERENCES

1. Decenzo and Robbins, Human Resource Management, Wiley, 6th edition, 2001.
2. BiswajeetPattanayak, Human Resource Management, Prentice Hall of India, 2001.
3. Eugene McKenna and Nic Beach, Human Resource Management, Pearson Education.
4. Dessler, Human Resource Management, Pearson Education Limited, 2002.
5. Mamoria C.B and Mamoria S., Personnel Management, Himalaya Publishing.
6. Wayne Cascio, Managing Human Resources, McGraw-Hill, 1998.
7. Ivancevich, Human Resource Management, McGraw-Hill, 2002.

HSS022	BANKING THEORY AND PRACTICE	L	T	P	C
		3	0	0	3
Prerequisite	Basic Understanding of Functions of Management				
Objective(s)	To introduce students to theories and research at individual, group and banking levels To improve your ability to work with and through other people.				
Course Outcome(s)					
CO1	Evaluate the Central Banking functions, Reserve Bank control over banks				
CO2	Understanding of personnelcustomer accounts, duties and relationship				
CO3	Understand the RBI control over loans andSecurities				
CO4	Student able to understand banking Agencies services				
CO5	Student able to understand the deficiency in banking services.				

Mapping of COs with POs												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						H						M
CO2						H						M
CO3						H		H				H
CO4						M						M
CO5						M		L				M

Course Topic(s)

EVOLUTION OF BANKING SYSTEM
Central Banking functions, Reserve Bank control over banks.
BANKER - CUSTOMER RELATIONSHIP
Bank as borrowers, customer accounts, duties of paying and collecting bankers.
LENDING BY BANKS
RBI control over loans and advances, Securities for loans.
AGENCY SERVICES BY BANKS
Banker as bailee, safe deposit vaults, credit cards.
CONSUMERS OF BANKING SERVICES Protection against deficiency in banking services.

REFERENCES

1. M.L.Tannan, Tannan's Banking Law and Practice in India, India Law House, New Delhi, 1997.
2. S.N.Gupta, The Banking Law in theory and Practice Vol. I & II, Universal Law Publishing
3. M.S.Parthasarathy, Banking Law-Leading Indian Cases, N.M.Tripathi, 1985.
4. L.C.Goyle, Law of Banking and Bankers, Eastern Law House, 1995.

HSS023	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
		3	0	0	3

Prerequisite	Basic Knowledge about business management
Objective(s)	This course develops an awareness of the state of entrepreneurship. Students are introduced to elements of successful entrepreneurship, opportunity identification and assessment, economic development potential of small business, alternative forms of work arrangements in the new economy balancing an entrepreneurial lifestyle.

Course Outcome(s)

CO1	Understand the concept of entrepreneurship and its close relationship with Enterprise and owner-management.
CO2	To understand the Business environment, Central and State Government Industrial Policies and Regulations of International Business.
CO3	Understand the concepts of innovation and creativity and the roles that both Play in entrepreneurship and business development.
CO4	To evaluate the Effective management of Business Units.
CO5	

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M		L	H			M
CO2						H					H	M
CO3						M			H		H	M
CO4						H		L		H	H	M
CO5												

Course Topic(s)

ENTREPRENEURIAL COMPETENCE
Entrepreneurship concept – Entrepreneurship as a Career – Entrepreneur – Personality Characteristics of Successful. Entrepreneur – Knowledge and Skills Required for an Entrepreneur.
ENTREPRENEURIAL ENVIRONMENT
Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organisational Services - Central and State Government Industrial Policies and Regulations - International Business.
BUSINESS PLAN PREPARATION
Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product - Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with the

Project - Feasibility Report Preparation and Evaluation Criteria.

LAUNCHING OF SMALL BUSINESS

Finance and Human Resource Mobilization Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching.

MANAGEMENT OF SMALL BUSINESS

Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units. Effective Management of small Business.

REFERENCES

1. Hisrich, 'Entrepreneurship', Tata McGraw Hill, New Delhi, 2001.
2. P. Saravanavel, 'Entrepreneurial Development', Ess Pee kay Publishing House, Chennai - 1997.
3. S.S.Khanka, 'Entrepreneurial Development', S.Chand and Company Limited, New Delhi, 2001.
4. Prasama Chandra, Projects – 'Planning, Analysis, Selection, Implementation and Reviews', Tata McGraw-Hill Publishing Company Limited 1996.
5. P.C.Jain (ed.), 'Handbook for New Entrepreneurs', EDII, Oxford University Press, New Delhi, 1999

HSS024	INDUSTRIAL PSYCHOLOGY	L	T	P	C
		3	0	0	3

Prerequisite	Basic Understanding of Functions of Industrial Management. Having studied Principles of Management subject.
Objective(s)	To introduce students to psychology theories and research at individual, group and industrial levels To help students understand industrial behavior and management practices by examining psychological principles To Improve your ability to work with and through other people. Improve your ability to work effectively with people who have different values, backgrounds or areas of expertise

Course Outcome(s)

CO1	Understanding of Perspective of Industrial Economics
CO2	Analysis of Markets and Market Structure
CO3	Goals of Firms/Industry and Market Performance
CO4	Apply theories toVertical Integration and Diversification
CO5	

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						L			M		L	M
CO2						L		M				M
CO3								M		M	H	M
CO4	L					M				M		H
CO5												

Course Topic(s)

A Perspective of Industrial Economics

The Analysis of Markets and Market Structure Goals of Firms/Industry and Market Performance Vertical Integration and Diversification

Technical Progress and Issues of Public Policy

REFERENCES

1. Gupta, G.S. Macroeconomics, Theory and Applications, Tata McGraw-Hill publishing company Ltd., New Delhi, 2001.
2. Samuelson, Paul A., and Nordhaus, W.D., Economics, Tata MGraw-Hill publishing company Ltd., New Delhi 2004.
3. D.N.Dewedi, Macro economic – Theory and policy, Tata McGraw-Hill publishing company Ltd., New Delhi, 2001.
4. K.P.M.Sundaram, Money Banking and international Trade, Himalaya Publishing House.

HSS031	ENGLISH ADVANCE LEVEL	L	T	P	C
		3	0	0	3
Prerequisite	Communication Skills (HSS018)				
Objective(s)	Acquisition of higher order Language skills: Style, Idiom, Nuance. Literature appreciation				
Course Outcome(s)					
CO1	Develop skills in writing level				
CO2	Develop skills in reading and oral.				
CO3					
CO4					
CO5					

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						L		L		H		M
CO2						M		L		H		M
CO3												
CO4												
CO5												

Course Topic(s)

Writing: Essays, Reports, Reading: Select Literary Texts: Prose, Poetry, Drama, Short Stories, Book Review, Oral Skills: Presentations; Discussions

REFERENCES:

1. Cambridge Advanced Learners' Dictionary 2005.
2. Palgrave's Golden Treasury: Ed. Palgrave, Frances Taylor London: Oxford University Press, 1861.
3. 20th Century English Literature, London: Penquin 1992.
4. The Garden of Forking Paths and other stories: Harris, V.C. New Delhi: Oxford University Press, 2002.
5. Discussion Materials: Film / News Clippings, Plays etc.

ONE CREDIT COURSE

MECX001	NON DESTRUCTIVE TESTING	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in mechanical testing, material characterization and defects				
Objective(s)	By the end of this course you should become familiar with a wide variety of nondestructive testing techniques for use in design, manufacturing and industrial service. You will able to know how each technique works, how you can apply it, when and where it can be used and the technique's capabilities and limitations. You will also be able to take an industrial NDT problem and determine which technique is best suited for the job, how you apply such technique and which information the technique will provide.				
Course Outcome(s)					
CO1	Understanding of processes and techniques used in multiple NDT Disciplines				
CO2	Analyze the non destructive testing for various industrial problems				
CO3	To apply nondestructive testing knowledge to effectively utilize problem solving skills as it relates to the operation of equipment in the industry				
CO4	Engage and interact as a team in a learning environment				
CO5	Develop skills which relate to the safe operation in the nondestructive testing industry standards.				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		M				CO1		M				CO 1
CO2		H	H		M	CO2		H	H		M	CO 2
CO3	M	M			H	CO3	M	M			H	CO 3
CO4				H		CO4				H		CO 4
CO5			H			CO5			H			CO 5

Course Topic(s)

INTRODUCTION AND RADIOGRAPHY

Introduction to NDT – need – advantages and limitations Radiography – Sources – IR192, cobalt 60 – X-ray film – processing – testing methods – film interpretation

ULTRASONIC TESTING

A,B,C scan, immersion Testing, Normal and Angle Probe Testing

MAGNETIC PARTICLE TESTING Methods – particles -

wet, dry and fluorescent **DYE PENETRANT TESTING**

Surface preparation –Testing procedure - types of penetrant

OTHER NDT METHODS

Thermography, Image processing TOFD and Phased Array - leak testing – Halogen, Helium

REFERENCES

1. Baldev Raj, Practical Radiology, Narosa Publishing House, 2004
2. R2 Non-Destructive Test and Evaluation of Materials by J Prasad , C. G. Krishnadas Nair, McGraw Hill R3 Education (India) Private Limited; 2 edition
3. R4 Non-Destructive Testing Techniques by , New Age International Pvt Ltd Publishers; Revised edition (1 December 2010)

4. R5. ASM Handbook, Volume 17, Non destructive testing and Quality control, ASM, 1976

MECX002	ADVANCED WELDING PROCESSES	L	T	P	C
		3	0	0	3

Prerequisite	Basic knowledge in manufacturing process, materials characterization and geometrical drawing.
Objective(s)	This course aims to understand the concept of advanced welding techniques. To know the welding geometry, welding joint and its application. To apply the recent welding techniques in various manufacturing engineering area. To enable the students, how to rectify the welding defects with latest technology.

Course Outcome(s)

CO1	Know the welding principle, safety equipments, handling procedures
CO2	Ability to understand the welding geometry, perform the welding joint as per design geometry construction and know the type of weld joints
CO3	Know the principles and application of advanced fusion welding processes
CO4	Understand the principle and application of advanced solid state welding
CO5	Analyze the welding defects with latest technology and know how to prevent the defects

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		M	H		M				H			
CO2		H	M		H						M	
CO3	L	M				M						
CO4			H	M				H				
CO5		M							M		M	

Course Topic(s)

INTRODUCTION AND SAFETY

Introduction to Welding – importance – recent technologies, Safe handling of machines and gases – tools and equipments

GEOMETRY

Welding Geometry – grooves – types – weld joints

ADVANCED FUSION WELDING PROCESSES

Electron beam welding, laser beam welding, plasma arc welding, Interpulse TIG welding, Cold metal transfer welding

ADVANCED SOLID STATE WELDING PROCESSES Diffusion Bonding,

Friction stir welding, friction stir spot welding **DEFECTS**

Welding defects – types – causes – remedial action

TEXT BOOKS

1. William A Bowditch, Welding Technology Fundamentals, Good Heart Willcox Publishers, 2006.

REFERENCES

1. Howard B Cary, "Modern Welding technology", Prentice Hall, New Jersy, 2002.
2. William A Bowditch, Welding Technology Fundamentals, Good Heart Willcox Publishers, 2006.
3. AWS Welding Handbook, Vol 1 & Vol 2, AWS New York, 1997.

4. Lancaster J F, " Metallurgy of Welding", George Allen Co, Boston, 1980

MECX003	CNC PROGRAMMING	L	T	P	C
		3	0	0	3
Prerequisite	Knowledge about the machining parameters				
Objective(s)	To learn the various types of modern CNC machines and CNC modes of operation To understand the fundamentals of part programming in terms of various steps needed to be taken for completing a successful CNC program To understand the different preparatory (G codes) and miscellaneous functions (M codes) as used in CNC programming.				
Course Outcome(s)					
CO1	Understand the basic procedures and concepts of programming, set up and operation of a CNC Machining Center				
CO2	Identify and understand the basic programming codes				
CO3	Identify and define the functions of the CNC machine control				
CO4	Set up the CNC machining center for manufacturing simple parts				
CO5	Manufacture simple parts on the CNC machining center				

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		H	M								M	
CO2			L		H	H						
CO3			H	M	H							
CO4	H		H		H						M	
CO5	L	M	M									

Course Topic(s)

CNC MACHINES

Numerical control – definition – components of NC systems, Development of NC, DNC, CNC, and adaptive control systems, Working principle of a CNC system, features and advantages of CNC machine Introduction to CNC systems - fanuc oi, siemens 840D, Heidenhein, current trends in programming, Human Machine Interface software – siemens – fanuc systems

CNC HARDWARE SYSTEM

CNC system elements, Drives, Slide ways, Feedback devices, ATC and Tool Magazines, and Machine Control Units

CNC PART PROGRAMMING

Part program structure, CNC program procedure – coordinate system, Sequence number, preparatory functions and G codes, miscellaneous functions and M codes, NC dimensioning – reference points – machine zero, work zero, tool zero and tool offsets, Types of motion control: point-to-point, paraxial and contouring Part Program – tool information – speed – feed data – interpolations, Macro – subroutines – canned cycles - Mirror images – thread cutting, Sample programs for lathe and milling, Conversational automatic programming, and APT programming Introduction to Computer assisted part programming – EdgeCAM, Master CAM etc.,

REFERENCE

1. CAD/CAM/CIM, R.Radhakrishnan, S.Subramanian, V.Raju, 2nd, 2003, New Age International Pvt. Ltd.
2. CAD/CAM, Mikell P.Groover, Emory Zimmers Jr. Indian Reprint Oct 1993, Prantice Hall of India Pvt., Ltd

		L	T	P	C

		3	**0**	**0**	**3**
Prerequisite	Basic knowledge in Mechanical Engineering and manufacturing processes				
Objective(s)	To understand the various processing techniques of plastic materials. To learn the fundamentals and compression molding and transfer molding of thermoset plastics. To learn the basic processing of thermoplastics by injection molding, extrusion and blow moulding.				

Course Outcome(s)

CO1	Know the basics of plastic materials
CO2	Understand the concept of moulding process
CO3	To take up responsibilities in production, testing, design and marketing in the plastics industries and contribute for the growth of industry.
CO4	
CO5	

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		H	H	M								
CO2	L						H				M	
CO3	M	M	H		H		M					M
CO4												
CO5												

Course Topic(s)

INJECTION MOULDING

Terminology – Process description- Theory of injection moulding – Design and consideration - moulding cycle —Trouble shooting operations. Types Injection unit & Elements of plastication process – Classification of screw – Screw design – Process control – Clamping unit.

BLOW MOULDING

Terminology – Basis in blow moulding - Process variables – Injection & stretch blow moulding – Single and multi layer. Extrusion blow moulding – Extrusion heads, moulding process controls for blow moulding – Machine, process and product controls. Thermoforming –Thermoforming machinery – Heating of sheet – Heating cycle - Stretching – Concept – Heat balance – Shrinkage – Trimmingoperations.

EXTRUSION AND COMPRESSION MOULDING

Principle – Types of Extruders – Single screw and twin-screw extruders – Metering – Screw Design - process control variables – Types of dies –Extrusion of Pipes- Extrusion profiles – Extrusion line for cable industry – Blown films – Flat film- Cast film - sheet film.

Types and procedure machinery and equipment moulding of thermoplastics – moulding of Thermosets - Transfer moulding advantages – Limitations-Rotational moulding – types of machines moulds – materials.

REFERENCES

1. Manas Chanda, Salil.K.Roy, Plastic Technology handbook. – CRC Press, Third edition 1998.
2. V. Rosato Kluwer, Injection moulding handbook. - Academic Publishers Boston 2nd edition 1995.
3. Richard C. Progelhof James. L. Throne, Polymer Engineering Principles, Hanser Publisher Munich 1993.
4. N.P. Charemisinoff & P.N. Chere, Handbook of applied Polymer processing Technology, Marcel Dekker Inc, NY 1996.
5. Herbert Rees, Understanding of Injection moulding Technology, Hanser Publications, Munich 1994
6. Vishu Shah, "Handbook of Plastics testing and Failure Analysis" — 3rd edition. John Wiley, NY, 2007

ONLINE COURSE

MECO001	MATERIAL SELECTION AND DESIGN	L	T	P	C
		3	0	0	3
Prerequisite	Sound of knowledge in Mechanical components and its Composite product.				
Objective(s)	To introduce the concept of various steps involved in the Design Process and 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, standard data, use of catalogues for designing standard machine components				
Course Outcome(s)					
CO1	Selection of materials for machine components suitable for applications				
CO2	Know the material property				
CO3	Understand the different material structure.				
CO4	Basic knowledge on composite materials.				
CO5					

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		L	M	M	L							
CO2			H	L	M							
CO3			M	M	L							
CO4				L	M		H					
CO5												

Course Topic(s)

INTRODUCTION TO MECHANICAL SYSTEM DESIGN

Materials and Design ,Evolution of Engineering Materials, Evolution of Engineering Materials, Material Resource in Indian Context, Classification of Materials, Case Study: Materials Selection for Vehicle Body,

MECHANICAL PROPERTIES OF MATERIALS

Overview of Material Properties, Surface Properties of Materials, Other Functional Properties of Materials,

BASIC STRUCTURE OF MATERIALS

Material Properties; The Role of Crystal Structure, Material Properties; The Role of Crystal Structure, Metals and Metallic Structure, METALLIC ALLOYS, CERAMICS & GLASSES ,Introduction to Polymeric Materials, Phases and microstructure of Polymers, Polymers for Mechanical Design

OVERVIEW OF COMPOSITE MATERIALS

Reinforcement Fibres for Composite Materials, Special type of Composites Metal Matrix Composite, Ceramic Matrix Composite, Design of Laminated Composite

THE DESIGN PROCESS

Material Selection using Ashby Method - Case Study, Multiple Constraints in material selection, Multiple Objectives, Role of Materials in Shaping the Product Character, Case Studies, The Role of Shape Factors in Material Selection, Design Case Studies - Guitar String Design

REFERENCES

1. Kenneth G.Budinski and Michael K.Budinski, Engineering Materials, Prentice-Hall of India Private Limited, 4th Indian Reprint 2002
2. Ronald Gibson, Principles of Composite Material Mechanics, Tata McGraw Hill, New Delhi, 1994.
3. Agarwal, B.D., and Broutman, L.J., Analysis and Performance of Fiber Composites, John Wiley and Sons, New York, 1980

MECO002	MICRO AND SMART SYSTEMS	L	T	P	C
		3	0	0	3
Prerequisite	Basic knowledge in Micro control system				
Objective(s)	To introduce and understand the Concepts & Design of Micro control systems.				

Course Outcome(s)

CO1	Describe product development, conceptual design and classify rapid prototyping systems; explain stereo lithography process and applications
CO2	Explain direct metal laser sintering, LOM and fusion deposition modeling processes
CO3	Demonstrate solid ground curing principle and process
CO4	Discuss LENS, BPM processes; point out the application of RP system in medical field define virtual prototyping and identify simulation components
CO5	Describe product development, conceptual design and classify rapid prototyping systems; explain stereo lithography process and applications

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L		H	M	M							
CO2			L		L							
CO3				H								
CO4		L										
CO5			H	M	M							

Course Topic(s)

INTRODUCTION

Glimpses of Microsystems; scaling effects, Smart materials and systems: an overview, Microsensors Microactuators, Microsystems: some examples, Examples of smart systems: structural health monitoring and vibration control

MICROFABRICATION PROCESSES

Structure of silicon and other materials, Silicon wafer processing; Thin-film deposition, Lithography, wet etching and dry etching, Bulk micromachining and Surface micromachining, Wafer-bonding; LIGA and other moulding techniques, Soft lithography and polymer processing, Thick-film processing; Low temperature co-fired ceramic processing, Smart material processing

MECHANICS OF SOLIDS

Stresses and deformation: bars and beams, Microdevice suspensions: lumped modelling, Residual stress and stress gradients, Poisson effect; Anticlastic curvature; examples of micromechanical structures, Thermal loading; bimorph effect, Dealing with large displacements; in-plane and 3D elasticity equations, Vibrations of bars and beams, Gyroscopic effect, Frequency response; damping; quality factor, Basic micro-flows for damping calculation,

FINITE ELEMENT METHOD

Types of numerical methods for solving partial differential equations, What is finite element method? Variational principles, Weak form; shape functions, Isoparametric formulation and numerical integration, Implementation of the finite element method, FEM for piezoelectrics, **ELECTRONICS AND PACKAGING**

Semiconductor devices: basics, OpAms and OpAmp circuits, Signal conditioning for microsystems devices, Control and Microsystems, Vibration control of a beam, Integration of microsystems and microelectronics, Packaging of Microsystems: why and how, Flip-chip, ballgrid, etc.; reliability, Case-study 1 (Pressure sensor), Case-study 2 (Accelerometer)

MECHANICS OF SOLIDS

Stresses and deformation: bars and beams, Microdevice suspensions: lumped modelling, Residual stress and stress gradients, Poisson effect; Anticlastic curvature; examples of micromechanical structures, Thermal loading; bimorph effect, Dealing with large displacements; in-plane and 3D elasticity equations, Vibrations of bars and beams, Gyroscopic effect, Frequency response; damping; quality factor, Basic

micro-flows for damping calculation,

REFERENCES

1. S.D. Senturia, Microsustem Design, Kluwer Academic Publishers, 2001.
2. Tai-Ran Hsu, MEMS & Microsystems Design and Manufacture, McGraw Hill, 2002.
3. V.K. Varadan, K.J. Vinoy, and S. Gopalakrishnan, Smart Material Systems and MEMS: Design and Development Methodologies, Wiley, 2006.

MECO003	FINITE ELEMENT ANALYSIS OF SOLIDS AND FLUIDS - I	L	T	P	C
		3	0	0	3
Prerequisite	Sound knowledge in mathematics, Solid Mechanics and Engineering Mechanics				
Objective(s)	To equip the students with the Finite Element Analysis fundamentals. and enable the students to formulate the design problems into FEA, to introduce basic aspects of finite element technology, including domain discretization, polynomial interpolation, application of boundary conditions, assembly of global arrays, and solution of the resulting algebraic systems.				

Course Outcome(s)

CO1	Identify mathematical model for solution of common engineering problems.
CO2	Formulate simple and complex problems into finite elements.
CO3	Solve structural, thermal, problems.
CO4	Derive element matrix equation by different methods by applying basic laws in mechanics and integration by parts.
CO5	

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	H									
CO2	M							L				
CO3	H	M	H	H	M					M		
CO4	H		L									
CO5												

Course Topic(s)

Introduction to finite element analysis process, Analysis of solids/structures and fluids, the principle of virtual work, The finite element formulation, Finite element solution process, Demonstration on using ADINA, Nonlinear finite element analysis of solids and structures, Heat transfer analysis, Finite element analysis of heat transfer and incompressible fluid flow, Physical explanation of Gauss elimination, Solution of dynamic equilibrium equations, Demonstration on finite element methods in ADINA, Modeling for dynamic analysis and solution, Wave propagation response, Solution of the generalized eigen value problem, Solution of $K\varphi = \lambda M\varphi$

REFERENCES

Bathe, K. J. Finite Element Procedures. Cambridge, MA: Klaus-Jürgen Bathe, 2007. ISBN: 9780979004902

MECO004	MECHANICAL ASSEMBLY AND ITS ROLE IN PRODUCT DEVELOPMENT	L	T	P	C
		3	0	0	3
Prerequisite	Sound knowledge of fundamentals of Mechanical components and its product.				
Objective(s)					

	To know the mechanical behavior of engineering materials, such as metals, ceramics, polymers, and composites. To understand the mechanical properties and testing of the materials and also find out the suitability of the materials for different applications
Course Outcome(s)	
CO1	Have the knowledge of fundamental mechanical behavior of engineering materials
CO2	Know fundamental response of engineering materials to loading conditions
CO3	Understand elastic and plastic deformation.
CO4	Knowledge of materials strengthening mechanisms, including work hardening, boundary strengthening, and solution and precipitation hardening.
CO5	Understand and solve metallurgical and materials selection and design problems.

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M				M	M	H					
CO2		M	L	M	M		L					
CO3		M	H	L								
CO4	M		L	L	M							
CO5	H	H	M	L								

Course Topic(s)

Introduction, Logistics, Context, History, Assembly in the Small - Step-by-step Process - Assembly Motions and Forces, Assembly in the Small-Rigid Part Mating Theory and RCC, Student project descriptions due, Key Characteristics, Mathematical Models of Assemblies, Feature-based Modeling of Assemblies, Constraint in Assembly, Variation Build up in Assemblies, Assembly Sequence Analysis, Algorithms, and Software, The Datum Flow Chain, Assembly in The Large - Basic Issues, Economics, Step-by-step Process, Product Architecture, Flexibility, Design for Assembly - Theory and Examples, AITL System Design Issues: Kinds of Assembly Lines and Equipment, Production Volume, Cycle Times, Assembly in The Large: Workstation Design Issues, Assembly System Design Techniques and Simulation, Economic Analysis of Assembly Systems, Flexible Manufacturing Systems, Outsourcing, and Supply Chain Management , 767 Wing Case Study

REFERENCES

Whitney, Daniel E. Mechanical Assemblies: Their Design, Manufacture, and Role in Product Development. New York, NY: Oxford University Press, 2004. ISBN: 9780195157826.