KUMARAGURU COLLEGE OF TECHNOLOGY

(Autonomous Institution Affiliated to Anna University, Chennai)

COIMBATORE – 641049

CURRICULUM
(REGULATIONS 2013)

First to Eighth Semester

B.E. AUTOMOBILE ENGINEERING

KUMARAGURU COLLEGE OF TECHNOLOGY, COIMBATORE – 641 049
(An Autonomous Institution Affiliated to Anna University, Chennai)

CURRICULUM

Regulation-2013
B.E – AUTOMOBILE ENGINEERING

SEMESTER - I

Code No.	Course Title	L	T	P	C
THEORY					
U13 EN*T* 101	Technical English	2	1	0	3
U13 MA*T* 101	Engineering Mathematics – I	3	1	0	4
U13 PH*T* 101	Engineering Physics	3	0	0	3
U13 CH*T* 101	Engineering Chemistry	3	0	0	3
U13 ME*T* 101	Engineering Graphics	2	0	3	3
U13 CS*T* 101	Structured Programming using 'C'	3	1	0	4
PRACTICAL					
U13 CH*P* 101	Chemistry Laboratory	0	0	3	1
U13 ME*P* 101	Engineering Practices Laboratory	0	0	3	1
U13 CS*P* 101	Structured Programming Laboratory using 'C'	0	0	3	1
U13 GH*P* 101	Human Excellence - Personal Values – I	1	0	1	1

TOTAL HOURS – 33 **TOTAL CREDIT – 24**

SEMESTER - II

Code No.	Course Title	L	T	P	C
THEORY					
U13 EN*T* 201	Professional English	1	0	2	2
U13 MA*T* 201	Engineering Mathematics – II	3	1	0	4
U13 PH*T* 202	Materials Science	3	0	0	3
U 13 CH*T* 202	Applied Chemistry	3	0	0	3
U13 ME*T* 201	Engineering Mechanics	3	1	0	4
U13 EE*T* 211	Basics of Electrical and Electronics Engineering	3	0	0	3
PRACTICAL					
U13 PH*P* 201	Physics Laboratory	0	0	3	1
U13 AU*P* 201	CAD Laboratory	0	0	3	1
U13 EE*P* 211	Basics of Electrical and Electronics Engineering Laboratory	0	0	3	1
U13 GH*P* 201	Human Excellence - Personal Values – II	1	0	1	1

TOTAL HOURS – 31 **TOTAL CREDIT – 23**

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CURRICULUM

Regulation-2013

B.E – AUTOMOBILE ENGINEERING

SEMESTER - III

Code	Course Name	L	T	P	C
THEORY					
U13 MA*T* 301	Numerical Methods	3	1	0	4
U13 AU*T* 301	Automotive Chassis	3	0	0	3
U13 AU*T* 302	Thermodynamics and Thermal Engineering	3	1	0	4
U13 AU*T* 303	Automotive Manufacturing Technology	3	0	0	3
U13 AU*T* 304	Engineering Fluid Mechanics	3	1	0	4
U13 AU*T* 305	Solid Mechanics	3	1	0	4
PRACTICAL					
U13 AU*P* 301	Manufacturing Technology Laboratory	0	0	3	**1**
U13 AU*P* 302	a) Strength of Materials Laboratory b) Fluid Mechanics & Machinery Laboratory	0	0	3	**1**
U13 AU*P* 303	Automotive Chassis and Engine Components Laboratory	0	0	3	**1**
U13 GH*P* 301	Human Excellence - Family Values	1	0	1	**1**

TOTAL HOURS – 33 **TOTAL CREDIT – 26**

SEMESTER - IV

Code	Course Name	L	T	P	C
THEORY					
U13 MA*T* 403	Modeling and Analysis of Engineering Systems	3	1	0	4
U13 AU*T* 401	Fuels and Lubricants	3	0	0	3
U13 AU*T* 402	Automotive Materials and Metallurgy	3	0	0	3
U13 AU*T* 403	Automotive Electrical and Electronics	3	0	0	3
U13 AU*T* 404	Automotive Petrol Engines	3	0	0	3
U13 AU*T* 405	Mechanics of Machines	3	1	0	4
PRACTICAL					
U13 AU*P* 401	Automotive Components Modeling Laboratory	0	0	3	1
U13 AU*P* 402	Fuels and Lubricants Laboratory	0	0	3	1
U13 AU*P* 403	Automotive Electrical & Electronics Laboratory	0	0	3	1
U13 GH*P* 401	Human Excellence - Professional Value	1	0	1	1

TOTAL HOURS – 31 **TOTAL CREDIT – 24**

SEMESTER - V

Code No.	Course Title	L	T	P	C
THEORY					
U13 AUT 501	Automotive Finite Element Analysis	3	1	0	4
U13 AUT 502	Measurements & Metrology	3	0	2	4
U13 AUT 503	Automotive Diesel Engines	3	0	0	3
U13 AUT 504	Machine Components Design	3	1	0	4
U13 AUT505	Automotive Sensors and Embedded Systems	3	0	2	4
U13 GST 001	Environmental Science and Engineering	3	0	0	3
PRACTICAL					
U13 AUP 501	Finite Element Analysis Laboratory	0	0	3	1
U13 AUP 502	Engine Performance and Emission Testing Laboratory	0	0	3	1
U13 GHP 501	Human Excellence -Social Values	1	0	1	1
U13 ENP 501	Communication Skill Laboratory	0	0	3	1
INDUSTRY ORIENTED ONE CREDIT COURSE					
U13 AUA 501	Overview of Motorsports Engineering	1	0	0	1

TOTAL HOURS – 37 **TOTAL CREDIT – 27**

SEMESTER - VI

Code No.	Course Title	L	T	P	C
THEORY					
U13 AUT 601	Chassis Design	3	1	0	4
U13 AUT 602	Engine Design	3	1	0	4
U13 AUT 603	Automotive Transmission	3	0	0	3
U13 AUT 604	Automotive Pollution and Control	3	0	0	3
U13 AUT 605	Advanced Automotive Systems	3	0	0	3
E1	Elective – I	3	0	0	3
PRACTICAL					
U13 AUP 601	Chassis and Engine Design Laboratory	0	0	3	1
U13 AUP 602	Advanced Automotive Systems Laboratory	0	0	3	1
U13 AUP 603	Mini Project	0	0	4	2
U13 GHP 601	Human Excellence - National Values	1	0	1	1
INDUSTRY ORIENTED ONE CREDIT COURSE					
U13 AUA 601	Automotive Styling	1	0	0	1

TOTAL HOURS – 33 **TOTAL CREDIT – 26**

SEMESTER - VII

Code No.	Course Title	L	T	P	C
THEORY					
U13 AUT 701	Vehicle Dynamics	3	1	0	4
U13 AUT 702	Vehicle Body Engineering	3	0	0	3
U13 AUT 703	Special Purpose Vehicles	3	0	0	3
U13 GST 008	Professional Ethics	3	0	0	3
E2	Elective – II	3	0	0	3
E3	Elective – III	3	0	0	3
PRACTICAL					
U13 AUP 701	Vehicle Dynamics Laboratory	0	0	3	1
U13 AUP 702	Vehicle Maintenance & Reconditioning Laboratory	0	0	2	1
U13 AUP 703	Project Phase – I	0	0	4	2
U13 GHP 701	Human Excellence - Global Values	1	0	1	1
INDUSTRY ORIENTED ONE CREDIT COURSE					
U13 AUA 701	Electronic Engine Management Systems	1	0	0	1

TOTAL HOURS – 31 **TOTAL CREDIT – 25**

SEMESTER - VIII

Code No.	Course Title	L	T	P	C
THEORY					
E 4	Elective – IV	3	0	0	3
E 5	Elective – V	3	0	0	3
PRACTICAL					
U13 AUP 801	Project Phase – II	0	0	24	9

TOTAL HOURS – 30 **TOTAL CREDIT – 15**

TOTAL CREDITS FOR THE PROGRAMME = 190

SUMMARY OF CREDITS FOR 2013 REGULATION

Semester	BASIC SCIENCES	GENERAL COURSES	ENGINEERING SCIENCES	CORE COURSES	Credits
Semester I	16	4	4	0	**24**
Semester II	8	3	11	1	**23**
Semester III	4	1	14	7	**26**
Semester IV	4	1	0	19	**24**
Semester V	1	4	0	22	**27**
Semester VI	0	1	0	25	**26**
Semester VII	0	4	3	18	**25**
Semester VIII	0	0	0	15	**15**
Total Credits	**33**	**18**	**32**	**107**	**190**
Percentage	**17%**	**9%**	**17%**	**56%**	

Note for Elective Courses:

The student can choose the electives as per the following guidelines

VI semester - Elective I : one from Group 1 or 2 or 3

VII semester - Elective II : one GST course from Group 4

VII semester - Elective III : one from Group 1 or 2 or 3

VIII semester - Elective IV : one from Group 1 or 2 or 3

VIII semester - Elective V : one from Group 1 or 2 or 4

ELECTIVE COURSES

Group -I (Design & Thermal)

Code No.	Course Title	L	T	P	C
U13 AUT E11	Automotive Aerodynamics	3	0	0	3
U13 AUT E12	Vehicle Concept Design and Styling	3	0	0	3
U13 AUT E13	Computational Fluid Dynamics	3	0	0	3
U13 AUT E14	Design for Manufacture and Assembly	3	0	0	3
U13 AUT E15	Noise, Vibration and Harshness	3	0	0	3
U13 AUT E16	Combustion Engineering	3	0	0	3
U13 AUT E17	Alternate Fuels and Energy Systems	3	0	0	3
U13 AUT E18	Computer Simulation of I.C. Engine Processes	3	0	0	3
U13 AUT E19	Advanced Theory of I.C. Engines	3	0	0	3

Group – II (Technology & Manufacturing)

Code No.	Course Title	L	T	P	C
U13 AUT E21	Hydraulic and Pneumatic Systems	3	0	0	3
U13 AUT E22	Automotive Air-Conditioning	3	0	0	3
U13 AUT E23	Modern Automobile Accessories	3	0	0	3
U13 AUT E24	Automotive Components Manufacturing	3	0	0	3
U13 AUT E25	Design of Jigs, Fixtures and Press tools	3	0	0	3
U13 AUT E26	Robotics	3	0	0	3
U13 AUT E27	Composite Materials and Structures	3	0	0	3
U13 AUT E28	Technical Textiles for Automobiles	3	0	0	3
U13 AUT E29	Vehicle Testing and Validation	3	0	0	3

Group -III (Advanced Systems / Automotive Electronics)

Code No.	Course Title	L	T	P	C
U13 AUT E31	Automotive Safety	3	0	0	3
U13 AUT E32	Microprocessor Based System Design	3	0	0	3
U13 AUT E33	Electric and Hybrid Vehicles	3	0	0	3
U13 AUT E34	Instrumentation and Control	3	0	0	3
U13 AUT E35	Fuel Cell Technology	3	0	0	3
U13 AUT E36	PLC and Data Acquisition Systems	3	0	0	3
U13 AUT E37	Virtual Instrumentation	3	0	0	3
U13 AUT E38	Embedded Communication System Protocols	3	0	0	3

Group – IV (Management)

Code No.	Course Title	L	T	P	C
U13 GST 002	Total Quality Management	3	0	0	3
U13 GST 003	Principles of Management	3	0	0	3
U13 GST 004	Operations Research	3	0	0	3
U13 GST 005	Engineering Economics and Financial Management	3	0	0	3
U13 GST 006	Product Design and Development	3	0	0	3
U13 AUT E41	Entrepreneurship Development	3	0	0	3
U13 AUT E42	Project Management	3	0	0	3
U13 AUT E43	Transport Management	3	0	0	3
U13 AUT E44	Quality Control and Reliability	3	0	0	3
U13 AUT E45	Energy Studies	3	0	0	3

SEMESTER 1

U13 EN*T* 101 TECHNICAL ENGLISH 2 1 0 3

OBJECTIVES

- To offer exposure to the extensive usage of Technical English with special reference to corporate world communication
- To embark on systematic, syntactic and semantic proficiency of Technically used English
- To embellish the usage of English to exhibit engineering and technical concepts.
- To improvise the quality of Written Technical English.
- To develop the competency level of professional writing with a keen focus to corporate situations

FUNDAMENTALS OF TECHNICAL ENGLISH 9 Hours

Glimpses of Technical English – Systematic nuances of Technical English – Parts of Speech -Word Formation using Affixation – Vocabulary (synonyms and one word substitutes) – Tenses – Concord – Note making- Paragraph writing – Discourse markers – Sequencing of jumbled sentences.

GRAMMAR IN TECHNICAL ENGLISH 9 Hours

Editing (Grammar - Articles, Parts of Speech, Punctuation and Spelling Rules) – Reading Comprehension – Application of Conditional Sentences.

TECHINICAL EXPRESSIONS 9 Hours

Abbreviations and Acronyms – Expressions of Purpose and Function (Devices, Theories & Hypotheses) – Letter for practical training- Industrial visit – Interrogatives (‘Wh’ questions, Verbal Questions & Question Tags) – Reporting an incident / accident

DRAFTING TECHNICAL DETAILS 9 Hours

Usage of Discourse Markers – Comparative Adjectives – Transcoding Graphics into continuous writing and text into graphics – Bar chart / Pie chart / Flow chart / Line graph / Tabulated data / Tree diagram or Organizational chart into text – E-mail Etiquette and its professional application.

APPLICATIONS OF TECHNICAL ENGLISH 9 Hours

Definitions – Impersonal passive structures – Describing a technical process – Writing instructions – Making suggestions – Writing formal letters (Leave Letters, Apology letters, Applying for bank loans, Bona-fide certificate/ mark list, Joining report, Letters of complaint).

TOTAL: 45 HOURS

REFERENCES

1. DhanavelS.P., English and Communication Skills for Students of Science and Engineering, Chennai, Orient Blackswan, 2009.
2. Devadoss K. andMalathy P., Fundamentals and Usage of Technical English, National Book Publishers, Chennai, 2013.
3. Rizvi Ashraf M., Effective Technical Communciation, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2008.

COURSE OUTCOMES

- Comprehend the technical jargon and define technical / engineering applications
- Exhibit practical proficiency in reading and writing skills
- Apply and analyze the technical and general communication

U13 MA*T* 101 ENGINEERING MATHEMATICS-I 3 1 0 4

OBJECTIVES

On completion of the course, the students are expected

- To know eigen values and eigen vectors and diagonalization of a matrix.
- To know about the geometrical aspects of curvature, evolute and envelope.
- To understand the concepts of partial differentiation, maxima and minima.
- To solve ordinary differential equations of first and higher order of certain types and its applications.

MATRICES 9 Hours

Rank of a matrix – Linearly dependent and independent vectors – Eigen values and eigenvectors of a real matrix – Properties of eigen values and eigenvectors – Cayley Hamilton theorem (excluding proof) – Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS 9 Hours

Curvature – Radius, Centre and Circle of curvature in Cartesian, Parametric and Polar form – Evolute – Envelope of family of curves with one and two parameters – Evolute as the envelope ofnormals.

FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 9 Hours

Leibnitz's equation – Bernoulli's equation – Equations of first order and higher degree - Clairauts form – Applications: Orthogonal trajectories and simple Electric circuit problems. (Differential equation and associated conditions need to be given).

HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS 9 Hours

Linear equations of second and higher order with constant coefficients – Euler's and Legendre's linear equations – Method of variation of parameters – First order Simultaneous linear equations with constant coefficients - Application - oscillatory electrical circuit. (Differential equation and associated conditions need to be given).

FUNCTIONS OF SEVERAL VARIABLES 9 Hours

Total derivative – Taylor's series expansion – Maxima and minima of functions of two variables – Constrained maxima and minima: Lagrange's multiplier method with single constraint – Jacobians.

L: 45, T: 15, TOTAL: 60 HOURS

REFERENCES

1. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
2. Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics,S. Chand & Co., New Delhi, 2008.
3. Kreyzig E., Advanced Engineering Mathematics, Eighth Edition, John Wiley & sons, 2010.
4. Arunachalam T., Engineering Mathematics I, Sri VigneshPublications, Coimbatore. (Revised) 2009.

5. Venkataraman M.K., Engineering Mathematics, The National Pub. Co., Chennai, 2003.
6. Ramana B.V, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company, New Delhi, 2007.
7. Grewal B.S., "Higher Engineering Mathematics",Khanna Publishers, New Delhi, 40th Edition. .

COURSE OUTCOMES

- Know eigen values and eigen vectors and its role in the system of equations
- Discover the radius, centre and circle of curvature of any curves
- Solve the ordinary differential equations of certain types and its applications.
- Identify the maximum and minimum values of surfaces.

U13 PH*T* 101 ENGINEERING PHYSICS 3 0 0 3

OBJECTIVES

At the end of the course, students would be exposed to fundamental knowledge in

- Various engineering subjects and applications.
- Structure identification of engineering materials.
- Non-destructive techniques.
- Interferometric techniques in metrology and electrical phenomena.
- Application of lasers in engineering and technology.
- Atomic and Nuclear related theories.

CRYSTAL PHYSICS 9 Hours

Space lattice – unit cell – lattice planes – Bravais space lattices – Miller indices – calculation of interplanar distances – Atomic radius – co- ordination number – Packing factor for SC, BCC, FCC and HCP structures – crystal imperfections – point defects – line defects – surface defects – volume defects – effect of crystal imperfections.

APPLIED OPTICS 9 Hours

Interference – airwedge and its applications – Michelsons interferometer – construction, working – determination of wave length and thickness – Lasers – spontaneous and stimulated emissions – Einsteins coefficients – Nd: YAG, Co_2 and semiconductor laser – Homojunction and Hetrojunction (only qualitative description) – applications – CD-ROM and holography (qualitative only) – optical fibre – principle and propagation of light in optcal fibers – Numerical aperture and acceptance angle – types of optical fibres – applications – fibre optic communication system – medical endoscopy.

QUANTUM PHYSICS 9 Hours

Plancks quantum theory of black body radiation (derivation) – Photo electric effect – Compton effect (derivation) and experimental verification of Compton effect – De-broglies concept - Schrodinger wave equation – time independent and time dependent equations (derivations) – physical significance of wave function – particle in a box (one dimensional case) – Electron microscope – Scanning electron microscope – Transmission electron microscope.

ULTRASONICS AND NDT 9 Hours

Introduction – production – magnetostriction effect – magnetostriction generator – piezoelectric effect – piezo electric generator –properties –detection – cavitation – acoustic grating – velocity measurement – applications –Sonar –velosity of blood flow – NDT –Liquid Penetrant method – Ultrasonic flaw detector – A scan, B scan, C scan – X-ray radiography and fluoroscopy – Thermography.

ATOMIC AND NUCLEAR PHYSICS 9 Hours

Introduction – Atomic spectra – Molecular spectra – Applications – Raman effect – Stokes lines and anti stokes lines – Applications – Nuclear models – Liquid drop model – The Shell model- Nuclear fission – Theory – Energy released per fission – Chain reaction – Controlled chain reaction – Nuclear reactors – Condition for sustained chain reaction – Types of Nuclear reactors – Nuclear fusion – Thermo nuclear reactions – Differences between fission and fusion

TOTAL: 45 HOURS

REFERENCES

1. Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
2. Gopal S., Engineering Physics, Inder Publications, Coimbatore, 2006.
3. Palinisamy P.K., Engineering Physics I, Scitech Publications, Chennai, 2011.
4. Avadhanulu M.N. andKshirsagar P.G., A textbook of Engineering Physics, S.Chand & Company Ltd, New Delhi,2005.
5. Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, DhanpatRai Publications (P) Ltd., New Delhi, 2003.

COURSE OUTCOMES

- Analyze and identify the crystal structure in materials
- Categorize and illustrate the optical materials and its application to engineering
- Examine and compare samples at nano level
- Apply lasers in engineering and technology
- Describe the properties nuclear materials

U13 CH*T* 101 ENGINEERING CHEMISTRY 3 0 0 3

OBJECTIVES

- To inculcate an understanding of the importance of chemistry by providing an overall perspective of theoretical and modern technological aspects of applied chemistry before beginning their more specialized courses.
- To embellish the usage of chemistry to exhibit engineering and technical concepts

ELECTROCHEMISTRY 9 Hours

Introduction - Electrode potential – Nernst equation and problems - Electrochemical series - Application of EMF measurements & problems - Kohlrausch law of independent migration of ions & its application - Conductometric titrations (acid - base & precipitation titration)

Electrodes : Standard and reference electrode (Hydrogen & Calomel) – Types of electrodes (metal – metal ion; Metal – metal insoluble salt, Redox electrode) - Ion selective (glass electrode) – determination of pH using glass electrode

Cells : Galvanic cell – Types of concentration cells

ENERGY STORING DEVICES 9 Hours

Batteries : Primary Battery (Lechlanche& Alkaline battery) - Secondary Battery (Lead acid storage battery, Nickel - cadmium battery & Lithium – Polymer battery) – Flow battery (hydrogen and oxygen Fuel Cell)

Solar Cells: Hybrid Solar cells

THERMODYNAMICS 9 Hours

Introduction - Thermodynamic process (isothermic, isobaric, isochoric and adiabatic processes) - Internal energy – first law of thermodynamics (Mathematical derivation & limitation) - Enthalpy - Second law of thermodynamics - Entropy - Entropy change of an ideal gas & problems - Free energy - work function - Gibbs Helmholtz equation (derivation, applications & problems) - Van't Hoff isotherm (derivation & problems) - Van't Hoff isochore - (derivation & problems) - Third law and zeroeth law (Only statements)

SURFACE CHEMISTRY 9 Hours

Introduction of adsorption - Types of Adsorption - Adsorption isotherm (Freundlich isotherm, Langmuir adsorption isotherm, BET isotherm) - Applications of adsorption : Role of adsorption in catalytic reactions, Ion exchange adsorption, adsorption chromatography (Column chromatography)

SPECTROSCOPY 9 Hours

Introduction to spectroscopy - Beer Lambert's Law - Colorimetric analysis (principle, instrumentation (block diagram only) & application (Estimation of concentration of Ferrous and copper ions a solution by colorimetry) - UV – visible spectroscopy (principles, instrumentation (block diagram only) & simple Applications) - IR spectroscopy (principles, instrumentation (block diagram only) & simple applications) - Flame photometry (Principle, instrumentation (block diagram only) & simple Applications)

TOTAL: 45 HOURS

REFERENCE

1. Bahl B.S.,Tuli G.D. and ArunBahl., Essential of Physical Chemistry, S.Chand& Co. Ltd., New Delhi.
2. Somorjai G.A., Introduction to surface chemistry and Catalysis, John Wiley & Sons Inc., New York.
3. Shaw D.J., Introduction to colloidal and surface Chemistry, Butterworth – Heinemann Publishers
4. Syed Shabudeen, P.S. and Shoba U.S., Engineering Chemistry, Inder Publishers, Coimbatore.
5. Jain P.C. and Monika Jain, Engineering chemistry, Dhanpatrai Pub. Co. (P) Ltd., New Delhi.
6. Puri B.R., Sharma L.R. and PathaniaM.S., Principles of Physical chemistry, ShobanLalNagin Chand & Co., New Delhi

COURSE OUTCOMES

- Assemble a battery and illustrate the phenomenon of production of electric current
- Discuss the thermodynamic concepts and predict the feasibility of chemical reaction
- Apply the theory of adsorption in real life situations
- Outline the principles and instrumentation of spectroscopic techniques

U13 ME*T* 101 ENGINEERING GRAPHICS 2 0 3 3

(Common to all branches of Engineering and Technology)

OBJECTIVES

- To understand the principle of orthographic projection of points, lines, surfaces and solids.
- To understand the principle of section and development of solids.
- To understand the principle of Isometric and Perspective projections.
- To study the principle of free-hand sketching techniques.

PLANE CURVES, PROJECTION OF POINTS AND LINES 15 Hours

Importance of graphics in design process, visualization, communication, documentation and drafting tools, Construction of curves - ellipse, parabola, and hyperbola by eccentricity method only. Orthographic projection of points.

Projections of straight lines located in first quadrant - determination of true length and true inclinations.

PROJECTIONS OF SURFACES AND SOLIDS 15 Hours

Projections of plane surfaces - polygonal lamina and circular lamina, located in first quadrant and inclined to one reference plane., Projection of simple solids - prism, pyramid, cylinder and cone. Drawing views when the axis of the solid is inclined to one reference plane.

SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 15 Hours

Sectioning of simple solids - prisms, pyramids, cylinder and cone. Obtaining sectional views and true shape when the axis of the solid is vertical and cutting plane inclined to one reference plane.

Development of lateral surfaces of truncated prisms, pyramids, cylinders and cones.

PICTORIAL PROJECTIONS 15 Hours

Isometric projection, Isometric scale, Isometric views of simple solids, truncated prisms, pyramids, cylinders and cones.

Perspective projection of prisms and pyramids when its base resting on the ground by vanishing point method.

FREE-HAND SKETCHING 15 Hours

Free hand sketching techniques, sketching of orthographic views from given pictorial views of objects, including free-hand dimensioning.

Sketching pictorial views from given orthographic views.

L: 30, P: 45, TOTAL: 75 Hours

REFERENCES

1. Nataraajan K.V., Engineering Drawing and Graphics, Dhanalakshmi Publisher, Chennai, 2005.
2. Warren J. Luzadder and Jon. M. Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., New Delhi, Eleventh Edition, 2005.
3. Gopalakirishna K.R., Engineering Drawing (Vol. I & II), Subhas Publications, 2001.
4. Basant Agrawal and CM Agrawal, Engineering Drawing, McGraw-Hill, New Delhi, First Edition, 2008.
5. Venugopal K. and Prabhu Raja V., Engineering Graphics, New Age International (P) Limited, New Delhi, 2008.

COURSE OUTCOMES

- To describe the principle of orthographic projection of points and lines
- To Explain the the principle of orthographic projection of surfaces and solids
- To Discuss the principle of section and development of solids
- To Demonstrate the the principle of Isometric and Perspective projections
- To Demonstrate the the principle of free-hand sketching techniques

U13CS*T* 101 STRUCTURED PROGRAMMING USING C 3 1 0 4

OBJECTIVES

- To enable students to learn about the basics of computers and problem solving methods
- To learn the various features of C
- To learn how to program using C language

INTRODUCTION **9 Hours**

Programs and Programming- Programming languages and Their Classification - Compiler, Linker, Loader and Interpreter – Structured Programming Concept – Algorithm – Pseudo Code – Flow Chart.Number System – Binary – Decimal – Conversion Problems.

C LANGUAGE BASICS **9 Hours**

Introduction to C Programming –Fundamentals – Structure of a C Program – Compilation And Linking Processes – Constants, Variables – Data Types – Expressions Using Operators In C – Managing Input And Output Operations – Decision Making And Branching – Looping Statements – Solving Simple Scientific And Statistical Problems.

ARRAYS AND STRINGS **9 Hours**

Arrays – Initialization – Declaration – One Dimensional And Two Dimensional Arrays. String- String Operations – String Arrays. Simple Programs- Sorting- Searching – Matrix Operations.

FUNCTIONS AND POINTERS **9 Hours**

Functions: Definition of function – Declaration of function – Pass by value – Pass by reference – Recursion.

Storage classes – auto, static, extern, register- scope rules.

Pointers: Definition – Initialization – Pointers arithmetic – Pointers and arrays- Dynamic memory allocation - Example Problems

STRUCTURES AND UNIONS AND FILES **9 Hours**

Structures and Unions: Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions.

Files: Introduction – Using files in C- Working with text files.

L: 45, T: 15, TOTAL: 60 Hours

REFERENCES

1. Rajasekaran S., Numerical methods in Science and Engineering-A practical approach, S. Chand and Company, New Delhi, 2012.
2. Kernighan B.W. and Ritchie D.M., The C Programming language, Second Edition, Pearson Education, 2006.
3. Byron S. Gottfried and Jitendar Kumar Chhabra, Programming with C, Tata McGraw Hill Publishing Company, Third Edition, New Delhi, 2011.
4. Ashok N. Kamthane, Computer programming, Pearson Education, 2007.
5. Pradip Dey and Manas Ghosh, Programming in C, Second Edition, Oxford University Press, 2011.

COURSE OUTCOMES

- Be able to understand structured programming concepts
- Be able to develop a computer program to solve real world problems
- Develop simple applications using C

U13 CH*P* 101 CHEMISTRY LABORATORY 0 0 3 1

OBJECTIVES

- To apply the theoretical principles and perform experiments
- Experience the importance of theory by using analytical equipments and quantitative and qualitative procedures.

LIST OF EXPERIMENTS

PREPARATION OF SOLUTIONS (STANDARD)

1. Preparation of normal solutions of the following substances - oxalic acid, sodium carbonate, hydrochloric acid.
2. Preparation of phosphate buffer using Henderson equation.

WATER TESTING

3. Determination of total, temporary and permanent hardness by EDTA method.
4. Estimation of DO by Winkler's method.
5. Estimation of alkalinity by Indicator method.
6. Estimation of chloride by Argentometric method.

ELECTRO CHEMICAL ANALYSIS

7. Estimation of hydrochloric acid by pH metry.
8. Conductometric titration of mixture of acids and strong base
9. Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4.
10. Estimation of Iron by Potentiometry

PHOTOMETRY

11. Estimation of the Ferrous ions (Thiocyanate method) by Spectrophotmetry.
12. Estimation of sodium and potassium by Flame photometry.

TOTAL: 45 HOURS

REFERENCES

1. Jeffery G.H., Bassett J., Mendham J. and Denny R.C., Vogel's Text Book ofQuantitative Chemical Analysis, Oxford, ELBS, London, 2002.
2. Shoemaker D.P. and C.W. Garland., Experiments in Physical Chemistry, TataMcGraw-Hill Pub. Co., Ltd., London, 2003.
3. Shoba U.S., Sivahari R. and Mayildurai R., Practical Chemistry, Inder Publications, Coimbatore, 2009.

COURSE OUTCOMES

- Prepare normal solutions
- Analyse the properties of water
- Estimate the concentration of solutions by electrochemical methods

U13 ME*P* 101 ENGINEERING PRACTICES LABORATORY 0 0 3 1
(Common to all branches of Engineering and Technology)

LIST OF EXPERIMENTS

GROUP – I **21 Hours**

A. CIVIL ENGINEERING

1. Carpentry

- Study of carpentry tools
- Preparation of T joint
- Preparation of dovetail joint

2. Plumbing

- Study of pipeline joints

B. MECHANICAL ENGINEERING

1. Fitting

- Study of fitting tools
- Preparation of L joint
- Preparation of square joint

2. Sheet Metal Working

- Study of sheet metal working tools
- Preparation of cone and tray

3. Welding

- Study of arc welding tools and equipment
- Preparation of butt joint

GROUP - II (ELECTRICAL & ELECTRONICS ENGINEERING)

C. ELECTRICAL ENGINEERING PRACTICE **12 Hours**

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

D. ELECTRONIC ENGINEERING PRACTICE **12 Hours**

1. Assembling simple electronic component on a small PCB and Testing.
2. Soldering simple electronic circuits and checking continuity.
3. Measurements using digital multimeter.
    - DC and AC voltage measurement
    - DC and AC current measurements.
    - Resistance Measurement.
    - Continuity measurement.
4. Testing of Electronic components
    - Resistors
    - Inductors and capacitors
    - Diodes (resistance in forward bias and reverse bias)
    - Transistors
5. Study of CRO and Function generator
    - Study of Panel Controls
    - Measurement of Amplitude, Frequency, phase difference

TOTAL: 45 HOURS

U13 CS*P* 101 STRUCTURED PROGRAMMING LABORATORY USING C

0 0 3 1

OBJECTIVES

- To enable students to solve problems using C
- To apply the various features of C

LIST OF EXPERIMENTS

1. Simple programs
    - To find whether the given number is prime or not
    - Factorial of the given number
2. Programs involving Control and Looping Structures
    - Arithmetic Progression
    - Trigonometric series evaluation
3. Programs using Arrays
    - Sorting
    - Matrix addition and Multiplication
4. Calculation of median of a frequency distribution.
5. Evaluation of integrals
    - Trapezoidal Rule
6. String Processing
7. Program using Recursive function
8. Using pointers in C
9. Program using Functions, Structures and Files
    - Students Mark Analysis
10. Iterative method for finding Roots of the polynomials
    - Lagrange interpolation method

TOTAL: 45 HOURS

COURSE OUTCOMES

- Develop skills on use of C for simple problem solving
- Develop skills on the usage of C for statistical and scientific problem solving

Acquire skills on the usage of C for statistical and scientific problem solving

U13 GH*P* 101 HUMAN EXCELLENCE -PERSONAL VALUES I 1 0 1 1

(Common to all branches of Engineering and Technology)

OBJECTIVE

- To inspire students to become best Humans.
- To know about self.
- To overcome evil temperaments.
- To practice meditation & pranayamam

LIFE & HUMAN EXCELLENCE 3 Hours

Human Excellence: Introduction – objective – personal values - importance.
Life: Self – Society – Nature – yoga – purpose of life – philosophy of life.

BODY, SOUL, MIND & THEIR FUNCTIONAL RELATIONSHIP 3 Hours

Panchboothas and it's association – Form of the body : physical body, astral body, causal body - Effect: Pain, Disease, Death; Soul – Life force – Bio magnetism – Genetic Centre – Mind : Origin & it's ten stages.

SELF INTROSPECTION 3 Hours

Introduction – Importance – Blemishes – Six evil temperaments &their maneuvering.

THOUGHT ANALYSIS 3 Hours

Introduction of Thought; process of thought – Mind& Thought relationship – causes for origin of Thoughts;Exercise : Training & Practice of Thought analysis

MEDITATION AND PRANAYAMAM - THEORY WITH PRACTICAL SESSION 3 Hours

Meditation: Introduction to Meditation
Pranayamam: Importance of Naadisudhi, Thanduvadasudhi (Clearance practice), Kabhalabathi and their practice.

TOTAL: 15 Hours

COURSE OUTCOMES

- Acquire knowledge on the individual in relation to Nature and Society.
- Demonstrate the skill of self- realization values the significant relationship to be maintained between individual's Body, Mind and Soul.
- Analysis of Thoughts and origin of thoughts
- Learn about Purpose and Philosophy of Life

SEMESTER 2

U13 EN*T* 201 PROFESSIONAL ENGLISH 1 0 2 2

OBJECTIVES

- To enhance application oriented usage of English language
- To inculcate essential language proficiency through a good combination of practical and theoretical exposure
- To widen the area of creative writing skill of the students
- To initiate the students to make use of English to exhibit their professionalism
- To enable the students with adequate language exposure to business, professional and corporate facets of life.

RUBRICS OF PUBLIC SPEAKING 12 Periods

Vocabulary (Antonyms) – Homonyms- Use of Compound Prepositions – Public address (compering /welcoming / proposing vote of thanks) –- Creating Advertisements.

ESSENTIAL REQUISITES OF PROFESSIONAL ENGLISH 12 Periods

Compound Nouns – Gerunds and Infinitives – Workplace Idioms – Reported Speech– Preparing a Check list- Composing Statement of Purpose (**SOP**) - Preparing a Resume with Cover letter.

CORPORATE CORRESPONDENCE 12 Periods

Usage of Cause and Effect Expressions – Collocation - Business Letters (quotation, order and complaint) – Composing a letter of resignation- recommendations – Composing e-Mail – Reading for information / global understanding- Writing Notices and Circulars.

NUANCES OF ENGLISH 12 Periods

American Vs British English – Contractions – Types of Conversations – Assertive, Persuasive Conversations – Telephonic Conversations – Greetings – Pronunciation tips – Reviewing books / articles.

SENSITIZING LANGUAGE SKILLS 12 Periods

Picture perception – Importance of Body Language in presentation – Strategic usage of Power Point Presentations – Essay writing.

TOTAL: 60 PERIODS

REFERENCES

1. Krishnaswamy N., Sri Raman T. Creative English for Communication, MacMillan Pub, Chennai, 2009.

2. Devadoss K. and Malathy P., Interfacing with Corporate, National Book Publishers, Chennai, 2013.

U13 MA*T* 201 ENGINEERING MATHEMATICS -II 3 1 0 4

OBJECTIVES

On completion of the course, the students are expected

- To understand double and triple integrations and enable them to find area and volume using multiple integrals.
- To know the basics of vector calculus comprising gradient, divergence and curl and line, surface and volume integrals.
- To understand analytic functions of complex variables and conformal mappings.
- To know the basics of residues, complex integration and contour integration.
- To understand Laplace transform and use it to represent system dynamic models and evaluate their time responses.

MULTIPLE INTEGRALS 12 Periods

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between cartesian and polar coordinates - Triple integration in cartesian coordinates – Application : Area as double integral – Volume as triple integral

VECTOR CALCULUS 12 Periods

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

ANALYTIC FUNCTION 12 Periods

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, cz , $1/z$ and bilinear transformation.

COMPLEX INTEGRATION 12 Periods

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's series expansions – Singularities – Residues – Cauchy's residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).

LAPLACE TRANSFORM 12 Periods

Definition - Properties – Superposition - Shift in t - Shift in s - Time Derivatives - Time Integral – Initial and Final Value Theorems – Periodic functions: sine wave, saw-tooth, square and triangular waves - Inverse Laplace Transform – Simple system dynamic models – Transfer Functions – Poles and Zeroes - Response of First-Order Systems - Solution of RC Free, Step and Sinusoidal Responses; Response of Second-Order Systems - Free Response, step Response - Convolution theorem

L: 60, T: 15, TOTAL: 75 PERIODS

REFERENCES

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 42nd Edition, 2012. (for Units I to IV).
2. Philip D. Cha, James J. Rosenberg, Clive L. Dym, Fundamentals of Modelling and Analyzing Engineering Systems, Cambridge University Press, United Kingdom, 2000. (for Unit – V)
3. Kreyzig E., Advanced Engineering Mathematics, John Wiley & Sons (Asia), Pvt, Ltd., Singapore, 10th Edition, 2010.
4. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
5. Venkataraman M.K., Engineering Mathematics, Volume - II, The National Pub. Co., Chennai, 2003.
6. Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics, S. Chand & Co., New Delhi, 2008.
7. Arunachalam T. and Sumathi K., Engineering Mathematics II, Sri Vignesh Publications, Coimbatore, Third Edition, 2011.

U13 PH*T* 202 MATERIALS SCIENCE 3 0 0 3

(Common to Mechanical, Mechatronics , Aeronautical Engineering and Automobile Engineering)

OBJECTIVES

At the end of the course students would be exposed to

- Types of defects in engineering materials and mechanisms of strengthening
- Properties of conducting, super conducting, magnetic and dielectric materials.
- Properties of Semi conducting, optical and new engineering materials.

CONDUCTING AND SUPERCONDUCTING MATERIALS 12 Periods

Classical free electron theory of metals-Electrical conductivity – Thermal conductivity - expression – Wiedemann Franz law(derivation) – Lorentz number – drawbacks of classical theory – Fermi distribution function – density of energy states – effect of temperature on Fermi energy.

Superconducting phenomena – properties of superconductors – Meissner effect, Isotope effect, Type I &Type II superconductors – High Tc superconductors - Applications – cryotron, magnetic levitation and squids.

SEMICONDUCTING MATERIALS 12 Periods

Origin of band gap in solids (Qualitative treatment only) - Concept of effective mass of an electron and hole – carrier concentration in an intrinsic semi conductor (derivation) – Fermi level – variation of Fermi level with temperature - Electrical conductivity – band gap semiconductor – carrier concentration in n-type and p-type semi conductors (derivation) – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – experimental set up – Applications.

MAGNETIC & DIELECTRIC MATERIALS 12 Periods

Properties of dia, para, ferro, anti ferro and ferri magnetic materials - Langevin's theory of paramagnetism – Weiss theory of Ferromagnetism – Domain theory of ferromagnetism - hysteresis – soft and hard magnetic materials – Ferrites – Applications - magnetic recording and readout - Storage of magnetic data, Tapes, floppy, magnetic disc drives – Bubble memory.

Dielectric materials – Electronic, ionic, orientation and space charge polarization - Frequency and temperature dependence of polarization – Dielectric loss – Dielectric breakdown – different types of break down mechanism - Ferro electric materials - properties and applications.

NANOTECHNOLOGY AND NEW ENGINEERING MATERIALS 12 Periods

Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications advantages and disadvantages of SMA.

Nano materials - synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparicles and applications. – Carbon nano tubes – fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

STRENGTHENING OF MATERIAL **12 Periods**

Strengthening mechanisms for the improvement of mechanical properties - cold working precipitation hardening, solute hardening and diffusion hardening-Fracture-Mechanism of brittle fracture (Griffith's theory) and Ductile fracture - difference between brittle and ductile fracture - fatigue failure and its prevention - creep different stages in creep curve-Factors affecting mechanical properties Grain size and heat treatment - Mechanical test Tensile, compression, hardness, impact creep, fatigue and stress.

TOTAL: 60 PERIODS

References:

1. Avadhanalu M.N. and Kshirsagar P.G., A textbook of Engineering Physics, S. Chand & Company Ltd, New Delhi, 2005, (Units: 1,2,3).
2. Rajendran V. and Marikani A., Materials science, 5th edition, Tata Mc-Graw-Hill publishing company Ltd, 2004, (Units: 4).
3. Arumugam M., Physics-II, Materials science for mechanical engineering, Anuradha agencies - publishers, Kumbakonam, 2005, (Units: 5).
4. Gopal S., Materials Science, Inder Publications, Coimbatore, 2007.
5. Pillai S.O., Solid State Physics, 5th edition, New Age International Publication, New Delhi, 2003.

U13 CH*T* 202 APPLIED CHEMISTRY 3 0 0 3

OBJECTIVE

To inculcate essential knowledge on theoretical and modern technological aspects of fuels and combustion, specialty materials, water technology, corrosion studies and powder metallurgy.

FUELS 12 Periods

Classification of fuels - coal varieties - analysis of coal (proximate and ultimate analysis) - coke manufacture (Otto-Hoffman byproduct coke oven method) - characteristics of metallurgical coke - cracking (thermal and catalytic cracking definition only) – manufacturing of synthetic petrol (Fischer Tropsch method, Bergius process) – knocking (octane number, cetane number) - gaseous fuels (production, composition and uses of producer gas, water gas and natural gas).

Combustion : gross and net calorific value - determination of calorific value by bomb calorimeter - explosive range - spontaneous ignition temperature - flue gas analysis (Orsat apparatus).

MECHANICAL ENGINEERING MATERIALS 12 Periods

Abrasives: Moh's scale of hardness - natural abrasives (diamond, corundum, emery, garnets and quartz) - artificial abrasives (silicon carbide, boron carbide).

Refractories: Characteristics - classification (acid, basic and natural refractories) - properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) - General manufacturing methods of refractories - preparation, properties and uses of high alumina bricks, magnesite and zirconia bricks.

Lubricants: Classification - Functions - properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point) - greases (calcium based, sodium based, lithium based) - solid lubricants (graphite, molybdenum disulphide).

CORROSION SCIENCE 12 Periods

Corrosion - Principles of electrochemical corrosion - difference between chemical and electrochemical corrosion - factors influencing corrosion.

Types of corrosion: galvanic corrosion - differential aeration corrosion (soil (microbial) corrosion, pitting corrosion, water line corrosion) - stress corrosion.

Corrosion control: cathodic protection (sacrificial anode) - Protective Coatings (Paint, Electroplating of Copper).

WATER TECHNOLOGY 12 Periods

Boiler feed water: requirements - disadvantages of hard water (formation of deposits in steam boilers, priming, foaming, caustic embrittlement & boiler corrosion).

Prevention of scale formation: external treatment (ion exchange method) - internal treatment (phosphate, calgon, carbonate, colloidal) - desalination by reverse osmosis - Treatment of Domestic water

PHASE RULE 12 Periods

Phase rule - condensed phase rule - construction of phase diagram (thermal analysis) – Applications of phase rule: one component system (Fe system only) - simple eutectic system (Ag-Pb system only).

POWDER METALLURGY

Preparation of metal powders (mechanical pulverization, atomization, chemical reduction, electrolytic process, decomposition) - mixing and blending - compacting - sintering - advantages and limitations of powder metallurgy.

TOTAL: 60 PERIODS

References:

1. Dara S.S., A Text book of Engineering Chemistry, S. Chand Co. (P) Ltd., New Delhi (Unit3, 4, 5).
2. Jain P.C. and Monika Jain, Engineering Chemistry, Dhanpat Rai Pub. Co. (P) Ltd., New Delhi (Unit 1, 2, 5).
3. Samir Sarkar, Fuels and Combustion, Orient Longman, India.
4. Syed Shabudeen P.S., Engineering Chemistry II, Inder publications, Coimbatore.
5. Derek Pletcher and Frank C Walsh, Industrial Electrochemistry, Blackie Academic and Professional, London.

U13ME*T* 201 ENGINEERING MECHANICS 3 1 0 4

OBJECTIVES

- To understand the concept of equilibrium of particles and rigid bodies.
- To understand the concept of first and second moment of area.
- To understand the concept of various types of frictions.
- To understand the principle of work energy method, Newton's law and impact of elastic bodies.

BASICS & STATICS OF PARTICLES 12 Periods

Introduction - Units and Dimensions - Laws of Mechanics Lame's theorem, Parallelogram and triangular Laws of forces – Coplanar Forces - Resolution and Composition of forces – Free body diagram - Equilibrium of a particle.

EQUILIBRIUM OF RIGID BODIES 12 Periods

Moment of a force about point – Varignon s theorem- Moment of a couple-Resolution of force in to force couple system-Resultant of coplanar non concurrent system - Types of supports and their reactions- Requirements of stable equilibrium - Equilibrium of Rigid bodies in two dimensions.

PROPERTIES OF SURFACES AND SOLIDS 12 Periods

First moment of area and the Centroid of sections Rectangle, circle, triangle, T section, I section Angle section and Hollow section. Second and product moments of plane area Rectangle, triangle, circle. T Section, I section, Angle section and Hollow section, Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia.

FRICTION 12 Periods

Frictional force-Law of coloumb friction , simple contact friction, Rolling resistance and Belt friction, Ladder friction, Wedge friction.

DYNAMICS OF PARTICLES 12 Periods

Kinematics: Rectilinear & Curvilinear motion of particles, Displacements Velocity and acceleration.

Kinetics: Newton's law, Work Energy method, Impulse and Momentum, Impact of elastic bodies.

L: 60, T: 15, TOTAL: 75 PERIODS

Reference:

1. Sukumar T.R. and Sridhar S., Engineering Mechanics, Inder Publications, Coimbatore, 2013
2. Hibbeller, R.C., Engineering Mechanics, Vol. I Statics and Vol. II Dynamics, Pearson Education, Asia Pvt. Ltd., 2000.

3. Ashok Gupta, Interactive Engineering Mechanics Statics A Virtual Tutor, Pearson Education, Asia Pvt. Ltd., New Delhi, 2002.
4. Palanichamy M.S., and Nagan S., Engineering Mechanics (Statics & Dynamics) Tata McGraw Hill, 2001.
5. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition, Pearson Education, Asia Pvt. Ltd., 2003.
6. Beer F.P. and Johnson Jr. E.R., Vector Mechanics for Engineers, Vol. I Statics and Vol. II Dynamics, McGraw-Hill International Edition, 2004.
7. Rajasekaran S. and Sankarasubramanian G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., Second Edition, 2002.

U13 EE*T* 211 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING 3 0 0 3

OBJECTIVES

- To study the characteristics of circuit elements
- To understand relationships among current, voltage and power in DC and AC circuits
- To study the construction, characteristics and applications of amplifiers and oscillators circuitry

ELECTRIC CIRCUITS FUNDAMENTALS 9 Hours

Electric current and Ohm's law – Resistance and Resistivity – Relation between Voltages, Current, Resistance and Power - Capacitance – Parallel plate capacitor – Energy stored in a capacitor.

ELECTROMAGNETISM 9 Hours

Magnetic field - Field intensity, magnetic flux , Flux density – Permeability – Magnetic effects of electric current – Magnetic circuit – Faraday's laws of Electromagnetic Induction – Self-inductance and Mutual inductance – Energy stored in magnetic field – Magnetic Hysteresis.

AC-CIRCUITS 9 Hours

Alternating voltages and current – Sinusoidal waveform – cycle and frequency – RMS value – vector diagram of sine waves of same frequency – Alternating current through Resistance, Inductance and Capacitance – current through series circuits – Power factor – Active and Reactive power – Generation of three phase voltage – Voltages, Currents and Power in Star and Delta connected loads.

ELECTRICAL MACHINES (Qualitative Treatment Only) 9 Hours

DC motor – Principle of operation – Back-emf and voltage equation – Torque and speed Characteristics of Series and Shunt connected motors – Transformer – Ideal Transformer relationship – Three phase induction motor – Cage rotor and Wound rotor – Principle of operation – Slip – Torque Slip characteristics – Single phase induction motors.

ELECTRONIC CIRCUITS 9 Hours

Semiconductor diode – Half wave and Full wave rectifier – Bipolar Junction transistors – circuit configurations – static characteristics – load line and biasing – simple introduction to amplifiers – Introduction to Binary logic gates – AND, OR, NOT, NAND, NOR, EX-OR & EX-NOR.

TOTAL: 45 HOURS

REFERENCES

1. Thomas L Floyd, Electronic Devices, 6th edition, Pearson Education, 2003.
2. Muthusubramanian R., Salivahanan S. and Muraleedharan. K.A., Basic Electrical Electronics and Computer Engineering, Tata Mcgraw Hill, 2nd edition, 2006.
3. Thyagarajan T., Sendur Chelvi K.P. and Rangaswamy T.R., Engineering Basics, Revised 2nd edition, New Age International Pvt. Ltd.
4. Theraja B.L., Fundamentals of Electrical Engineering and Electronics, S. Chand Publishing, 2012.

COURSE OUTCOMES

- Acquire the knowledge of fundamental laws of electrical and electronics engineering.
- State the definition of magnetic circuits.
- Choose suitable motor for desired application.
- The students have the ability to apply the fundamental laws of magnetic circuits to electrical machines.
- The learners can verify the truth table of digital logic gates.

U13 PH*P* 201 PHYSICS LABORATORY 0 0 3 1

LIST OF EXPERIMENTS

Any Ten Experiments

1. Lee's disc - determination of thermal conductivity of a bad conductor
2. Air wedge - determination of thickness of agiven specimen.
3. Spectrometer - determination of wavelength of mercury source using grating
4. Compound pendulum - determination of accelaration due to gravity.
5. Carey foster bridge – determination of specific resistance of given coil of wire.
6. Viscosity - determination of co-efficient of viscosity of a liquid by poiseuille's flow method.
7. Non-uniform bending – determination of Young's modulus
8. Ultrasonic interferometer –determination of velocity of sound and compressibility of liquid.
9. Band gap determination of a semiconductor using post office box
10. Semiconductor laser:
    a. Determination of wavelength of laser using grating
    b. Particle size determination
    c. Acceptance angle of optical fibre
11. Torsional pendulum - determination of Rigidity modulus of the wire
12. Field along the axis of a coil – Determination of magnetic moment.

Demonstration experiments:

1. Determination of solar cell parameters
2. Hall effect
3. Four probe apparatus
4. Animations – (Laser, Fiber optics and hysteresis curve)

TOTAL: 45 PERIODS

L	T	P	C
0	0	3	1

U13 AU*P* 201 CAD LABORATORY

OBJECTIVES:

To provide computerized drawing skills.

LIST OF EXPERIMENTS:

1. Introduction to CAD Commands
2. Creation of simple objects
3. Special curves
4. Projection & Section of simple solids
5. Orthographic views of solids
6. Isometric views of objects
7. Simple trusses
8. 3D modeling of simple solids
9. 2D multiple views from 3D model

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to

3. Draw 2D and 3D drawings using drafting software
4. Convert orthographic view into isometric view
5. Become familiar to draw Special curves

U13 EE*P* 211 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY **0 0 3 1**

AIM

To provide experimental skill in the operation of DC, AC machines and Hands on experience in the development of electronic circuits.

OBJECTIVES

- To experimentally verify the principle of operation, performance characteristics of DC Motors and AC Motors.
- To obtain the characteristics of electronic devices and its applications

LIST OF EXPERIMENTS

1. Load Test on DC Shunt Motor
2. Load Test on DC Series Motor
3. Speed Control of DC Shunt Motor
4. Load Test on three phase Induction Motor
5. Load Test on single phase Induction Motor
6. Load test on single phase transformer
7. Half wave and full wave rectifier
8. Characteristics of CE transistor configuration
9. Characteristics of PN diode
10. Verification of truth table of logic gates

TOTAL: 45 HOURS

COURSE OUTCOMES

- The Students will gain the basic knowledge and understanding the concept of AC and DC machines.
- Students will know the working principle, performance characteristics, (Torque, Speed, Efficiency) control and applications of Electrical Machines.
- Students will be able to design and conduct performance experiments in machines and Rectifiers.
- To familiarize the starting methods of all rotating machines.
- Students will be exposed to the practical applications of identify and solve machines related problems.

U13 GH*P* 201 HUMAN EXCELLENCE -PERSONAL VALUES II 1 0 1 1

(Common to all branches of Engineering and Technology)

OBJECTIVE:

- To inspire students to become blissful humans.
- To make the students able to a come out of greed and keep mind pure.
- To outgrow the dangerous emotions.
- To achieve sound health and reach the intuition level.

MORALIZATION OF DESIRE 4 Periods

Introduction – Causes of desire – Types of desire – Contra qualities evolving out of desire – effect of unfulfilled desire – Renunciation – Is attainment of desire in harmony with Law of Nature.

Training : Moralization of Desire.

NEUTRALIZATION OF ANGER 4 Periods

Introduction – Origin of Anger – Alternative forms of Anger –A chain action – Consequence of anger on self & others – neutralization of anger – the point where anger is won.

Training : neutralizing anger.

ERADICATION OF WORRIES 4 Periods

Worry – causes & Effects of worries – Types of problems – Solution to problems – Overcoming Worries.

Training : Eradication of Worries.

REALIZATION OF SELF 4 Periods

Introduction – hints & caution – hand exercises – leg exercises – foot reflexology – neuro muscular breathing exercises – kapalapathy – magarasanas I & II - benfits. Introduction – agna meditation – practice - benefits of agna meditation. Introduction – practice – benefits of shanthi meditation.

THEORY & PRACTICAL SESSION ON MEDITATION & PHYSICAL EXERCISE 15 Periods

Who I am? - Understanding Self – need of a guru with eternal wisdom – body or lif-force or mind or consciousness? – from flower to akash – will the true YOU please step forward? - Who am I? - am I god? - you are infinite – the bottom of the lake – shaping one's destiny – basics – in each dewdrop the same sun.

TOTAL: 30 PERIODS

SEMESTER 3

U13 MA*T* 301 **NUMERICAL METHODS**

L	T	P	C
3	1	0	4

OBJECTIVES:

- To understand concepts of pseudocode and various errors.
- To solve algebraic, transcendental and system of linear equations by using various techniques.
- To understand the concepts of curve fitting, interpolation with equal and unequal intervals.
- To understand the concepts of numerical differentiation and numerical integral by various methods.
- To solve the ordinary differential equations with initial condition by numerical techniques.
- To solve the partial differential equations using numerical techniques.

INTRODUCTION **3**

Simple mathematical modeling and engineering problem solving – Algorithm Design – Flow charting and pseudocode - Accuracy and precision – round off errors

NUMERICAL SOLUTION OF ALGEBRAIC EQUATIONS **6**

Solution of nonlinear equations - False position method – Fixed point iteration – Newton Raphson method for a single equation and a set of non- linear equations

Solution of linear system of equations by Gaussian elimination, Gauss Jordan method - Gauss Seidel method.

CURVE FITTING AND INTERPOLATION **6**

Curve fitting – Method of least squares - Newton's forward and backward difference formulas – Divided differences – Newton's divided difference formula - Lagrange's interpolation – Inverse interpolation.

NUMERICAL DIFFERENTIATION AND INTEGRATION **7**

Numerical differentiation by using Newton's forward, backward and divided differences – Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules – Numerical double integration.

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS **10**

Initial value problems - Single step methods: Taylor's series method – Truncation error – Euler and Improved Euler methods – Fourth order Runge – Kutta method – Multistep methods: Milne's predictor - corrector method.

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATION(PDEs) **13**

PDEs and Engineering Practice – Laplace Equation derivation for steady heat conduction – Numerical solution of the above problem by finite difference schemes – Parabolic Equations from Fourier`s Law of Transient Heat Conduction and their solution through implicit schemes – Method of Lines – Wave propagation through hyperbolic equations and solution by explicit method.

Use of MATLAB Programs to workout solutions for all the problems of interest in the above topics.

L : 45 T : 15 **Total Hrs = 60**

REFERENCES:

1. Steven C.Chapra and Raymond P. Canale, " Numerical Methods for Engineers with Programming and Software Applications", SixthEdition, WCB/McGraw-Hill, 1998.
2. John H. Mathews and Kurtis D. Fink, "Numerical Methods using Matlab", Fourth Edition, Prentice Hall of India, 2004.
3. Gerald C. F. and Wheatley P.O, "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi, 2002.
4. Sastry S.S, "Introductory Methods of Numerical Analysis", Third Edition, Prentice – Hall of India Pvt Ltd, New Delhi, 2003.
5. Kandasamy P., Thilagavathy K. and Gunavathy K., "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2007.

COURSE OUTCOMES:

On successful completion of the course the learner would be able to:

i. Solve a set of algebraic equations representing steady state models formed in engineering problems
ii. Fit smooth curves for the discrete data connected to each other or to use interpolation methods over these data tables
iii. Find the trend information from discrete data set through numerical differentiation and summary information through numerical integration
iv. Predict the system dynamic behaviour through solution of ODEs modeling the system
v. Solve PDE models representing spatial and temporal variations in physical systems through numerical methods.
vi. Have the necessary proficiency of using MATLAB for obtaining the above solutions.

U13 AU*T* 301- AUTOMOTIVE CHASSIS

L	T	P	C
3	0	0	3

OBJECTIVES

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

INTRODUCTION **9 hrs**

Types of Chassis layout, with reference to Power Plant location and drive, various types of frames, Loads acting on vehicle frame, Constructional details and materials for frames, Testing of frames, Types of Front Axles and Stub Axles, Front Wheel Geometry, namely, Castor, Camber, King Pin Inclination and Toe–in, Condition for True Rolling Motion of Wheels during Steering, Ackerman's and Daut's Steering Mechanisms, Steering Error Curve, Steering Linkages, Different Types of Steering Gears, Slip Angle, Over–Steer and Under–Steer, Reversible and Irreversible Steering, Power–Assisted Steering.

DRIVE LINE **9 hrs**

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

AXLES **9 hrs**

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

SUSPENSION SYSTEM **9 hrs**

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

BRAKING SYSTEM **9 hrs**

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

L: 45 T: 0 **Total 45 Hrs**

Reference book

1. Kripal Singh, "Automobile Engineering",Standard Publishers,2011
2. R.K. Rajput, "A Text–Book of Automobile Engineering", Laxmi Publications Pvt.Ltd,2007.
3. N.K. Giri, "Automotive Mechanics" Khanna Publishers, New Delhi, 2005.
4. Heldt P.M., "Automotive Chassis" Chilton Co., New York,1990.
5. Newton Steeds and Garret, "Motor Vehicles" 13th Edition, Butterworth, London, 2005.
6. Heinz Hazler, "Modern Vehicle Technology", Butterworth, London, 2005.

Course outcome:

On successful completion of the course the learner would be able to:

i) Understand the construction details of various types of automotive chassis and basic functions of subsystems in the chassis.

ii) Distinguish various types of suspension system, brake system, steering system and wheels & tires in the vehicles.

iii) Apply the knowledge for selection of suitable subsystems for a vehicle.

U13 AU*T* 302- THERMODYNAMICS AND THERMAL ENGINEERING

L	T	P	C
3	1	0	4

OBJECTIVES

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

BASIC THERMODYNAMICS 12hrs

Systems, Zeroth low, First law. Steady flow energy equation. Heat and work transfer in flow and non-flow processes. Second law, Kelvin-Planck statement – Clausius statement - Concept of Entropy, Clausius inequality, Entropy change in non-flow processes. Properties of gases and vapours.

AIR STANDARD CYCLES AND COMPRESSORS 9 hrs

Otto, Diesel and Dual combustion. Air standard efficiency. Mean effective pressure, Reciprocating compressors. Intercooling – Minimum work requirement

STEAM AND JET PROPULSION 8 hrs

Properties of steam – Rankine cycle – Steam Nozzles – Brayton cycles -Simple jet propulsion system – Thrust rocket motor – Specific impulse.

REFRIGERATION AND AIR-CONDITIONING 9 hrs

Principles of Psychrometry and refrigeration - Vapour compression – Vapour absorption types - Co-efficient of performance, Properties of refrigerants – Basic Principle and types Air conditioning, introduction to HVAC and its applications in automotive.

HEAT TRANSFER 8 hrs

Modes of Heat Transfer – Conduction, Convection and Radiation. Basics of Conduction in parallel, radial and composite wall – Basics of Convective heat transfer - Fundamentals of Radiative heat transfer. Introduction to Heat Exchanger.

L: 45 T: 15 Total 60 Hrs

(Use of standard thermodynamic tables, Mollier diagram and Refrigerant property tables are permitted)

Reference book

1. Nag.P.K., “Engineering Thermodynamics”, Tata McGraw-Hill, New Delhi, 2007.
2. Rathakrishnan E., “Fundamentals of Engineering Thermodynamics”, Prentice-Hall India, 2005.
3. Ramalingam K.K. “Thermodynamics”, Sci-Tech Publications, 2006
4. Holman.J.P., “Thermodynamics”, 3rd Ed. McGraw-Hill, 2007.
5. Venwylen and Sontag, “Classical Thermodynamics”, Wiley Eastern, 1987
6. Arora C.P, “ Thermodynamics”, Tata McGraw-Hill, New Delhi, 2003.
7. Merala C, Pother, Craig W, Somerton, “Thermodynamics for Engineers”, Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.

Course outcome:

On successful completion of the course the learner would be able to:

i. Understand the basics and laws of thermodynamics with respect to heat engines and thermal equipment.
ii. Apply the knowledge of working fluids in various thermodynamic equipment.
iii. Understand the modes of heat transfer with respect to various heat exchangers.
iv. Apply the concept of HVAC in automotive air conditioning.

U13 AU*T* 303- AUTOMOTIVE MANUFACTURING TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES

1. To gain theoretical and Theoretical knowledge in material casting processes and develop an understanding of the dependent and independent variables which control materials casting in a production setting.
2. Introduce students to good Machining Process and product design considerations.
3. Understanding manufacturing process, Application to Automotive

CASTING **8 hrs**

Casting types, procedure to make sand mould, types of core making, moulding tolls, machine moulding, special moulding processes – CO_2 moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

WELDING **8 hrs**

Classification of welding processes. Principles of Oxy-acetylene gas welding. A.C metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermit welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.

MACHINING **13hrs**

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines.

General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.

FORMING AND SHAPING OF PLASTICS **9 hrs**

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Blow moulding – Rotational moulding – Film blowing – Extrusion - Typical industrial applications – Thermoforming – Processing of Thermosets – Working principles and typical applications - Compression moulding – Transfer moulding – Bonding of Thermoplastics – Fusion and solvent methods – Induction and Ultrasonic methods

METAL FORMING AND POWDER METALLURGY **7hrs**

Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy – Principal steps involved advantages, disadvantages and limitations of powder metallurgy.

L: 45 T: 0 **Total 45 Hrs**

Reference book

1. Hajra Choudhury, "Elements of Workshop Technology", Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005.
2. Nagendra Parashar B.S. and Mittal R.K., "Elements of Manufacturing Processes", Prentice-Hall of India Private Limited, 2007.
3. Serope Kalpajian, Steven R.Schmid, "Manufacturing Processes for Engineering Materials", 4/e, Pearson Education, Inc. 2007.
4. R.K.Jain and S.C. Gupta, "Production Technology", Khanna Publishers. 16th Edition, 2001.
5. "H.M.T. Production Technology – Handbook", Tata McGraw-Hill, 2000.
6. Roy. A. Linberg, "Process and Materials of Manufacture", PHI, 2000.
7. M. Adithan and A.B. Gupta, "Manufacturing Technology", New Age, 2006.

Course outcome:

On successful completion of the course, the learner would be able to

i) Understand the Casting, Welding & Machining process used for automotive components manufacturing

ii) Understand the basic method of Forming

iii) Apply the knowledge for selecting suitable manufacturing process for various automotive components manufacturing.

U13 AU*T* 304 - ENGINEERING FLUID MECHANICS

L	T	P	C
3	1	0	4

OBJECTIVES

To introduce the concepts of fluid statics viscosity and buoyancy. To make the student understand the basic laws namely, mass momentum and energy. To give an introduction on fluid machinery.

BASIC CONCEPTS **9hrs**

Introduction – Fluid properties – Newton's viscosity law – Classification of fluids and fluid motion – Fluid statics – Hydrostatic force on submerged surfaces – stability of floating bodies – Dimensional analysis – The Buckingham-Pi theorem – Significant dimensionless groups – Flow similarity and model studies

BASIC EQUATIONS OF FLUID FLOW ANALYSIS **10hrs**

Basic laws for a system in integral form – Conservation of mass – Newton's 2nd law – Laws of thermodynamics – Application of the basic laws for a control volume – Kinematics – Motion of a fluid particle – Fluid deformation – Differential analysis of fluid motion – Continuity equation – Differential momentum equation – The Navier Stokes equations

INCOMPRESSIBLE INVISCID FLOW **8hrs**

Euler's equations of motion – Bernoulli's equations – Applications – Methods of pressure measurement – Flow measurement – Orifice plate – Venturi meter – Irrotational flow – Stream function and velocity potential – Laplace equation – Elementary plane flows

INCOMPRESSIBLE VISCOUS FLOW **8hrs**

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

FLUID MACHINERY **10hrs**

Introduction and classification of fluid machines – Turbo machinery analysis – The angular momentum principle – Euler turbo machine equation – Velocity triangles – Application to fluid systems – Working principle of turbines, fans, blowers, pumps and compressors.

L: 45 T: 15 **Total 60 Hrs**

Reference book

1. Shames I H, 'Mechanics of Fluids', Kogakusha, Tokyo, 1998
2. R.K. Bansal – "Fluid mechanics and hydraulic machines," Laxmi Publications (P) Ltd, 2006
3. Robert W Fox & Alan T Mc.Donald, 'Introduction to fluid Mechanics', John Wiley and Sons, 1995
4. V.L. Streeter – "Fluid mechanics," McGraw-Hill, 1998
5. Rathakrishnan, E, 'Fundamentals of Fluid Mechanics', Prentice-Hall, 2007

Course outcome:

On successful completion of the course, the learner would be able to

i. Understand the mathematical techniques of practical flow problems.
ii. Understand the properties of the fluid and solve the fluid flow problems
iii. Analyzing fluid flows through the proper use of modeling and the application of the basic fluid-flow principles
iv. Analyzing the performance of pumps and turbines.

U13 AU*T* 305 - SOLID MECHANICS

L	T	P	C
3	1	0	4

OBJECTIVES

- To gain knowledge of simple stresses, strains and deformation in components due to external loads.
- To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both.
- Effect of component dimensions and shape on stresses and deformations are to be understood.
- The study would provide knowledge for use in the design courses

AXIAL LOADING **9hrs**

Stresses and strains – Hooke's law – stress and strain diagrams - elastic constants – statically determinate and indeterminate problems in tension & compression – thermal stresses – impact loading.

STRESSES IN BEAMS **7hrs**

Shear force & bending moment diagrams – bending stresses – shear stress variation in beams of symmetric sections – beams of uniform strength.

DEFLECTION OF BEAMS **9hrs**

Double integration method – Macaulay's method – moment area method – conjugate beam method – principle of superposition – Strain Energy in axial, bending, torsion and shear loadings. Castigliano's theorems and their applications.

TORSION – SPRINGS – COLUMNS **11hrs**

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

BIAXIAL STRESSES **9hrs**

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

L: 45 T: 15 **Total 60 Hrs**

Reference book

1. Gere & Timoshenko, 'Mechanics of Materials', McGraw Hill, 1993
2. William Nash, Strength of Materials, Tata McGraw Hill, 2004
3. Bansal R.K. Strength of materials, Laxmi Publications, New Delhi-2007.
4. Dym,C.L., and Shames,I.H., 'Solid Mechanics', McGraw Hill, Kogakusha, Tokyo,1973.
5. R.K.Rajput, 'Strength of Materials', S. Chand and Co., 1999.
6. Timoshenko,S. and Young,D.H., Elements of Strength of Materials, T.Van Nostrand Co. Inc., Princeton, N.J., 1977.

COURSE OUTCOMES

On successful completion of the course the learner would be able to:

i.) Gain knowledge about the behavior of members subjected to different types of Forces.

ii.) Analyze different kinds of material strength using Stress-Strain relationships.

U13 AU*P* 301-MANUFACTURING TECHNOLOGY LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES

Demonstration and study of the various machines. The Main emphasis will be on a complete understanding of the machine capabilities and processes.

LIST OF EXPERIMENTS

1. **LATHE**
   - 1.1. Facing, plain turning and step turning
   - 1.2. Taper turning using compound rest.
   - 1.3. Taper turning using taper turning attachment
   - 1.4. Single start V thread, cutting and knurling
2. **SHAPER AND SLOTTER**
   - 2.1. Machining a V- block (in a Shaper)
   - 2.2. Machining internal key-way (in a Slotter)
3. **DRILLING**
   - 3.1. Drilling 4 or 6 holes at a given pitch circle on a plate
   - 3.2. Drilling, reaming and tapping
4. **MILLING**
   - 4.1. Plain Milling Exercise
   - 4.2. Gear Milling Exercise
5. **GRINDING**
   - 5.1. Cylindrical Grinding Exercise

Total: 45Hrs

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

i. Use appropriate machine tools for Lathe operations
ii. Use appropriate machine tools for drilling
iii. Use appropriate machine tools for grinding
iv. Use appropriate machine tools for manufacturing gears

U13 AU*P* 302 A)STRENGTH OF MATERIALS LABORATORY
B) FLUID MECHANICS & MACHINERY LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES

1. To expose the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally.

2. The students can able to have hands on experience in flow measurements using different devices and also perform calculation related to losses in pipes and also perform characteristic study of pumps, turbines etc.,

LIST OF EXPERIMENTS

A)STRENGTH OF MATERIALS LABORATORY

1. Tension test on a mild steel rod
2. Torsion test on mild steel rod
3. Hardness test on metals - Brinell and Rockwell Hardness
4. Deflection test on beams
5. Compression test on helical springs
6. Impact Test.

B) FLUID MECHANICS & MACHINERY LABORATORY

1. Determination of the Coefficient of discharge of a given Orifice meter.
2. Determination of the Coefficient of discharge of a given Venturi meter.
3. Determination of friction factor for a given set of pipes.
4. Performance Characteristic curves of centrifugal pump
5. Performance characteristics of Francis turbine.

Total: 45Hrs

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

i. Required knowledge in the area of testing of materials and components of structural elements experimentally.
ii. Use the measurement equipments for flow measurement
iii. Do performance test on different fluid machinery

U13 AU*P* 303 -AUTOMOTIVE CHASSIS AND ENGINE COMPONENTS LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES

To provide training the Students to know the details of different Chassis and Engine Components, dismantle and assembling them.

LIST OF EXPERIMENTS

AUTOMOTIVE CHASSIS LABORATORY

1. Study and measurement of the Light duty vehicle chassis frame

Study, dismantling and assembling of

2. Front Axle and Rear Axle
3. Differential
4. Steering systems along with any two types of steering gear box
5. Braking systems – hydraulic servo vacuum, compressed air power brakes.

Study, Dismantling and Assembling of

6. Clutch assembly of different types

ENGINE COMPONENTS LABORATORY

1. Dismantling of 4 cylinder petrol engine.
2. Assembling of 4 cylinder petrol engine.
3. Dismantling of 4 cylinder diesel engine.
4. Assembling of 4 cylinder diesel engine.
5. Study of oil filter, fuel filter, fuel injection system, carburetor, MPFI
6. Study of engine lubrication system components

Total : 45 Hrs

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

i. Dismantle and Assemble the automobile chassis and Engine components
ii. Identify & differentiate components of SI & CI engines
iii. Understand working of braking, steering, clutch, transmission, Suspension systems.
iv. Differentiate various subsystems of two, three & Four wheeler vehicles

U13 GH*P* 301 HUMAN EXCELLENCE – FAMILY VALUES
(Common to all branches of Engineering and Technology)

L	T	P	C
1	0	1	1

Restraint in family **4 Hours**

Definition - Greatness of life force & mind. Introduction - Kayakalpa yoga -aim - maintaining youthfulness – sex & spirituality – ten stage of mind – mental frequency-method of concentration – kayakalpa philosophy - physical body – sexual vital fluid – life force – bio-magnetism - mind –food transformation into seven minerals – postponing the ageing process – death – importance of kayakalpa training.

Spiritual development through good Family life **4 Hours**

Kayakalpa exercise – methods –aswinimudhra – ojus breathing – explanations – benefits – practices – Responsibility of men and women – introduction a good education – need of morality – spiritual development.Revision of previous physical exercises. Introduction – hints & caution – body massaging – accu-pressure –relaxation.

Peace in Family. **4 Hours**

Family value – meaning – Introduction – values – benefits of blessings – effect of vibrations – make blessings a daily habit – greatness of friendship – individual & family peace – reason for misunderstanding in the family – no comment – no command – no demand – no ego – peace of mind.

Greatness of womanhood & Food is Medicine **4 Hours**

Good–cultured behavioral patterns – love and compassion - Greatness of womanhood – Food is medicine (healthy food habits)

Simplified physical exercises **7 Hours**

Simplified physical exercises – Kaya Kalpa Yoga (Benefits related to the Patient, Tolerance, Sacrifice)

Meditation & Yogasanas **7 Hours**

Thuriya meditation – introduction – practice – benefits. Asanas– ashtanga yoga – pathanjali maharishi –hints & cautions – posture - movement – involvement – standing asanas: thadasana – ekapathasana – chakrasana(side) – uthkatasana – trikonasana. Sittingasanas: thandasana – padmasana – vajrasana – suhasana – siddhasana – parvathasana – yogamudhra.Downward lying asanas: makkarasana – bhujangasana – salabhasana –navukasana– dhanurasana. Upward lying asanas: savasana - arthapavanamukthasana– pavanamukthasana – utthanapathasana – navasana& Surya namaskara.

SEMESTER 4

U13 MA*T* 403 MODELING AND ANALYSIS OF ENGINEERING SYSTEMS

3 1 0 4

Objectives:

- To identify systems, their inputs and outputs
- To apply laws of physics to derive models for simple dynamic systems
- To evaluate the dynamic response of systems of interest with selected excitation signals
- To analyze signals through their frequency components using Fourier series and Fourier transforms
- To appreciate the frequency response characteristics of linear systems and its usefulness in specifying system dynamic behavior.

Fundamental Modeling Concepts: 7 Hours

Systems, Modeling and Analysis – Abstraction of physical behaviour using laws of physics – Linearity and Superposition – Lumped system dynamic behaviour represented by ordinary differential equations – Conservation laws to form dynamic equations

Modeling Elementary Systems: 10 Hours

Modeling Translational Mechanical Systems, RLC Electrical Circuit, Electrical Analogues for Mechanical System Parameters, Modeling of rotational mechanical systems, hydraulic systems and thermal systems, Model Representation of time delay

System Dynamic Response: 10 Hours

Obtaining dynamic response of first order and second order linear systems for step inputs through analytical solution of governing equations – Transient response specifications – Delay time, rise time, peak overshoot, undamped natural frequency, damping factor, settling time – Experimental determination of above parameters.

Dynamic response of general (including non - linear) system models through numerical integration of ODEs using MATLAB.

Fourier analysis of Signals: 8 Hours

Obtaining trigonometric Fourier series – Exponential Fourier Series – Fourier Spectra – Parseval's Theorem – Fourier Transform pairs and equations relating them – Magnitude and Phase Spectra from Fourier Transforms

Frequency Response of Linear Time–Invariant Systems: 10 Hours

Excitation and response signals of systems – Transfer functions – The sinusoidal steady state – Magnitude and phase response – Bode plots from transfer functions – Contributions from first order poles and zeros and complex conjugate pole pairs in frequency response – Frequency filtering characteristics of simple electrical and mechanical systems.

Total: (45 +15 Tutorial) hours

References:

1. P.D. Cha, J.J. Rosenberg & C.L. Dym, `Fundamentals of Modeling and Analyzing Engineering Systems', Cambridge University Press, 2000
2. Mrinal Mandal and Amrit Asif, `Continuous and Discrete Time Signals and Systems', Cambridge University Press, 2007 (for Unit IV only)
3. Y. Jaluria, `Design and Optimization of Thermal Systems', Mc Graw Hill, 1998
4. A. K. Chopra, `Dynamics of Structures: Theory and Applications to Earthquake Engineering', Pearson, 2007.
5. W. F. Phillips, `Mechanics of Flight', John Wiley & Sons, 2010.
6. J. B. Brockman,` Introduction to Engineering : Modeling and Problem Solving', John Wiley & Sons,2009.

Course Outcomes:

On successful completion of the course, the learner would be able to

- Attempt modeling real life systems of interest in order to predict its dynamic behavior
- Use simulation tools to determine dynamic response of system following external inputs
- Use Fourier analysis to identify the different frequency components in signals used for monitoring system health
- Use frequency response techniques to appreciate inherent dynamics of linear systems and design suitable feedback controllers
- Take up advanced courses on system dynamics, monitoring and control with familiarity on terminology and techniques employed in the above.

U13 AUT 401 - FUELS & LUBRICANTS

L	T	P	C
3	0	0	3

OBJECTIVES

To understand the source of automotive fuels and lubricants, their basic properties, determination of air requirement for the combustion of fuels and basic theory of lubrication.

MANUFACTURE OF FUELS AND LUBRICANTS 9 hrs

Fuels, Structure of petroleum, refining process, thermal and catalytic cracking, products of refining process, manufacture of lubricating oil base stocks and finished automotive lubricants.

FUELS FOR I.C. ENGINES 9 hrs

Types of Fuels, Liquid and gaseous fuels, heating value of fuels, higher and lower heating values, chemical structure of hydro-carbons SI Engine fuels, Volatility characteristics, desirable characteristics of SI Engine fuels, knock rating and additives.

COMBUSTION OF FUELS 9 hrs

Stoichiometry - calculation of theoretically correct air required for combustion of liquid and gaseous fuels, volumetric and gravimetric analysis of the dry products of combustion, mass of dry gas per kg of fuel burnt, mass of carbon in the exhaust gas, mass of carbon burnt to carbon-monoxide per kg of fuel, heat loss due to incomplete combustion, exhaust gas analysis by Orsat apparatus.

LUBRICANTS 9 hrs

Theory of Lubrication, Effect of engine variables on friction, Types of Lubrications-Hydrodynamic and Hydrostatic lubrication. Requirements for automotive lubricants and types, oxidation deterioration and degradation of lubricants, additives of lubricants and synthetic lubricants, classification of lubricating oils, tests on lubricants. Grease, classification, properties, testing of grease.

ALTERNATE FUELS 9 hrs

Alternate fuels for SI engines and CI engines, desirable characteristics, Octane and cetane rating, biodiesel. Introduction to electric, hybrid and fuel cell vehicles.

L: 45 T: 0 Total 45 Hrs

Reference book

1. V.Ganesan, “Internal Combustion Engines” Tata McGraw-Hill Publishing Co. New delhi, 1999
2. M.L.Mathur and P.Sharma “A Course in internal combustion engines”, Dhanpatrai Publications,2012
3. Brame, J.S.S. and King, J.G. – Fuels – Solids, Liquids, Gaseous. London: Edward Arnold, 1955.
4. Francis, W – Fuels and Fuel Technology, Vol. I & II,1980
5. A.R.Lansdown – Lubrication – A practical guide to lubricant selection – Pergamon press – 1982.
6. Raymond.C.Gunther – Lubrication – Chilton Book Co., - 1971.

Course outcome:

On successful completion of the course, the learner would be able to

1. Understand the refining process of petroleum
2. Understand the various types of fuels and their properties
3. Apply the knowledge in testing the fuel properties
4. Understand the properties and purpose of lubricants.
5. Understand the Alternate fuels

U13 AUT 402 - AUTOMOTIVE MATERIALS & METALLURGY

L	T	P	C
3	0	0	3

OBJECTIVES

To impart knowledge on the structure, properties, treatment, testing and applications of metals and on non-metallic materials so as to identity and select suitable materials for various engineering applications.

CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 10hrs

Overview of crystal structures and defects, Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphism, eutectic, peritectic, eutectoid and peritectroid reactions, Iron – Iron carbide equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application.

HEAT TREATMENT 11hrs

Definition – Full annealing, stress relief, recrystallisation and spheroidizing – normalizing, hardening and Tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR - Hardenability, Jominy end quench test – Austempering, martempering – case hardening, carburizing, nitriding, cyaniding, carbonitriding – Flame and Induction hardening. Heat treatment of crank shaft and Cam Shaft.

MECHANICAL PROPERTIES AND TESTING 6 hrs

Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell) Impact test Izod and charpy, fatigue and creep test.

NON-METALLIC MATERIALS 9 hrs

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE Polymers – Urea and Phenol formal deliydes – Engineering Ceramics – Properties and applications of Al2O3, SiC,Si3, N4, PSZ and Sialon – Fibre and particulate reinforced composites.

APPLICATION OF MATERIALS 9 hrs

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. Automotive technical textiles.

L: 45 T: 0 Total 45 Hrs

Reference book

1. Kenneth G.Budinski and Michael K.Budinski “Engineering Materials” Prentice-Hall of India Private Limited, 4th Indian Reprint 2002.
2. William D Callsber “Material Science and Engineering”, John Wiley and Sons 1997.
3. Raghavan.V.Materials Science and Engineering, Prentice Hall of India Pvt. Ltd., 1999
4. Sydney H.Avner “Introduction to Physical Metallurgy” McGraw-Hill Book Company, 1994.

Course outcome:

On successful completion of the course, the learner would be able to

1. Understand the importance of engineering materials and their structures, properties
2. Understand the various heat treatments process
3. Select the materials for particular engineering application

U13AU*T* 403-AUTOMOTIVE ELECTRICAL AND ELECTRONICS

L	T	P	C
3	0	0	3

OBJECTIVES

To impart knowledge to the students in the principles of operation and constructional details of various Automotive Electrical and Electronic Systems like Batteries, Starting System, Charging System, Ignition System, Lighting System and Dash –Board Instruments.

TYPES OF BATTERIES 9 hrs

Principle and construction of Lead Acid Battery, Nickel – Cadmium Battery, Nickel Metal Hydride Battery, Sodium Sulphur Battery and Aluminum Air Battery, Characteristics of Battery, Battery Rating, Capacity and Efficiency, Various Tests on Battery, Battery– Charging Techniques, Maintenance of batteries.

ELECTRICAL COMPONENTS 9 hrs

Requirements of Starter Motor, Starter Motor types, construction and characteristics, Starter drive mechanisms, Starter Switches and Solenoids, Charging system components, Generators and Alternators ,types, construction and Characteristics . Voltage and Current Regulation, Cut –out relays and regulators, Charging circuits for D.C. Generator, A.C. Single Phase and Three – Phase Alternators.

IGNITION SYSTEMS 9 hrs

Battery Coil and Magneto–Ignition System, Circuit details and Components of Battery Coil and Magneto–Ignition System, Centrifugal and Vacuum Advance Mechanisms, Spark Plugs, Constructional details and Types.

ELECTRICAL AND ELECTRONIC IGNITION SYSYTEMS 9hrs

Electronically–Assisted and Full Electronic Ignition System, Non–Contact–type Ignition Triggering devices, Capacitive Discharge Ignition Distributor–less Ignition System, Digital Ignition System, Control Strategy of Electronic Ignition System.

WIRING, LIGHTING AND OTHER INSTRUMENTS AND SENSORS 9hrs

Automotive Wiring, Insulated and Earth Return System, Positive and Negative Earth Systems, Head Lamp and Indicator Lamp Details, Anti–Dazzling and Dipper Details, Electrical and Electronic Fuel Lift Pumps, Theory and Constructional Details of Dash Board Instruments and their Sensors like Speedometer, Odometer, Fuel Level Indicator Oil Pressure and Coolant Temperature Indicators, Horns and Wiper Mechanisms, Automotive Wiring Circuits.

L: 45 T: 0 Total 45 Hrs

Reference book

1. Young, A.P. and Griffith, S.L., Automobile Electrical Equipments, ELBS and New Press,1999
2. Kholi .P.L.Automotive Electrical Equipment,Tata McGraw-Hill co ltd,New Delhi,2004
3. Crouse.W.H. Automobile Electrical Equi\pment,McGraw Hill Book CoInc.NewYork, 2005.
4. Judge.A.W.Modern Electrical Equipments of Automobiles,Chapman & Hall, London 2004 .
5. Robert Bosch, Automotive Handbook, Bently Publishers,2004

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

i. Recognize and understand the different wiring diagrams used in automobile manuals.
ii. Distinguish the various electrical systems of an automobile and identify the sensors from the wiring diagrams.
iii. Apply the knowledge of sensors in the management of the vehicle control.
iv. Analyze and solve the problems related to automobile wiring.

U13 AU*T* 404- AUTOMOTIVE PETROL ENGINES

L	T	P	C
3	0	0	3

OBJECTIVES

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

ENGINE CONSTRUCTION AND OPERATION 10 hrs

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

SI ENGINE FUEL SYSTEM 10 hrs

Carburettor working principle. Requirements of an automotive carburetor – starting, idling, acceleration and normal circuits of a carburetor – Compensation – Maximum power devices – Constant choke and constant vacuum carburetor, multi barrel and multiple venturi systems – Fuel feed system – Mechanical and electrical pumps – Petrol injection.

COOLING AND LUBRICATION SYSTEM 8 hrs

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

COMBUSTION AND COMBUSTION CHAMBERS 9 hrs

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

TWO STROKE ENGINES 8 hrs

Two stroke engine – types, terminologies, definitions, construction and operation. Comparison of four stroke and two stroke engine operation. Theoretical scavenging methods. Scavenging pumps – Types of scavenging.

L: 45 T: 0 Total 45 Hrs

Reference book

1. Ramalingam. K. K., Internal Combustion Engines, Scitech publications, Chennai, 2003.
2. Ganesan.V., Internal Combustion Engines, Tata McGraw Hill Publishing Co., New York, 1994.
3. Heldt.P.M. High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1975.
4. William.H.Crouse, Automotive Engines, McGraw Hill Publishers, 1985.
5. Obert E.F., Internal Combustion Engines Analysis and Practice, International Text Books: Co., Scranton, Pennsylvania, 1988.
6. Ellinger, H.E., Automotive Engines, Prentice Hall Publishers, 1992.

Course outcome:

On successful completion of the course, the learner would be able to

i) Understand the fundamentals & working of Petrol Engines
ii) Understand the various basic subsystems of a Petrol engine
iii) Apply the knowledge for different Petrol engine and various methods of combustion.

U13 AU*T* 405- MECHANICS OF MACHINES

L	T	P	C
3	1	0	4

OBJECTIVES

To expose the students the different mechanisms, their method of working, Forces involved and consequent vibration during working

MECHANISMS **9 hrs**

Machine Structure – Kinematic link, pair and chain – Grueblers criteria – Constrained motion – Degrees of freedom - Slider crank and crank rocker mechanisms – Inversions – Applications – Kinematic analysis of simple mechanisms – Determination of velocity and acceleration.

FRICTION **9 hrs**

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 drive.

GEARING AND CAMS **9 hrs**

Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, compound gear trains and epicyclic gear trains - Determination of speed and torque- Cams – Types of cams – Design of profiles – Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions.

BALANCING **9 hrs**

Static and dynamic balancing – Single and several masses in different planes –Balancing of reciprocating masses- primary balancing and concepts of secondary balancing – Single and multi cylinder engines (Inline) – Balancing of radial V engine – direct and reverse crank method.

VIBRATION **9 hrs**

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.

L: 45 T: 15 **Total 60 Hrs**

Reference book

1. Rattan S.S, “Theory of machines” Tata McGraw Hill publishing Co., New Delhi, 2002.
2. Rao J.S.and Dukkipati R.V. “Mechanism and Machine Theory” Second Edition,Wiley Eastern Limited, 1992.
3. Bansal Dr.R.K. “ Theory of Machines” Laxmi Publications (P) Ltd., New Delhi, 2001.
4. Shingley J.E. and Vicker J.J. Theory of Machines and Mechanisms” McGraw Hill, 1986.
5. Malhotra D.R. and Gupta H.C “The Theory of machines” Satya Prakasam, Tech. India Publications, 1989.

Course outcome:

On successful completion of this course, student should be able to:

i) Understand and remember the fundamentals of various mechanisms, structures, inversion mechanisms etc

ii) Applying the knowledge for selecting the suitable drives like belt, ropes, pulleys etc.

iii) Creating the cam profile for required conditions.

iv) Analyzing the various vibrations in the moving components of a mechanism

U13 AU*P* 401- AUTOMOTIVE COMPONENTS MODELING LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES

To provide practical training in designing and drawing of various Automotive components using modeling software

LIST OF EXPERIMENTS

Part Design:

1. Piston
2. Connecting Rod
3. Crank shaft
4. Cam Shaft
5. Valve
6. Flywheel
7. Cylinder Block
8. Cylinder Head
9. Tyre & Rim
10. Clutch Components

Assembly Design:

1. Piston ,Connecting Rod and Crank shaft Assembly
2. Clutch Assembly

Total : 45 Hrs

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

i. Modeling the Automotive components using Design software

ii. Assemble the Automotive components.

U13 AUP 402 - FUELS & LUBRICANTS LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES

To import the skill of testing conventional and alternative fuels for their properties using various fuels testing equipments.

LIST OF EXPERIMENTS

1. Testing of fuels - Ultimate analysis, proximate analysis
2. ASTM distillation test of liquid fuels
3. Aniline Point test of diesel
4. Calorific value of liquid fuel.
5. Calorific value of gaseous fuel.
6. Reid vapour pressure test.
7. Flash and Fire points of petrol and diesel.
8. Copper strip Corrosion Test
9. Cloud & Pour point Test.
10. Temperature dependence of viscosity of lubricants & Fuels by Redwood Viscometer.
11. Viscosity Index of lubricants & Fuels by Saybolt Viscometer
12. Ash content and Carbon Residue Test
13. Drop point of grease and mechanical penetration in grease.

Total : 45 Hrs

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Understand the process for finding out fuels & lubricant characteristics
2. Analyze the characteristics of fuels & lubricants

U13 AU*P* 403 AUTOMOTIVE ELECTRICAL & ELECTRONICS LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES

(i) The various automotive electrical systems like Batteries, Starting System, Charging System, Ignition System, Lighting System and Dash –Board Instruments the instrumentation systems involved in signal conditioning and data acquisition

(ii) Microprocessor based programming and interfacing

LIST OF EXPERIMENTS

AUTOMOTIVE ELECTRICAL LABORATORY

1. Testing of batteries and battery maintenance
2. Testing of starting motors and generators
3. Testing of regulators and cut – outs
4. Diagnosis of ignition system faults
5. Study of Automobile electrical wiring

AUTOMOTIVE ELECTRONICS LABORATORY

1. Study of rectifiers and filters
2. Study of logic gates, adder and flip-flops
3. Study of SCR and IC timer
4. Study of RTD, LVDT, and Load Cell.
5. Interfacing DAC for Control Application
6. Interfacing A/D converter for simple data acquisition
7. Micro Processor programming and interfacing

Total : 45 Hrs

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

i. Recognize and understand the different wiring diagrams used in automobile manuals.

ii. Troubleshoot the malfunctions if any, related to automobile wiring.

iii. Interface the various automobile systems with the microprocessor / other signal conditioning units

U13 GH*P* 401 HUMAN EXCELLENCE – PROFESSIONAL VALUES
(Common to all branches of Engineering and Technology)

L	T	P	C
1	0	1	1

Personality concepts - 5C's & 5E's **5 Hours**

Personality-concepts, definition,-types of personality-personality development activities-how to develop a good personality factors affecting personality development tools of improve personality-steps to a dynamic personality-5 C's and 5 E's

Time Management **5 Hours**

Self-development – importance of self development – how to develop oneself – continuous learning – laser focus +persistence – working a plan – sound mind follows sound body –complete responsibility – practice – those who make it, made it – never give-up – meditation – ten commandments of self development – self control technique for teenagers.

Leadership traits **5 Hours**

Leadership traits – style – factors of leadership – principles of leadership - time management – importance of time management – benefits – top five time sucks of the average Human –time management for college students. Passion for excellence – what is passion? – Why passion? – Value of life – index of life – fuel for fulfillment – secret of physical & spiritual fitness – improves learning ability.

Empowerment of Mind **5 Hours**

IQ, - Factors affecting the intelligence quotient – IQ and the brain – sex – race – age – relationship between IQ & intelligence – how to develop good intelligence quotient power – exercise can improve IQ – food plan to increase IQ – meditation – reading – playing – try right with opposite hands – learn new things - the IQ tests. EQ – emotional Intelligence – list positive & negative emotions. SQ – spiritual quotients – definition – basic science of spiritual quotient – how to build SQ? – Relationship between IQ, EQ, SQ.

Simplified Physical Exercise & Yogasanas & Meditation **10 Hours**

Panchendhriya meditation – Introduction – practice – benefits. Asanas – revision of previous asanas–standing asanas: natarasana –virabhadrasana – pathangusthasana–ardhachandrasana–utthithatrikonasana–parsvakonasana.

SEMESTER 5

U13 AUT 501 - AUTOMOTIVE FINITE ELEMENT ANALYSIS

L	T	P	C
3	1	0	4

OBJECTIVES

- To understand the principles involved in discretization and finite element approach
- To learn to form stiffness matrices and force vectors for simple elements

INTRODUCTION 8 hrs

Historical background – Relevance of FEA to design problems, Application to the continuum –Discretisation – Matrix approach, Matrix algebra – Gaussian elimination – Governing equationsfor continuum – Classical Techniques in FEM – Weighted residual method – Ritz method,Galerkin method

ONE DIMENSIONAL PROBLEMS 12hrs

Finite element modeling – Coordinates and shape functions – Potential energy approach– Element matrices and vectors – Assembly for global equations – Boundary conditions – Higher order elements - Shapes functions – Applications to axial loadings of rods – Extension to plane trusses – Bending of beams – Finite element formulation of stiffness matrix and load vectors – Assembly to Global equations –boundary conditions – Solutions and Post processing – Automotive Examples..

TWO DIMENSIONAL PROBLEMS – SCALAR VARIABLE PROBLEMS 6 hrs

Finite element modeling – CST element – Element equations, Load vectors and boundary conditions – Assembly – Application to heat transfer - Automotive Examples.

TWO DIMENSIONAL PROBLEMS – VECTOR VARIABLE PROBLEMS 10hrs

Vector Variable problems – Elasticity equations – Plane Stress, Plane Strain and Axisymmetric problems – Formulation – element matrices – Assembly – boundary conditions and solutions Examples

ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL PROBLEMS 9 hrs

Natural coordinates, Iso parametric elements, Four node quadrilateral element– Shape functions – Element stiffness matrix and force vector – Numerical integration – Stiffness integration – Displacement and Stress calculations – Examples.

L: 45 T: 15 Total 60 Hrs

Reference book

1. Chandrupatla T.R., and Belegundu A.D., “Introduction to Finite Elements in Engineering”,Pearson Education 2002, 3rd Edition.
2. Logan D.L., “A First course in the Finite Element Method”, Third Edition, Thomson Learning, 2002
3. Rao S.S., “The Finite Element Method in Engineering”, Pergammon Press, 1989.
4. David V.Hutton,”Fundamentals of Finite Element Analysis”, Tata McGraw-Hill Edition 2005. ISBN-0-07-239536-2

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Understand the discretization and finite element approach
2. Select appropriate elements to solve physical and engineering problems with emphasis as an automobile engineering applications

U13 AUT 502 - MEASUREMENTS AND METROLOGY

L	T	P	C
3	0	2	4

OBJECTIVES

Study of the theory, construction and operation of different measurement technology, instruments transducers and their application

LINEAR MEASUREMENT **9 hrs**

Units and standards, terminology and measurement errors. Linear measuringinstruments, dial gauges, comparators and linear measuring machines. Angular measuring instruments-measurement of straightness flatness and surface finish. Profilographs..

PRESSURE MEASUREMENT **9 hrs**

Bourden tube, diaphragm, bellows and pressure capsules: Transducers used in pressure measurement- potentiometer, strain gauges, LVDT, capacitive and variable reluctance type transducers. Dynamic pressure measurement piezo electric and piezo resistive transducers. Farnboro engine indicator. Low pressure measurement Mc leod gauge, Pirani gauge,, thermal conductivity type pressure measurement.

FLOW MEASUREMENT **9 hrs**

Obstruction type flow meter- orifice plate, venturimeter, flow nozzles, pitot tube, rotometer. Positive displacement flow meters – turbine flow meter, flouted tube flowmeter, anemometer, ultrasonic flow meter, magnetic flow meters. Alcock viscous air flow meter.

TEMPERATURE MEASUREMENT **9hrs**

Temperature scales – mechanical temperature sensors, liquid in glass, vapour pressure, bimetal temperature gauges. Resistance type temperature sensors. Thermistors, thermocouples, Laws of thermocouple, types of thermocouples. Construction and circuits for thermocouples. High temperature measurement pyrometers.

FORCE AND TORQUE MEASUREMENT **9 hrs**

Force measuring devices- Balances, platform scales, weigh bridges, load cells, proving ring. Torque measurement – prony brake, rope brake and fan type brakes. Dynamometers – hydraulic, electric cardle and eddy current dynamometers. Transmission dynamometers. Chassis dynamometers.

L: 45 T: 0 **Total 45 Hrs**

Reference book

1. Jain R.K., “Engineering Metrology”, Khanna publishers, New Delhi, 2005.
2. Rangan C.S., Sarma G.E and Mani V.S “Instrumentation devices and systems”. TMH Publishing Co. New Delhi, 2001.
3. Beckwith T.G & Buck N.L “Mechanical Measurements”, Oxford and IBH publishing house New Delhi, 2004.
4. Patranabis D, “Principles of industrial instrumentation”, TMH Publishing Co. New Delhi, 2000.
5. Jain R.K., “Mechanical & Industrial Measurements” , Khanna publishers, New Delhi, 2005.
6. Doeblin,”Measurement System Application &Design” McGraw Hill ,New Delhi, 2004.
7. Gaylor F.W and Shotbolt C.R “Metrology for Engineers”, ELBS, 2006.

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Handle the basic measurement tools
2. Apply the concept of measurements in inspecting various parameters.

U13 AU*T* 503- AUTOMOTIVE DIESEL ENGINES

L	T	P	C
3	0	0	3

OBJECTIVES

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

DIESEL ENGINE BASIC THEORY 9 hrs

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

FUEL INJECTION SYSTEM 9 hrs

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

AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS 10 hrs

Importance of air motion – Swirl, squish and turbulence, Swirl ratio. Fuel air mixing. Stages of combustion. Delay period – factors affecting delay period. Knock in CI engines. Comparison of knock in CI & SI engines. Direct and indirect injection combustion chambers. Air cell chamber. Combustion chamber design – objectives – Different types of combustion chamber. M Combustion chamber. Combustion chambers for Homogeneous charge compression ignition systems.

SUPERCHARGING AND TURBOCHARGING 8 hrs

Necessity and limitation – Charge cooling. Types of supercharging and turbocharging – Relative merits. Matching of turbocharger. Modification of an engine for supercharging. Effect of supercharging on engine performance.

DIESEL ENGINE TESTING AND PERFORMANCE 9 hrs

Automotive and stationary diesel engine testing and related standards – Engine power and efficiencies – performance characteristics. Variables affecting engine performance – Methods to improve engine performance – Heat balance – Performance maps.

L: 45 T: 0 Total 45 Hrs

Reference book

1. Ramalingam. K. K., Internal Combustion Engines, Scitech publications, Chennai,2003
2. Ganesan.V., Internal Combustion Engines, Tata McGraw Hill Publishing Co., New York, 1994.
3. Heldt.P.M. High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1985.
4. Obert E.F., Internal Combustion Engines Analysis and Practice, International Text Books: Co., Scranton, Pennsylvania, 1988.
5. Maleev,V.M., Diesel Engine Operation and Maintenance, McGraw Hill, 1974. Dicksee,C.B., Diesel Engines, Blackie & Son Ltd., London, 1964.

Course Outcomes:

On successful completion of the course, the learner would be able to

i. Understand the fundamentals & working of Diesel Engines
ii. Understand the various basic subsystems of an diesel engine
iii. Apply the knowledge for Diesel engine performance testing and various methods of charging.

U13AU*T* 504- MACHINE COMPONENTS DESIGN

L	T	P	C
3	1	0	4

AIM:

This course gives a complete procedure for designing different kinds of problems occurring in design engineering field especially in automobile engineering**.**

OBJECTIVES

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

INTRODUCTION 9 hrs

Classification of design - Engineering materials and their physical properties as applied to design - Selection of materials - Factors of safety in design – Endurance limit of materials - Determination of endurance limit for ductile materials.

Limits-Types of fits – types of tolerance – calculation of minimum and maximum clearances and allowances.

DESIGN OF SHAFTS AND SPRINGS 9 hrs

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

GEAR DESIGN 9 hrs

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

FLYWHEELS 9hrs

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

DESIGN OF BEARINGS 9hrs

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

L: 45 T: 15 Total 60 Hrs

Reference book

1. Jain,R.K., "Machine Design", Khanna Publishers, 1992.
2. Sundararaja Murthy, T.V., "Machine Design", Khanna Publishers, New Delhi, 1991.
3. Bhandari,v.B., "Design of Machine Elements", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1990.
4. Hall Allen,S. & other, “Machine Design” , Schaum publisher Co., 1982.
5. Sigley, “Machine Design”, McGraw Hill,1981.
6. “Design Data Book “, PSG College of Technology, Coimbatore,1992

Course Outcomes:

On successful completion of the course, the learner would be able to

i. Understand and Apply Engineering Design process
ii. Apply engineering principles and analytical techniques in the design process
iii. Design the Machine Components like Shafts and Springs Gear Design Flywheels and Bearings.

U13AU*T* 505-AUTOMOTIVE SENSORS AND EMBEDDED SYSTEMS

L	T	P	C
3	0	2	4

OBJECTIVES

To give the students an overview of automotive sensors, their principles, types, and fabrication and also provide an exposure to recent developments in this area.

UNIT –I TRANSDUCER PRINCIPLES 8 hrs

Introduction to sensors - Variable resistance transducers, Metal and semiconductor strain gages and their signal conditioning, Inductive transducers, Electromagnetic sensors, Hall effect sensors, Capacitive transducers, Piezo electric transducers and their signal conditioning, Ultrasonic sensors

UNIT –II SENSORS FOR TRANSPORTATION 8 hrs

Vehicle Body:- Torque sensors/ Force sensors, Sensors Flap air flow sensors, Temperature sensor, Ultrasonic sensors, Ranging radar (ACC) **Power Train:-** Fuel level sensors, Speed and RPM sensors, Lambda Oxygen sensor, NOX sensors, Hotwire air mass meter **Chassis:-** Steering wheel angle sensor, Vibration and acceleration sensors, Pressure sensors, Speed and RPM sensors, torque sensors

UNIT –III ACTUATORS 9 hrs

Automotive Actuator Technologies-Operation and application of DC brushless motors and switched reluctance motors, Magneto-rheological Actuators-Suspension semi active actuators, Mangetostrictive anti vibration actuators, Solenoids and actuators, Piezo Actuators, Micro positioning, Motion controller-Servo and stepper motors, Exhaust control valves, Smart micro actuators

UNIT –IV INTRODUCTION TO EMBEDDED SYSTEM 10 hrs

Introduction to embedded system, architecture, applications of embedded system, Microcontroller v/s microprocessor, introduction to MPLAB, making and running projects in MPLAB, basic programs, introduction to PIC Microcontroller, Types and products of PIC - architecture - memory devices - addressing modes, memory mapping, System Peripherals and User peripehrals – ADC, Interfacing temperature sensor with PIC micro via ADC

UNIT –V INTERRUPTS, TIMERS AND INTERFACING 10 hrs

Programming interrupts, counters and timers and serial communication(MSSP), CCP(Capture Compare PWM gen module), External Memory Interface, simple interfacing programs.

Reference book

1. Automotive Sensors, BOSCH. 2002
2. Ronald K. Jurgen, “Sensors and Transducers, 2nd Edition, SAE, 2003.
3. Muhammad Ali Mazidi, Rolin McKinlay, Danny Causey, "PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18" Pearson Education, 2007.

COURSE OUTCOME’S:

On successful completion of the above course, the learner would be able to

1. To select sensors for measuring various parameters in automotive systems.
2. Apply the knowledge of sensors in the management of the vehicle control.
3. Program and interface various sensors used in automobiles using PIC microcontroller.

U13 GS*T* 001 - ENVIRONMENTAL SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES

At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity.

INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES **10hrs**

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

ECOSYSTEMS AND BIODIVERSITY **14hrs**

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity – Biogeographical classification of India – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Exsitu conservation of biodiversity.

ENVIRONMENTAL POLLUTION **8 hrs**

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Soil waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

SOCIAL ISSUES AND THE ENVIRONMENT **7hrs**

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

HUMAN POPULATION AND THE ENVIRONMENT **6hrs**

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

Field Work

Visit to local area to document environmental assets- river / grassland / hill / mountain, visit to local polluted site- urban / rural / industrial / agricultural, study of common plants, insects, birds, study of simple ecosystems-pond, river, hill slopes etc.

L: 45 T: 0 **Total 45 Hrs**

Reference book

1. 1. Deswal.S and Deswal.A, " A basic course in Environmental studies" Dhanpat Rai &Co, 2006.
2. Gilbert M.Masters, Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
3. Miller T.G. Jr., Environmental Science – Sustaining the earth, Wadsworth Publishing Co., 1993
4. Bharucha Erach, the Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad India., 2002
5. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media. 1996
6. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopedia, Jaico Publ., House, Mumbai, 2001
7. Wager K.D., Environmental Management, W.B. Saunders Co., Philadelphia, USA, 1998.
8. Townsend C., Harper J and Michael Begon, "Essentials of Ecology", Blackwell Science Publishing Co., 2003
9. Trivedi R.K and P.K.Goel "Introduction to Air pollution" Techno-science Pubications. 2003
10. Yamuna R.T "Environmental Science" Inter Publications, 2008

U13 AU*P* 501- FINITE ELEMENT ANALYSIS LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES

To enhance analysis skill using FEA tools.

LIST OF EXPERIMENTS

I. STRUCTURAL ANALYSIS
   1. 1-D truss
   2. 2-D truss
   3. 3-D truss
   4. Beam analysis
   5. 2-D structure with various loadings
   6. 2-D structures with different materials
   7. Plate with hole
   8. Modal analysis
   9. Transient Response

II. THERMAL ANALYSIS
   1. Steady State heat transfer
   2. Transient heat transfer

III. FLUID ANALYSIS
   1. Flow through pipes

Total : 45 Hrs

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Analyze various 1D, 2D and 3D Structures using FEA tools.
2. Analyze heat transfer modes using FEA tools.
3. Analyze fluid flow through pipes using FEA tools.

U13 AU*P* 502- ENGINE PERFORMANCE AND EMISSION TESTING LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES

To provide practical training in conducting performance test on various Automotive Engines and to become familiar with different types of loading devices.

LIST OF EXPERIMENTS

1. Performance study of petrol engine at full throttle and part throttle conditions.
2. Performance study of diesel engine both at full load and part load conditions.
3. Morse test on petrol engines.
4. Determination of compression ratio, volumetric efficiency and optimum cooling water flow rate in IC engines.
5. Heat balance test on an automotive diesel and petrol engine.
6. Engine tuning for performance improvement.
7. Testing of 2 wheelers using chassis dynamometers.
8. Study of NDIR Gas Analyser and FID.
9. Study of Chemiluminescent NOx analyzer.
10. Measurement of HC, CO, CO_2, O_2 using exhaust gas analyzer.
11. Diesel smoke measurement.
12. Study of 2 wheeler chassis Dynamometers.

Total : 45 Hrs

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

i. Identify& differentiate varies types of dynamometers
ii. Conduct the performance test on various engines using various dynamometers.
iii. Calculate the performance characteristics.
iv. Handle various measuring devices related to engines and vehicles.
v. Measure the emission levels from vehicles and compare with Standards.

U13 GH*P* 501- HUMAN EXCELLENCE -SOCIAL VALUES

L	T	P	C
0	0	1	1

Responsible citizens to family and society **5 Hours**

Evolution of man - evolution of universe – creating theory – evolution theory – theory permanence theory – mithya – maya or illusion – evolution of living being –

Politics and need Education **5 Hours**

Human being & group – unity of man in society – relationship between individual – society.

Development of Science, education & Economics **5 Hours**

Duties and Responsibilities- Duty to self, family, society and world – politics & society – education & society – case study and live example – impact of science, economic & society.

Disparity among human beings **5 Hours**

Disparity among human beings – seven values – bodily structure – character of personality – advancement of knowledge or intellectual clarity – fame of service – physical strength –health – financial status. sixteen factors heredity – food – historical age – place of living – education – work – government – art – effort – physical age – friendship – opportunity – research – practice – accepted sentiments of society – morality.

Service and Sacrifice **3 Hours**

Social welfare – need – pure & pure society.

Yogasanas & Meditation **7 Hours**

Pancha bhootha navagraha meditation.
Sitting asanas: mahamudhra – ustrasana– gomukhasana– matsyasana – ArdhaMatsyendrasana.Upward lying asanas: setubhandasana–viparitakaranai – sarvangasana – halasana. Downward lying asanas: arthasarvangasana – adhomukhasvanasana–padmamayura

Total : 45 Hrs

U13 ENP 501 - COMMUNICATION SKILLS LABORATORY

L	T	P	C
0	0	3	1

Globalization has brought in numerous opportunities for the teeming millions, with more focus on the students' overall capability apart from academic competence. Many students, particularly those non- English medium schools, find that they are not preferred due to their inadequacy of communication skills and soft skills, despite possessing sound knowledge in their subject area along with technical capability. Keeping in view their pre- employment needs and career requirements, this course on Communication Skills Laboratory will prepare students to adapt themselves with ease to the Industry environment, thus rendering them as prospective assets to Industries. The course will equip the student with the necessary communication skills that would go a long way in helping them in their profession.

OBJECTIVES

- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them develop their soft skills and people skills, which will make the transition from college to workplace smoother and help them to excel in their jobs.
- To enhance students' performance at Placement Interviews, Group discussions and other recruitment exercises.

PC based session (Weightage - 40%) 24 periods

I. English Language Lab (18 Periods)

1. **Listening Comprehension 6hrs**
   Listening – Listening and sequencing of sentences – Filling in the Blanks – Listening and answering the question
2. **Reading Comprehension and Vocabulary 6hrs**
   Filling in the blanks – Cloze Exercises –Vocabulary building – Reading and Answering questions
3. **Speaking: 6hrs**
   Phonetics:
   Intonation – Ear Training – Correct Pronunciation – Sound Recognition exercises – Common Errors in English
   Conversations:
   Face to face Conversation – Telephone conversation - Role play Activities (Students take on roles and engage in conversation) B. Career Lab (6 Periods) **(Samples are available to learn and practice in the class room session)**

1. **Resume / Report Preparation / Letter Writing (1)**
   Structuring the resume / report – Letter writing / E-mail communication – Samples
2. **Presentation Skills (1)**
   Elements of an effective presentation – Structure of a presentation –Presentation Tools – Voice Modulation – Audience analysis – Body Language
3. **Soft Skills (2)**
   Time Management – Articulateness – Assertiveness – Innovation and Creativity – Stress Management & Poise
4. **Group Discussion (1)**
   Why is GD part of selection process? – Structure of a GD- Moderator-led and Other GDs – Strategies in GD – team work – Body Language –Mock GD
5. **Interview Skills**
   Kinds of Interviews –Required Key Skills – Corporate culture- Mock Interviews

II. Class Room Session (welghtage-60%) 24 periods

1. **Resume / Report Preparation /Letter writing:**
   Students prepare their own resume and report. (2)
2. **Presentation Skills:**
   Students make presentations on given topics. (8)
3. **Group Discussion:**
   Students participate in group discussions (8)
4. **Interview Skills**:
5. Students participate in Mock Interviews. (8)
6. **Note:**
   Classroom sessions are practice sessions

REFERENCES BOOKS:

1. Meenakshi Raman and Sangeetha Sharma, Technical Communication- Principles and Practice, Oxford University Press. New Delhi (2004).
2. Barker. A – Improve your communication skills – Kogan page India Pvt Ltd. New Delhi (2006).
3. Adrian Doff and Christopher Jones- Language in Use (Upper- Intermediate). Cambridge University Press. First South Asian Edition (2004).
4. John Seely, the Oxford Guide to writing and speaking, Oxford University Press, New Delhi (2004).
5. Customize yourself to corporate life Dr. K. Devadoss & P. Malathy Inder Publications, Coimbatore (2007).

CD's

1. Train2sucess series 1.Telephone Skills.2. Interviewing Skills 3. Negotiation Skills by Zenith Global Consultants Ltd. Mumbai.
2. BEC Series.
3. Look Ahead by Cambridge University Press.

U13 AUA 501 - OVERVIEW OF MOTORSPORTS ENGINEERING

L	T	P	C
1	0	0	1

OBJECTIVES:

To create awareness of motorsport engineering and its rules and regulations.

1. **Introduction to motorsport engineering**

   The history of motorsport engineering-Review of motorsport engineering-Pioneers of Motorsport engineering -Motorsport technology evolution review.

2. **List of motorsport competitions for students**

   A brief look at all the events students can take part to develop their skills - Formula SAE - Baja SAE - SAE Super mileage.

3. **Professional motorsport events**

   The various types of professional motorsport events that take place around the world - Cars – Formula One, World rally championship, Touring car championship, GP2, GP3, World Endurance Racing Championship, dirt track racing, NASCAR, Indy Car, Cross Country rallies, drag racing - Motorcycles – MotoGP, Superbike, Endurance, Motocross, Supermoto, Freestyle, Trials, Cross-country rallies, Speedway, Board track, drag racing

4. **Rules and regulations of motorsports**

   Introduction about the rule book - About - the world governing bodies of the sport - Why the rule book keeps changing - How to interpret the rule book- Rules for car races - Rules for bikes races

5. **Career in motorsports Engineering**

   Motorsport Engineer Race Driver / Rider - Test Driver / Rider - Design engineer - Race technician -Aerodynamics Engineer - Race official / steward

Total : 15 Hrs

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to

1. Participate in various activities of motorsport engineering

SEMESTER 6

U13 AU*T* 601 - CHASSIS DESIGN

L	T	P	C
3	1	0	4

OBJECTIVES

At the end of the course the student will be able to understand the fundamental principles involved in design of components of automotive chassis, the complete design exercise and arrive at important dimensions of chassis components.

Note: *(Use of P S G Design Data Book and Approved Design Data books are permitted in the University examination)*

INTRODUCTION TO CHASSIS FRAME AND SUB-SYSTEMS 9 hrs

Types of vehicles – Classification of vehicles – conventional and off-highway vehicles – Multi axle vehicles - vehicle specifications - Different layouts of power plant with reference to location and drive - Types of frames – Frameless chassis - various forces acting on frames, different sections-materials.

Calculation of power required to propel a vehicle.

DESIGN OF STEERING AND SUSPENSION SYSTEM 10 hrs

Functions and requirements of steering system - conditions for true rolling of wheels –- roll centre and roll axis - Steering linkages - steering kinematics - under steering and over steering –Calculation of steering wheel effort and pitman arm torque-design of pitman arm for equivalent stresses.

Need of suspension system - factors affecting ride quality - Types of suspension systems– need anti-roll bar – Design of leaf and torsion bar spring –Basics of pneumatic suspension and design- Basics of shock absorber design-empirical relationships

BRAKING SYSTEM 9 hrs

Function, stopping time and distance, weight transfer during braking, brake actuating mechanisms – mechanical, hydraulic and pneumatic, disc and drum brakes - design and analysis of brake shoes and friction pads. Brake shoe materials and leading and trailing brakes.

GEAR BOX 8 hrs

Gear train calculations, layout of gearboxes. Calculation of bearing loads and selection of bearings. Design of gearboxes.

DRIVE LINE AND REAR AXLE 9 hrs

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 and design aspects of final drive.

L: 45 T: 15 Total 60 Hrs

Reference book

1. Giri, N.K., Automobile Mechanics, Khanna publishers, New Delhi, 2007.
2. Khurmi. R.S. & Gupta. J.K., A textbook of Machine Design, Eurasia Publishing House (Pvt) Ltd, 2001.
3. Heldt, P.M., Automotive Chassis, Chilton Book Co., 1992.
4. Dean Averns, Automobile Chassis Design, Illife Book Co., 2001.

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Understand the design assumptions.
2. Design of various automotive Chassis components

U13 AU*T* 602 -ENGINE DESIGN

L	T	P	C
3	1	0	4

OBJECTIVES

To make the students understand the design concept and principles of various engine components. These concepts and principles are familiarized for design of components.

Note: *(Use of P S G Design Data Book and Approved Design Data books are permitted in the University examination)*

UNIT –I DESIGN OF CYLINDER AND PISTON 9 hrs

Choice of material for cylinder and piston, design assumptions and procedure for cylinder and piston. Design of cylinder, piston, piston pin, piston rings, piston failures, lubrication of piston assembly.

UNIT –II CONNECTING ROD 9 hrs

Design of Connecting Rod-determining minimum length of connecting rod, small end design, shank design, design of big end cap bolts.

UNIT –III DESIGN OF CRANKSHAFT 9 hrs

Balancing of I.C. engines, significance of firing order. Material for crankshaft, design of crankshaft under bending and twisting, balancing weight calculations, development of short and long crank arms. Front and rear-end details.

UNIT –IV CLUTCH 9 hrs

Design of single plate clutch, multiplate clutch, design of centrifugal clutch, and cone clutch, energy dissipated, torque capacity of clutch, design of Clutch Components, Design details of roller and sprag type of clutches.

UNIT –V DESIGN OF VALVES AND VALVE TRAIN 9 hrs

Design aspects of intake & exhaust manifolds, inlet & exhaust valves, valve springs, tappets and valve train. Design of cam & camshaft. Design of rocker arm. Cam profile generation.

L: 45 T: 15 Total 60 Hrs

Reference book

1. Engine Design – Giles J. G., Lliffe Book Ltd.1968
2. Engine Design – Crouse, Tata McGraw Publication, Delhi
3. Khurmi. R.S. & Gupta. J.K., A textbook of Machine Design, Eurasia Publishing House (Pvt) Ltd, 2001.
4. Jain.R.K, “Machine Design”, Khanna Publishers, New Delhi, 2005.
5. I. C. Engine & Air Pollution – E. F. Obert, Harper & Row Publishers, New York
6. Giri.N.K, Automobile Mechanics, Khanna Publishers, New Delhi, 2007.

Reference book

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Understand the design assumptions.
2. Design of various Automotive Engine components

U13 AU*T* 603 - AUTOMOTIVE TRANSMISSION

L	T	P	C
3	0	0	3

OBJECTIVES

The main objective of this course is to impart knowledge in automotive transmission. The detailed concept, construction and principle of operation of various types of mechanical transmission components, hydrodynamic devices, hydrostatic devices and automatic transmission system will be taught to the students. The design of clutch and gearbox will all so be introduce to the students. At the end of the course the students will have command over automotive transmission concepts and application

CLUTCH AND GEAR BOX **9 hrs**

Problems on performance of automobile - such as resistance to motion, tractive effort, engine speed, engine power and acceleration. Requirement of transmission system. Different types of clutches, principle, Construction and torque capacity. Determination of gear ratios for vehicles. Different types of gearboxes such as Sliding mesh gearbox, Constant mesh gearbox and Synchromesh gearbox.

HYDRODYNAMIC DRIVE **9 hrs**

Fluid coupling - Principle of operation, Constructional details, Torque capacity, Performance characteristics and Reduction of drag torque. Hydrodynamic Torque converter - Principle of operation, Constructional details and Performance characteristics. Multistage torque converters. Polyphase torque converters. Converter coupling

PLANETARY GEAR BOXES **9 hrs**

Construction and operation of Ford – T-model gearbox, Wilson Gear box and Cotal electromagnetic transmission.

AUTOMATIC TRANSMISSION APPLICATIONS **9 hrs**

Need for automatic transmission, Principle of operation. Hydraulic control system for automatic transmission. Chevrolet "Turboglide" Transmission, Continuously Variable Transmission (CVT) – Types – Operations.

HYDROSTATIC AND ELECTRIC DRIVE **9 hrs**

Hydrostatic drive - Various types of hydrostatic systems, Principles of Hydrostatic drive system. Advantages and limitations. Comparison of hydrostatic drive with hydrodynamic drive, Construction and Working of typical Janny hydrostatic drive. Electric drive - Principle of operation of Early and Modified Ward Leonard Control system, Advantages & limitations.

L: 45 T: 0 **Total 45 Hrs**

Reference book

1. Heldt P.M – "Torque Converters"- Chilton Book Co.-1992
2. Judge, A.W., Modern Transmission systems, Chapman and Hall Ltd., 1990.
3. Newton and Steeds – "Motor Vehicle"- Illiffee Publisher- 2000.
4. Design Practices, passenger Car Automotive Transmissions- SAE Hand book-1994.
5. Crouse, W.H., Anglin, D.L., Automotive Transmission and Power Trains construction, McGraw Hill, 1992.
6. Heldt, P.M., Torque converters, Chilton Book Co., 1992.

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Understand the purpose of clutch, gear box and drive train
2. Compare various types of transmission system
3. Understand the various types of drives

U13 AU*T* 604 - AUTOMOTIVE POLLUTION AND CONTROL

L	T	P	C
3	0	0	3

OBJECTIVES

To make the students to realize the impact of automobile emissions on the environment and expose student to factors affecting the formation and control of automobile pollutants.

INTRODUCTION **9 hrs**

Vehicle population assessment in metropolitan cities and contribution to pollution, effects on human health and environment, global warming, types of emission, transient operational effects on pollution. National and international pollution control norms.

POLLUTANT FORMATION IN SI ENGINES **9 hrs**

Pollutant formation in SI Engines, mechanism of HC and CO formation in four stroke and two stroke SI engines, NOx formation in SI engines, effects of design and operating variables on emission formation, control of evaporative emission. Two stroke engine pollution.

POLLUTANT FORMATION IN CI ENGINES **9 hrs**

Pollutant formation in CI engines, smoke and particulate emissions in CI engines, effects of design and operating variables on CI engine emissions. Nox formation and control. Color and Aldehyde emissions Noise pollution from automobiles, measurement and standards.

CONTROL OF EMISSIONS FROM SI AND CI ENGINES **9 hrs**

Design of engine, optimum selection of operating variables for control of emissions, EGR, Air injector PCV system, Thermal reactors, secondary air injection, catalytic converters, catalysts, fuel modifications, fuel cells, Two stroke engine pollution control.

MEASUREMENT TECHNIQUES EMISSION STANDARDS AND TEST PROCEDURE **9 hrs**

NDIR, FID, Chemiluminescent analyzers, Gas Chromatograph, smoke meters, emission standards, driving cycles – USA, Japan, Euro and India. Test procedures – ECE, FTP Tests. SHED Test – chassis dynamometers, dilution tunnels.

L: 45 T: 0 **Total 45 Hrs**

Reference book

1. Paul Degobert – Automobiles and Pollution – SAE International ISBN-156091-563-3, 1991.
2. Ganesan, V- “Internal Combustion Engines”- Tata McGraw-Hill Co.- 2003.
3. Springer and Patterson, Engine Emission, Plenum Press, 1990.
4. SAE Transactions- “Vehicle Emission”- 1982 (3 volumes).
5. Obert.E.F.- “Internal Combustion Engines”- 1988
6. Marco Nute- “ Emissions from two stroke engines, SAE Publication – 1998

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Familiarize the norms of pollution standards
2. Analyze the sources of pollution from automobiles
3. Understand the pollution control methods and apply.

U13 AU*T* 605 - ADVANCED AUTOMOTIVE SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES

To understand the electronic advancements achieved in the field of automobile technology

UNIT –I EMBEDDED CONTROL SYSTEMS 9 hrs

Introduction to Embedded control systems, Microcontroller and processors used in Automotive systems, need for electronics in automobiles, Engine control unit, Electronic– Input devices- Sensors- wheel speed sensor, Crash sensor etc.

UNIT –II ELECTRONIC FUEL INJECTION & IGNITION SYSTEM 9hrs

Introduction, feedback carburettor system, throttle body injection, advanced GDI and multi point fuel injection system, injection system controls, advantage of electronic ignition systems, types of solid state ignition system and their principles of operation, electronic spark timing control.

UNIT –III BRAKING AND ELECTRONIC STABILITY CONTROL 9hrs

Vehicle motion control, collision avoidance control – cruise control, Adaptive cruise control, Electronic transmission control. Vehicle stabilization system -Antilock braking system, Traction control system, Anti slip regulation, Electronic stability program. On-board diagnosis system.

UNIT –IV PASSIVE SAFETY SYSTEMS 9 hrs

Air bags and seat belt pretensioner systems: Sensor functions, Distributed front air bag sensing systems, Single-point sensing systems, Side-impact sensing – driver monitoring systems.

UNIT –V INFOTAINMENT SYSTEMS 9 hrs

Global positioning systems, geographical information systems, navigation systems, automotive vision system, lane departure warning system, driver assistance systems such as power seats, Power windows, and Remote keyless entry systems.

L: 45 T: 0 Total 45 Hrs

Reference book

1. Automotive Computer Controlled Systems Diagnostic tools and techniques-Allan W. M. Bonnick, Butterworth-Heinemann Linacre House, Jordan Hill, Oxford OX2 8DP
2. Electronic Engine Control Technologies, 2nd Edition-Ronald K. Jurgen-SAE International
3. Ljubo Vlacic, Michel Parent & Furnio Harshima, "Intelligent Vehicle Technologies: Theory and Applications", Butterworth-Heinemann publications, 2001
4. Denton. (2004) Automotive Electrical and Electronic Systems, Burlington, MA 01803, Elsevier Butterworth-Heinemann.
5. Ronald K. Jurgen. (1999) Automotive Electronics Handbook, McGraw-Hill Inc.,
6. Bosch. (1999) Automotive Electrics & Electronics, Robert Bosch GmbH, 3rd edition.
7. Telematics Communication Technologies and Vehicular Networks: Wireless Architectures and Applications-Chung-Ming Huang, National Cheng Kung University, Taiwan; Yuh-Shyan Chen, National Taipei University, Taiwan
8. Active Safety and the Mobility Industry -Dr. Andrew Brown, Jr.-SAE International

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Understand the advancements in the fuel injection system.
2. Compare the various types of advanced braking systems.
3. Outline the active and passive safety systems in automobiles.

U13 AUP 601 - CHASSIS AND ENGINE DESIGN

L	T	P	C

LABORATORY

0	0	3	1

OBJECTIVES

To enhance design and analysis skill for Chassis and Engine components using modeling and FEA tools.

List of Experiments:

DESIGN AND ANALYSIS FOR FOLLOWING CHASSIS COMPONENTS:

1. Chassis Frame
2. Helical spring
3. Leaf Spring
4. Clutch
5. Propeller Shaft

DESIGN AND ANALYSIS FOR FOLLOWING ENGINE COMPONENTS:

1. Cylinder
2. Piston
3. Connecting Rod
4. Crank Shaft
5. Valve

Total : 45 Hrs

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Design and analyze the Chassis components using Modeling / FEA tools
2. Design and analyze the Engine components using Modeling / FEA tools

U13 AU*P* 602 - ADVANCED AUTOMOTIVE SYSTEMS LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES

To understand the electronic advancements achieved in the field of automobile technology

List of Experiments:

1. **PIC microcontroller programming and interfacing**
2. **RPM Measurement Using**
   - (i) Hall effect Sensor
   - (ii) Inductive Type Sensor
3. **Brake Pedal Position measurement**
   - (i) using Hall Eeffect sensor
   - (ii) Designing of P, PI, PID controllers using performance criteria
4. **Labview Programming :**
   - (i) Temperature Conversion
   - (ii) Debugging and Sub-VI creation
   - (iii) Loops and Waveform Charts
   - (iv) Case statements, Arrays and Clusters
   - (v) Strings and File Input/output
5. **Data Acquisition Systems and Labview**
   - (i) Strain measurement system
   - (ii) Temperature measurement system
   - (iii) Pressure measurement system
6. **Matlab /Simulink Programming**

   Case Study1 : ABS

   Case Study2: TCS

Total : 45 Hrs

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Apply the knowledge of sensors in the management of the vehicle control.
2. Program and interface various sensors used in automobiles using PIC microcontroller
3. Interface and simulate various sensors used in automotive systems to Labview and Matlab

U13 AU*P* 603 - MINI PROJECT

L	T	P	C
0	0	3	2

OBJECTIVES

The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.

GUIDELINES:

1. Selection of a topic or project title in consultation with a staff member.
2. Develop a project planning strategy.
3. If it is an industry – sponsored project, a concurrent letter from industry is required.
4. A maximum of 4 students per group will do the project.
5. The project may be done in one of the labs under the supervision of a guide or in the selected industry.
6. At the end of the project, a report will be written and a technical presentation along with demonstration will be made by the students.
7. The report, project demonstration and technical presentation will be evaluated by the internal and external examiners

Total : 60 Hrs

COURSE OUTCOMES:
On successful completion of the course, the learner would be able to

1. Design, analyze and fabricate device and mechanisms of automotive specific.

U13 GH*P* 601 - HUMAN EXCELLENCE - NATIONAL VALUES

L	T	P	C
1	0	1	1

OBJECTIVES

The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.

GUIDELINES:

Rights and responsible citizenship **5 Hours**

Citizenship- its significance-Enlightened citizenship - what are the rights to citizenship Emerging India-its glory today- Global perspective

Greatness of Indian culture **5 Hours**

Outsiders view about India – about yoga - culture – joint family – morality – service - food–behavior – attitude – work.

Indian culture and it's greatness – dress coding - festivals – food is medicine – games – traditional medicines

India and Peace **5 Hours**

India and Peace – who are the person to participate world peace - India and Spirituality- Great spiritual leaders – Shankarar – Ramanujar – mathvar – budha – mahaveerar – vallalar – Ramakrishna paramahamsar –mathaamirthananthamaayi – ramanar – aravindhar – annai.

India's message to the world **7 Hours**

India's message to the world – thiruvalluvar – thirukural – manivasagar – tiruvasagam – aravindhar – B.K.S Iyengar – yoga asanas – Sir C.V.Raman – Physics –ramanujam – maths – rabinthranathtagore – literature – A.P.J Abdulkalam.

Global peace **3 Hours**

It's role in global peace - – vethathiri maharishi – world peace –Thiruvalluvar – vallalar - Service and sacrifice-Unity in diversity – case studies-live examples - National values identification and practice.

Meditation & Yogasanas

5 Hours

Nine Centre Meditations , Yogasanas - II

Total :30Hrs

U13 AU*A* 601 - INDUSTRY ORIENTED COURSE – AUTOMOTIVE STYLING

L	T	P	C
1	0	0	1

OBJECTIVES

Car design courses, such as this one focused on race cars, give students the opportunity to create their own cars from scratch.

Design Expressions

Design methodology, Lifestyle board, Mood board, Theme board, Design trends, Design movements, Application of design principles and product aesthetics

Introduction to Concept Cars

Importance of concept cars, Blending technology, Form in concept cars

Car Design

Art and colour, Product styling, Introduction to human factors engineering, Digital design, Concept to reality, Auto show vehicles

Visual Factors in Design

Colour harmony, Colour in design, Artist's spectrum, Basic color schemes

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

Total: 15 Hrs

SEMESTER 7

U13 AUT 701 - VEHICLE DYNAMICS

L	T	P	C
3	1	0	4

OBJECTIVES

To familiarize the students in vehicle dynamics.

INTRODUCTION **9 hrs**

Fundamentals of vibration, - Single, two, multi degrees of freedom systems - Derivation of equations of motion, influence coefficients, orthogonality principle, calculation of natural frequencies by Raleigh, Dunkerley, Holzer and matrix iteration methods, branched system, geared system. Modeling of an automobile for vibration study.

PERFORMANCE MODE **9 hrs**

Acceleration - free body diagram of accelerating vehicle, maximum transferable tractive force, gradability, deceleration - maximum decelerating rates, stopping distance, maximum braking force, adhesion utilization - Straight line motion - aerodynamic forces and moments, viscosity effects -separation and its control - aerodynamic lift and its control - ground effect - profile for minimum drag.

RIDE MODE **9 hrs**

Effects of damping the vibration, vibration absorbers, pitch and bounce motion, oscillation centers - active and semi active suspension - Orthogonality of mode shapes, modal analysis, vehicle performance testing.

HANDLING MODE **9 hrs**

Tyres - mechanics, testing and modeling, vehicle control - low speed cornering and static steering -Ackerman steering geometry, steady-state cornering - steering factors, vehicle control parameters (under steer, neutral steer and over steer), steady state handling - lateral acceleration gain, characteristic speed, yaw velocity gain and critical speed - effect of braking on vehicle handling - constant radius testing - fish hook measurement testing.

VEHICLE STABILITY AND NOISE **9hrs**

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

Properties of sound – sound level designation and measurements techniques - Sound isolation and absorption - machine enclosures, silencers and mufflers.

L: 45 T: 15 **Total 60 Hrs**

Reference book

1. Gillespie T.D, “Fundamentals of Vehicle Dynamics”, SAE USA 1992.
2. Rao J.S and Gupta. K “Theory and Practice of Mechanical Vibrations”, Wiley Eastern Ltd., 2002.
3. Giri N.K – Automotive Mechanics, Khanna Publishers, 2007.
4. Karl Popp, Werner O. Schiehlen, “Ground Vehicle Dynamics”, Springer, 2010.
5. Rajesh Rajamani, “Vehicle Dynamics and Control”, Springer, 2012.
6. Georg Rill, “Road Vehicle Dynamics: Fundamentals and Modeling”, CRC Press, 2012.
7. Giles.J.G.Steering - “Suspension and Tyres”, Illiffe Books Ltd., London- 1998
8. Ellis. J.R, “Vehicle Dynamics”, Business Books Ltd., London, 1991.

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Understand the concept of mechanical vibrating system.
2. Analyze the performance, ride and handling mode of the vehicle.
3. Analyze the stability and noise of vehicle.

U13 AUT 702 - VEHICLE BODY ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES

At the end of the course, the students will be able to have a sound knowledge for the design of the vehicles body to give maximum comfort for the passengers and exposed to the methods of stream lining the vehicles body to minimize drug.

CAR BODY DETAILS **9 hrs**

Types Saloon, convertibles, Limousine, Estate Van, racing and sports car – Visibility: regulations, driver's visibility, tests for visibility – Methods of improving visibility and space in cars – Safety: safety design, safety equipments for car. Car body construction.

VEHICLE AERODYNAMICS **9 hrs**

To make the students understand the design concept and principles of various engine components. These concepts and principles are familiarized for design of components.

BUS BODY DETAILS **9 hrs**

Types: Mini bus, single decker, double decker, two level, split level and articulated bus – Bus body lay out – Constructional details: Types of metal sections used – Regulations – Conventional and integral type construction.

COMMERCIAL VEHICLE DETAILS **9 hrs**

Different types of commercial vehicle bodies – Light commercial vehicle body types – Construction details of flat platform body, Tipper body & Tanker body – Dimensions of driver's seat in relation to controls – Drivers cab design.

BODY MATERIALS, TRIM AND MECHANISMS **9hrs**

Steel sheet, timber, plastics, GRP, properties of materials – Corrosion – Anticorrosion methods – Selection of paint – Modern painting process in details – Body trim items – Body mechanisms.

L: 45 T: 0 **Total 45 Hrs**

Reference book

1. Powloski,J., Vehicle Body Engineering, Business Books Ltd., 1989.
2. John Fenton, Vehicle Body layout and analysis, Mechanical Engg. Publication Ltd.,London, 1982.
3. Giles,G.J., Body construction and design, Illiffe Books Butterworth & Co., 1971.
4. Braithwaite,J.B., Vehicle Body building and drawing, Heinemann Educational Books Ltd., London, 1977.
5. Dieler Anselm., The passenger car body, SAE International, 2000

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Understand various category of vehicle frames
2. Understand various types of vehicle body construction
3. Familiarize various aero dynamic styles of vehicle body

U13 AUT 703 - SPECIAL PURPOSE VEHICLES

L	T	P	C
3	0	0	3

OBJECTIVES

At the end of the course, the students will be able to understand the various Off road vehicle and their systems and feature.

CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES 6 hrs

Construction layout, capacity and applications. Power Plants, Chassis and Transmission, Multiaxle vehicles.

EARTH MOVING MACHINES 10hrs

Earthmovers like dumpers, loaders - single bucket, Multi bucket and rotary types - bulldozers, excavators, backhoe loaders, scrappers, drag and self powered types, Bush cutters, stumpers, tree dozer, rippers etc. – Power and capacity of earth moving machines.

SCRAPPERS ,GRADERS, SHOVELS AND DITCHERS 10hrs

Scrappers, elevating graders, motor graders, self powered scrappers and graders, Power shovel, revolving and stripper shovels – drag lines – ditchers – capacity of shovels.

FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES 8hrs

Power take off, special implements. Special features and constructional details of tankers, gun carriers and transport vehicles.

VEHICLE SYSTEMS ,FEATURES 11hrs

Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders. Power steering system. Kinematics for loader and bulldozer operational linkages. Safety features, safe warning system for dumper. Design aspects on dumper body, loader bucket and water tank of sprinkler.

L: 45 T: 0 Total 45 Hrs

Reference book

1. Robert L Peurifoy, “Construction, planning, equipment and methods” Tata McGrawel Hill Publishing company Ltd.
2. Nakra C.P., “Farm machines and equipments” Dhanparai Publishing company Pvt. Ltd
3. Abrosimov.K. Bran berg.A and Katayer.K., Road making machinery, MIR Publishers, Moscow, 1971..
4. SAE Handboob Vol. III. Wong.J.T., Theory of Ground Vehicles”, John Wiley & Sons, New York, 1987.
5. Off the road wheeled and combined traction devices – Ashgate Publishing Co. Ltd. 1988.
6. Schulz Erich.J, Diesel equipment I & II, Mcgraw Hill company, London.
7. Bart H Vanderveen, Tanks and Transport vehicles, Frederic Warne and Co Ltd., London.
8. Satyanarayana. B., Construction planning and equipment, standard publishers and distributors, New Delhi.

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Understand special type of vehicles based on the need and purpose.
2. Understand the working of power take off shaft
3. Understand various types of wheels for off road vehicles

U13 GS*T* 008 - PROFESSIONAL ETHICS

L	T	P	C
3	0	0	3

OBJECTIVES

- To create an awareness on Engineering Ethics and its use in ones profession
- To instill moral values, social values and loyalty
- To provide an insight into ones professional rights and a view of professional ethics in the global context

ENGINEERING ETHICS AND THEORIES 9 hrs

Definition, Moral issues, Types of inquiry, Morality and issues of morality, Kohlberg and Gilligan's theories, consensus and controversy, Professional and professionalism, moral reasoning and ethical theories, virtues, professional responsibility, integrity, self respect, duty ethics, ethical rights, self interest, egos, moral obligations.

SOCIAL ETHICS AND ENGINEERING AS SOCIAL EXPERIMENTATION 9 hrs

Engineering as social experimentation, codes of ethics, Legal aspects of social ethics, the challenger case study, Engineers duty to society and environment.

SAFETY 9 hrs

Safety and risk – assessment of safety and risk – risk benefit analysis and reducing risk – the Three Mile Island and Chernobyl case studies. Bhopal gas tragedy.

RESPONSIBILITIES AND RIGHTS OF ENGINEERS 9 hrs

Collegiality and loyalty – respect for authority – collective bargaining – confidentiality – conflicts of interest – occupational crime – professional rights – employee rights – Intellectual Property Rights (IPR) – discrimination.

GLOBAL ISSUES AND ENGINEERS AS MANAGERS, CONSULTANTS AND LEADERS 9 hrs

Multinational Corporations – Environmental ethics – computer ethics – weapons development – engineers as managers – consulting engineers – engineers as expert witnesses and advisors – moral leadership – Engineers as trend setters for global values.

L: 45 T: 0 Total 45 Hrs

Reference books

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering". (2005) McGraw-Hill, New York.
2. John R. Boatright, "Ethics and the Conduct of Business", (2003) Pearson Education, New Delhi.
3. Bhaskar S. "Professional Ethics and Human Values", (2005) Anuradha Agencies, Chennai.
4. Charles D. Fleddermann, "Engineering Ethics", 2004 (Indian Reprint) Pearson Education / Prentice Hall, New Jersey.
5. Charles E. Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and cases", 2000 (Indian Reprint now available) Wadsworth Thompson Learning, United States.

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. CO1 - Understand the ethical theories and concepts
2. CO2 - Understanding an engineer's work in the context of its impact on society
3. CO3 - Understand and analyze the concepts of safety and risk
4. CO4 - Understand the professional responsibilities and rights of Engineers
5. CO5 - Understand the concepts of ethics in the global context

U13 AU*P* 701 - VEHICLE DYNAMICS LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES

To study of various dynamic behavior of road vehicles under various loading conditions as well as computer simulation of the same.

List of Experiments:

1. Study on automotive systems simulation
2. Simulation and analysis of Rigid Axle Suspension system
3. Simulation and analysis of Independent Suspension system
4. Simulation and analysis of hydraulic brake system
5. Simulation and analysis of air brake system
6. Simulation of steady state cornering characteristics of vehicle
7. Modeling of tires and analysis of cornering characteristics
8. Roll stability and Rollover threshold analysis
9. Simulation of a half car model for pitch and bounce
10. Simulation of Quarter car model for sprung mass response for road inputs

Total : 45 Hrs

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Analyze the Dynamic modeling and simulations of road vehicles and their subsystems.

U13 AU*P* 702 – VEHICLE MAINTENANCE & RECONDITIONING LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES

To provide training to the Students to know about the trouble shooting and Maintenance of Automotive vehicles.

List of Experiments:

1. Study and layout of an automobile repair, service and maintenance shop.
2. Study and preparation of different statements/records required for the repair and maintenance works.
3. Minor and Major Tuning of Diesel and Petrol Engines and Fault diagnosis.
4. Fault Diagnosis of Ignition, Starting and Charging System.
5. Fault Diagnosis of Lighting System, Horn & Wiper and Head Lights- Beam alignment
6. (i)Hand Brake, Brake, Clutch and Steering Wheel Play Adjustment.
   (ii)Study of Steering gearbox trouble shooting and maintenance
7. (i)Brake system(Air, Hydraulic, Mechanical) trouble shooting and Maintenance
   (ii)Bleeding of Hydraulic Brake System
8. Wheel maintenance and Removal, fitting of tire and tube and checking wheel balance
9. Wheel alignment – Testing of camber, caster, kingpin inclination, toe-in and toe-out
10. (i) Study of suspension system trouble shooting and maintenance.
    (ii) Study of door lock and window glass rising mechanisms.
11. Cylinder reboring - Crankshaft balancing & grinding.
12. Valve grinding, valve lapping. Setting the valve angle and checking for valve leakage

TOTAL: 45Hrs

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Identify the faults and knowledge on maintenance
2. Understand the Engine Trouble shooting and Maintenance

U13 AU*P* 703 – PROJECT PHASE – I

L	T	P	C
0	0	4	2

OBJECTIVES:

To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.

GUIDELINES:

1. The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor.
2. A Project topic must be selected either from published lists or the students themselves may propose suitable topics in consultation with their guides. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.
3. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.
4. A project report is required at the end of the semester.
5. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 45Hrs

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Execute the project based on the design developed during Phase I
2. Prepare a report based on their project identified.

U13 GH*P* 701 – HUMAN EXCELLENCE - GLOBAL VALUES

L	T	P	C
1	0	1	1

Global brotherhood and protect globe **5 Hours**

Global values – understanding and identification – its importance - Racial discrimination and solution

Man is the Cause and Man is the Solution **5 Hours**

Ecological imbalance – global warming – rain fall – status – acid rain – plastic usage – control - Political upheavals – nowadays political status – basic rights to citizen – corruption – youths participate in politics –e.g: M.K.Stalin – Kanimozhi – ragul Gandhi.

Greatness of Culture **5 Hours**

Social inequality and solution– live case discussions and debate – black money – poverty people - Cultural degradation– live case discussions and debate – difference between Indian culture & western culture – impact of western culture in India – how to retain our culture and solution.

Emergence of monoculture **4 Hours**

Emergence of monoculture – solution - Global terrorism – it's cause and effect – solution

Marginalization of Global Economic **4 Hours**

Economic marginalization and solution – it's impact in the globe – globalization in market – its effect in local market – merits – demerits of globalization - Man is the cause and man is the solution.

Meditation & Yogasanas **7 Hours**
Nithyananda Meditation & Divine Meditation
Yogasanas - III

TOTAL: 30Hrs

U13 AU*A* 701 - ELECTRONIC ENGINE MANAGEMENT SYSTEMS

L	T	P	C
1	0	0	1

OBJECTIVES:

To give an overview of engine management systems and the various control techniques involved.

- An overview of Engine Management System
- Current trends in automotive electronic engine management system
- Control of SI & CI engines for better performance and low emissions
- Closed loop control of engine parameters of fuel injection and ignition.
- Digital control techniques – Dwell angle calculation, Ignition timing calculation and Injection duration calculation.
- Electronics emission control techniques

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Familiarize the importance of ECU for better performance of engines.

Total : 15 Hrs

SEMESTER 8

U13 AU*P* 801 – PROJECT PHASE – II

L	T	P	C
0	0	24	9

OBJECTIVES:

To train the students in preparing project reports and to face reviews and viva voce examination.

GUIDELINES:

1. The progress of the project is evaluated based on a minimum of three reviews.
2. The review committee may be constituted by the Head of the Department.
3. A project and project reports are required at the end of the semester.
4. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

TOTAL: 45Hrs

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. Take up industrial design and fabrication projects.
2. Create innovative ideas to solve real time engineering problems.

Group 1

Design & Thermal

U13 AU*T* E11 - AUTOMOTIVE AERODYANAMICS

L	T	P	C
3	0	0	3

OBJECTIVES

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

INTRODUCTION **9hrs**

Scope, historical developments, fundamental of fluid mechanics, flow phenomenon related to vehicles, external and Internal flow problem, resistance to vehicle motion, performance, fuel consumption and performance potential of vehicle aerodynamics, engine cooling requirement, air flow to passenger compartment, duct for air conditioning, cooling of transverse engine and rear engine.

AERODYNAMIC DRAG OF CARS **9 hrs**

Cars as a bluff body, flow field around car, drag force, types of drag force, analysis of aerodynamic drag, drag coefficient of cars, strategies for aerodynamic development, low drag profiles.

SHAPE OPTIMIZATION OF CARS **9 hrs**

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 **9 hrs**

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

WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS **9 hrs**

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.

L: 45 T: 0 **Total 45 Hrs**

Reference book

1. Hucho.W.H. - “Aerodynamic of Road Vehicles” - Butterworths Co., Ltd., - 1997.
2. Pope - “Wind Tunnel Testing “ - John Wiley & Sons - 2nd Edition, New York - 1974.
3. Automotive Aerodynamic: Update SP-706 - SAE – 1987
4. Vehicle Aerodynamics - SP-1145 - SAE – 1996.

U13 AU*T* E12 - VEHICLE CONCEPT DESIGN AND STYLING

L	T	P	C
3	0	0	3

INTRODUCTION **9 hrs**

Drawing in product design, drawing by hand, drawing by computer, mass production, geometric versus naturalistic drawing, modernist design. Basic drawing skills - Perspectives, metric projections, spherical projections, orthographic projections, sections and scrap views. Tools and materials - Pencils, pens, erasers, markers, paints, ink, airbrush, drawing instruments, paper and aboard.

COMPUTER SYSTEMS **9 hrs**

The computer processor, system software, the central processing unit, memory, frame buffers, display, input devices, hardcopy output, 3D output devices, networking, health and safety. Concept design - Satisfying the client, sketch, schematic, evaluating the design, 3D modelling concepts, hybrid approach, commercial computer solutions, drawing in space, creating organic forms.

PRESENTATION DRAWING AND VISUALS **9 hrs**

From watercolour washes to markers, painting by numbers, the art of design, visual tricks, making marker drawing, 2D computer programs: paint and vector, 3D computer aided styling (CAS), creating virtual reality, shading a computer model, ray tracing and radiosity, adding texture, fractals and commercial modelers.

FROM GENERAL ARRANGEMENTS DRAWING TO PRODUCTION **9 hrs**

Technical production documentation, the general arrangement drawing, drafting standards, computer aided drafting, geometric constructions, controlling curves, parametric design, CAD data - Exchange standards and all change in the CAD market.

TECHNICAL ILLUSTRATION **9 hrs**

Art of technical illustration, techniques of technical illustration, thick and thin lines, sections, cutaways and ghosting, photo-tracing, annotation and labeling, computer aided illustration, interactive technical illustration and commercial solutions.

L: 45 T: 0 **Total 45 Hrs**

Reference Book

1. Alan Pipes, “Drawing for Designers”, Laurence King Publishing, 2007
2. Erik Olofsson, Klara Sjölén, “Design Sketching”, Keeos Design Books AB, 2005
3. Tony Lewin, Ryan Borroff, “How to Design Cars Like a Pro”, MotorBooks International, 2010.
4. Stuart Macey, Geoff Wardle, Ralph Gilles, Freeman Thomas, Gordon Murray , “H-Point: The Fundamentals of Car Design & Packaging”, Design Studio Press, 2009
5. Thom Taylor, “How to Draw Cars Like a Pro”, MotorBooks International, 2006

U13 AU*T* E13 -COMPUTATIONAL FLUID DYNAMICS

L	T	P	C
3	0	0	3

OBJECTIVES

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

INTRODUCTION **8 hrs**

Application areas of CFD, Basic concepts of fluid flow - Governing equations, conservation of mass, momentum and energy – Navier-stokes and energy equation for Newtonian fluid, Mathematical classification of flow - Hyperbolic, parabolic, elliptic and mixed flow types.

DISCRETISATION **13 hrs**

Finite difference method - Forward, backward and central difference schemes, explicit and implicit methods - Numerical solution for heat transfer and fluid flow problems for steady state and transient conditions, stability analysis and error estimation. Grid generation - Choice of grid, grid oriented velocity components, cartesian velocity components, staggered and collocated arrangements.

CFD TECHNIQUES **9 hrs**

Lax - Wendroff technique, MacCormack's technique, relaxation technique. ADI technique, pressure correction technique, SIMPLE algorithm. Fluid flow and convection problems - Upwind scheme and stability criteria.

TURBULENCE MODELING **9 hrs**

Turbulence energy equation - One-equation model, k-ω model and k- ε model.

CASE STUDIES **5hrs**

Modelling and analysis of heat transfer, fluid flow and automobile components using CFD packages

L: 45 T: 0 **Total 45 Hrs**

Reference Books

1. John D Anderson, " Computational Fluid Dynamics – The Basics with Applications", McGraw Hill, New York, 1995.
2. Muralidhar K and Sundararajan T, "Computational Fluid Flow and Heat Transfer", Narosa Publications, New Delhi, 2003.
3. Chung T.J, "Computational Fluid Dynamics", Cambridge University Press, London, 2002.
4. David C Wilcox, "Turbulence Modeling for CFD", DCW Industries, Inc, 1993.
5. Versteeg H.K and Malalasekara W, "An Introduction to Computational Fluid Dynamics - The Finite Volume Method', Longman, 1995.

U13 AU*T* E14 - DESIGN FOR MANUFACTURE AND ASSEMBLY

L	T	P	C
3	0	0	3

DFM APPROACH, SELECTION AND SUBSTITUTION OF MATERIALS IN INDUSTRY **9 hrs**

DFM approach, DFM guidelines, standardisation, group technology, value engineering, comparison of materials on cost basis.

GEOMETRIC DIMENSIONING & TOLERANCE INTRODUCTION **9 hrs**

Process capability, process capability metrics, Cp, Cpk , cost aspects, feature tolerances, geometric tolerances, surface finish, review of relationship between attainable tolerance grades and different machining process, cumulative effect of tolerances, sure fit law, normal law and truncated normal law, 6σ concept.

TOLERANCE CHARTING TECHNIQUE **9 hrs**

Operation sequence for typical shaft type of components, preparation of process drawings for different operations, tolerance worksheets and centrality analysis, examples.

DESIGN FOR MANUFACTURE **9 hrs**

Design features to facilitate machining, datum features - Functional and manufacturing, component design-machining considerations, redesign for manufacture, examples Redesign of castings based on parting line considerations, minimising core requirements, redesigning cast members using weldments, use of welding symbols – Case studies.

SELECTIVE ASSEMBLY **9 hrs**

Interchangeable and selective assembly, deciding the number of groups, Model-I: group tolerances of mating parts equal; Model-II: total and group tolerances of shaft, control of axial play-introducing secondary machining operations, laminated shims, examples

L: 45 T: 0 **Total 45 Hrs**

Reference Books:

1. Harry Peck, "Designing for Manufacture", Pitman Publications, London, 1983.
2. Krulikowski A, “Fundamentals of Geometric Dimensioning and Tolerancing, Delmar Publishers, New York, 1991
3. Spotts M. F, "Dimensioning and Tolerance for Quantity Production", Prentice Hall Inc., New Jersey, 1983.
4. Oliver R Wade, "Tolerance Control in Design and Manufacturing", Industrial Press Inc., New York, 1967.
5. James G Bralla, "Hand Book of Product Design for Manufacturing", McGraw Hill Publications, 1983.
6. Trucks H E, "Design for Economic Production", Society of Manufacturing Engineers, Michigan, 1987.
7. Creveling C. M, "Tolerance Design - A Hand Book for Developing Optimal Specifications", Addison Wesley Longman Inc.,USA, 1997.
8. Pahl.G and Beitz .W, "Engineering Design-Systematic Approach", Springer Verlag Publications, 1996.

U13 AU*T* E15 –NOISE, VIBRATION AND HARSHNESS

L	T	P	C
3	0	0	3

OBJECTIVE

This course reviews the fundamental concepts of acoustics, noise propagation and vibrations. Focus is given to the theory and equipment pertaining to the measurement of automotive acoustics, sound quality and vibration

FUNDAMENTALS OF ACCOUSTICS, NOISE AND VIBRATION 8 hrs

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

EFFECT OF NOISE, BLAST, VIBRATION AND SHOCK ON PEPOLE 7 hrs

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

TRANSPORTATION NOISE AND VIBRATION – SOURCES, PREDICTION AND CONTROL 10 hrs

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

INTERIOR TRANSPORTATION NOISE AND VIBRATION – PREDICTION AND CONTROL 10 hrs

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

NOISE AND VIBRATION TRANSDUCERS, ANALYSIS EQUIPMENT, SIGNAL PROCESSING AND MEASURING TECHNIQUES. 10 hrs

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

L: 45 T: 0 Total 45 Hrs

Reference

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

U13 AU*T* E16 – COMBUSTION ENGINEERING	L	T	P	C
	3	0	0	3

OBJECTIVES

- To provide information on various types of fuels, their property and characterization.
- To understand the thermodynamics and kinectics of combustion.
- To understand and analyze the combustion of various fuels.

INTRODUCTION — **9 hrs**

Historical perspective of combustion science – perspective of fuels and combustion technology. Types and general characteristics of fuels – proximate and ultimate analysis of fuels. ROM, DMMF, DAF and bone dry basis. Moisture and heating value determination – gross and net hearting values – claorimetry, DuLong's formula for HV estimation, Flue gas analysis – Orsat apparatus.

THERMODYNAMICS AND KINETICS OF COMBUSTION — **9 hrs**

Properties of mixture – combustion stoichiometry – chemical energy – chemical equilibrium and criteria – properties of combustion products. First law combustion calculations – adiabatic flame temperature (analytical and graphical methods) – simple second law analysis. Elementary reactions – chain reactions – pre-ignition kinetics – global reactions – kinectics – reaction at solid surface.

COMBUSTION OF SOLID FUELS — **9 hrs**

Drying - devolatilization - char combustion. Fixed bed combustion - suspension burning - fluidized bed combustion. Briquetting of Bio mass.

COMBUSTION OF LIQUID FUELS — **9 hrs**

Spray formation and droplet behaviour - oil fired furnace combustion - gas turbine spray combustion – direct and indirect Injection combustion in IC engines.

COMBUSTION OF GASEOUS FUELS — **9 hrs**

Energy balance and furnace efficiency – gas burner types - pulse combustion furnace. Premixed charge engine combustion. Detonation of gaseous mixtures.

L:	**45**	**T:**	**0**	**Total**	**45 Hrs**

Reference Book

1. Kuo, K.K., Principles of Combustion, 2nd Edition, John Wiley and Sons, Inc., 2005.
2. Annamalai, K and Puri, I.K, Combustion science and Engineering, CRC Press, 2007
3. Borman, G.L. and Ragland, K.W., Combustion Enginnering, McGrawHill International Editions, 1998.
4. Samir Sarkar, Fuels and Combustion, 2nd Edition, Orient Longman, 1990
5. Sharma SP and Mohan Chander, Fuels and Combustion, Tata Mcgraw Hill, 1984.
6. Bhatt, B.I and Vora, S.M., Stoichiometry, 2nd Edition, Tata Mcgraw Hill, 1996
7. Clive Davis, Calculations in Furnace Technology, Pergamon Press, Oxford, 1970.

U13 AU*T* E17 -ALTERNATE FUELS AND ENERGY SYSTEMS	L	T	P	C
	3	0	0	3

OBJECTIVES

At the end of the course, the student will be able to acquire knowledge of alternate fuels and the changes in the engine design for handling them and understand various energy systems for use in the automobiles.

ALCOHOLS AS FUELS — **10 hrs**

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

VEGETABLE OILS AS FUELS — **10 hrs**

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

HYDROGEN AS ENGINE FUEL — **9 hrs**

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

BIOGAS, NATURAL GAS AND LPG AS FUELS — **8 hrs**

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

ELECTRIC, HYBRID AND FUEL CELL VEHICLES — **8 hrs**

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

L:	**45**	**T:**	**0**	**Total**	**45 Hrs**

Reference Book

1. Ayhan Demirbas, **Biodiesel A Realistic Fuel Alternative for Diesel Engines',** Springer-Verlag London Limited 2008,ISBN-13: 9781846289941
2. Gerhard Knothe, Jon Van Gerpen, Jargon Krahl, **The Biodiesel Handbook,** AOCS Press Champaign, Illinois 2005.
3. Richard L Bechtold P.E., **Alternative Fuels Guide book,** Society of Automotive Engineers, 1997 ISBN 0-76-80-0052-1.
4. Transactions of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc..)
5. Science direct Journals (**Biomass & Bio energy, Fuels, Energy, Energy conversion Management, Hydrogen Energy**, etc.) on biofuels.
6. Devaradjane. Dr. G., Kumaresan. Dr. M., "Automobile Engineering", AMK Publishers, 2013.

U13 AU*T* E18 - COMPUTER SIMULATION OF IC ENGINE PROCESSES

L	T	P	C
3	0	0	3

OBJECTIVE:

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

INTRODUCTION **9 hrs**

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

COMBUSTION AND STOICHIOMETERY **9 hrs**

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

ADIABATIC FLAME TEMPERATURE **9 hrs**

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

SIMULATION OF IC ENGINES **9 hrs**

SI and CI engine simulation – Air standard cycle, fuel-air cycle, progressive combustion cycle and actual cycle simulation – Part throttle, full throttle and supercharged conditions

SIMULATION OF NEW ENGINE CONCEPT **9 hrs**

Dual fuel engine, **l**ow heat rejection engine, lean burn engine, variable compression ratio engine, homogeneously charged compression ignition engine and controlled auto ignition engine.

L: 45 T: 0 **Total: 45 Hrs.**

Reference Book

1. Ganesan,V., Computer Simulation of spark ignition engine process, Universities Press (I) Ltd., Hyderabad, 1996.
2. Ganesan V, “Computer Simulation of Compression-Ignition Engine Processes”, University Press (I) Ltd, Hyderabad, 2000
3. Ramoss,A.L., Modelling of Internal Combustion Engines Processes, McGraw Hill Publishing Co., 1992.
4. Ashley Campbel, Thermodynamics analysis of combustion engines, John Wiley & Sons, New York, 1986.
5. Benson,R.S., Whitehouse,N.D., Internal Combustion Engines, Pergamon Press, Oxford, 1979.

U13 AU*T* E19 – ADVANCED THEORY OF I.C. ENGINES

L	T	P	C
3	0	0	3

COMBUSTION PROCESSES **10hrs**

Combustion in premixed and diffusion flames, combustion process in IC engines, adiabatic flame temperature, effect of super charging and scavenging on combustion.

ABNORMAL COMBUSTION IN SI ENGINES **10hrs**

Stages of combustion, flame propagation, rate of pressure rise, cycle-to-cycle variation, abnormal combustion, theories of detonation, heat release.

COMBUSTION AND KNOCK IN CI ENGINES **10hrs**

Droplet and spray combustion theory, stages of combustion, delay period, peak pressure, heat release, gas temperature, diesel knock.

COMBUSTION OF FUELS **10hrs**

Combustion stoichiometry of petrol, diesel, alcohol and hydrogen fuels, chemical energy and heating values, chemical equilibrium and maximum temperature, flame velocity and area of flame front, fuel spray characteristics - Droplet size, penetration and atomization.

ADVANCED IC ENGINES **5hrs**

Adiabatic and low heat rejection engines, homogeneously charged compression ignition engines - MAN combustion chamber and multi-fuel engines, stratified charged and lean burn engines.

L: 45 T: 0 **Total 45 Hrs**

Reference Books:

1. Heywood J B, “Internal Combustion Engine Fundamentals” McGraw Hill Book Co., USA, 1988.
2. Ganesan V. “Internal Combustion Engines", Tata Mc-graw Hill Publishing Co. Ltd., New Delhi 2008.
3. Lewis B, Pease.R.N. and Taylor.H.S., "Combustion Process High Speed Gas dynamics and Jet Propulsion Series", Princeton University Press, New Jersey, 1976.
4. Taylor E.F, “The Internal Combustion Engines", International Book Co., Pennsylvania, 1982.
5. Spalding D.B, “Some Fundamental of Combustion", Butterworth Science Publications, London, 1985.
6. Ganesan V, “Computer Simulation of Spark Ignition Engine Processes", Universities Press (India) Ltd, Hyderabad, 1996.
7. Ganesan V, “Computer Simulation of Compression Ignition Engine Processes", Universities Press (India) Ltd, Hyderabad, 2000.

Group 2

Technology & Manufacturing

U13 AU*T* E21 - HYDRAULICS AND PNEUMATICS SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES

This course will give an appreciation of the fundamental principles, design and operation of hydraulic and pneumatic machines, components and systems and their application in recent automation revolution.

INTRODUCTION TO FLUID POWER & PRINCIPLE 9 hrs

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

FLUID POWER DRIVES 12hrs

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

FLUID POWER ELEMENTS 12hrs

Control valves- pressure, flow direction- working principles and construction- Special type valves- cartridge, modular, proportional and servo- Selection and actuation methods.

Actuators- Selection and specification, cylinders- mounting, cushioning, pipe fittings- Fluid conditioning elements- Accumulators. Case study related to automotive application.

HYDRAULICS AND PNEUMATICS CIRCUITS DESIGN 9hrs

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

AUTOMOTIVE APPLICATIONS 6hrs

Use of electrical timers, switches, solenoid, relay, proximity sensors etc. Electro pneumatic

sequencing Ladder diagram- PLC: – elements, function and selection- PLC programming-

Ladder and different programming methods- Sequencing circuits. Case study related to automotive application.

L: 45 T: 0 Total 45 Hrs

Reference book

1. Anthony Esposito, “Fluid power with applications” , 5th Edition, Pearson Education 2003.
2. Majumdar, “ Oil Hydraulics: Principles and Maintenance”, Tata McGraw Hill, 2004
3. Majumdar, “Pneumatic system: Prinicples and maintenance”, Tata McGraw Hill,2004
4. Andrew Parr, “ Hydraulics & Pneumatics” Jaico Publishing House,2004
5. William W.Reaves, “Technology of Fluid Power”, Delmer Publishers,1997
6. Shanmugasundaram.K, “Hydraulic and Pneumatic controls”, Chand & Co, 2006.
7. Peter Rohner,” Fluid Power Logic circuit Design” MacMillion Press Ltd., 1990.
8. Micheal J, Pinches and Ashby, J.G., “Power Hydraulics”, Prentice Hall, 1989.
9. Dudelyt, A Pease and John J Pippenger, “Basic Fluid Power”, Prentice Hall, 1987.

U13 AU*T* E22 - AUTOMOTIVE AIR-CONDITIONING

L	T	P	C
3	0	0	3

OBJECTIVES

At the end of the course, the students will be able to understand the components of the automotive air-conditioning and their functions and the latest developments in this field.

AUTOMOTIVE AIRCONDITIONING FUNDAMENTALS 9 hrs

Air conditioning system - Schematic layout, compressor, condenser, expansion valve, evaporator, controlling evaporator temperature, evaporator pressure regulator, evaporator temperature regulator.

PSYCHROMETRY 9 hrs

Moist air behaviour, psychrometric chart, psychrometric processes - Summer and winter airconditioning, cooling load calculations.

REFRIGERANT 9 hrs

Properties of refrigerants, common refrigerants, containers, handling refrigerants, tapping into the refrigerant container, ambient conditions affecting air conditioning system, refrigeration system diagnostics

AIR ROUTING & TEMPERATURE CONTROL 9 hrs

Objectives – Evaporator case air flow through the Dash recirculating unit – Automatic temperature control – Ducting system in Passenger car and Bus– Controlling flow – Vacuum reserve – Testing the air control and handling systems- Load calculations - Psychrometry

AIR CONDITIONING 9 hrs

Automotive heaters - Heater system, manually and automatically controlled air conditioner, air conditioning in cars, busses, trucks, location, working and maintenance

L: 45 T: 0 Total 45 Hrs

Reference book

1. Boyce H Dwiggins, "Automotive Air conditioning", Cengage Learning, Stamford, 2002.
2. Arora C.P, “Refrigeration & Air conditioning” Tata McGraw Hill, New Delhi 2000
3. William H Crouse and Donald L Anglin, Automotive Air conditioning, McGraw Hill Inc., 1990..
4. Mitchell Information Services, Inc., Mitchell Automatic Heating and Air Conditioning Systems, Prentice Hall Inc., 1989
5. Steven Daly “Automotive Air Conditioning and climate control systems”, Butterworth Heinemann, Burlington, 2011
6. Russel Carrigan, John Eichelberer, “Automotive Technology Heating and Air Conditioning”,Cengage Learning, Stamford, 2011.
7. Mark Schnubel, “Automotive Engineering Heating & Air Conditioning”, Cengage Learning, Stamford, 2010.

U13 AU*T* E23 - MODERN AUTOMOBILE ACCESSORIES

L	T	P	C
3	0	0	3

OBJECTIVES

At the end of the course, the students will be able to apply and introduce the modern developments in vehicle technology with their advancements, comfort, and security. etc.,

ENGINE MANAGEMENT SYSTEMS **9hrs**

Electronically controlled SI and CI engine fuel injection systems, related hardware and software. Closed loop ignition system. Catalytic converters and particulate traps.

CHASSIS **9 hrs**

Active suspension control, Pneumatic suspensions, Power train monitoring, safety views-Modern development in Chassis management of vehicles.

HEATING AND AIR CONDITIONING **9 hrs**

Principles of vehicle air conditioning and heating-Automatic climate control system-Modern trends in thermal management of vehicles-Influence of Electronics in thermal management of vehicles.

COMFORT AND CONVENIENCE **9 hrs**

Adaptive cruise control, car entertainment, power windows, navigation system, adaptive noise control, electric seats, driver information system. Power windows, power steering.

SAFETY AND SECURITY SYSTEMS **9 hrs**

Airbags, seat belt tightening system, collapsible and tiltable steering column, Anti-theft system, anti-lock braking system, electronic stability control system/traction control system, roll over protection system.

L: 45 T: 0 **Total 45 Hrs**

Reference book

1. Tom Denton - "Automobile Electrical and Electronic Systems" - Edward Arnold, London - 1995.
2. Eric Chowanietz - 'Automotive Electronics' - SAE International USA - 1995.
3. Bosch Automotive Hand Book - 5th Edition - SAE Publication, USA - 2000.

U13 AU*T* E24 - AUTOMOTIVE COMPONENT MANUFACTURING

L	T	P	C
3	0	0	3

ENGINE COMPONENTS **10hrs**

Casting of engine block - conventional and expendable pattern, machining of engine blocks in machining center. Preparation of casting for cylinder heads, forging of crank shaft, connecting rod and gudgeon pins, machining and heat treatment, casting of piston by gravity casting, squeeze casting, machining and finishing, upset forging of valves, heat treatment and surface improvement, cylinder liners and piston ring manufacturing. Engine bearing manufacturing.

TRANSMISSION COMPONENTS-I **8 hrs**

Manufacturing of friction plates using conventional blanking and fine blanking. Manufacture of composite friction lining, composite moulding of phenol formaldehyde lining. Casting of gear box casing, precision forging of gears, gear hobbing, shaping, powder metallurgy, orbital forming of spur, helical, and bevel gears, hypoid gears, heat treatment and finishing.

TRANSMISSION COMPONENTS-II **8 hrs**

Continuous casting of propeller shaft, extrusion of propeller shaft, extrusion dies, heat treatment and surface hardening of propeller shaft, composite propeller shaft manufacturing. Forging of rear axles, casting of rear axle casing, wheels, brake drum, tyre manufacturing

BODY COMPONENTS **10hrs**

Introduction, thermoforming and hydro forming, press forming, welding of body panels, resistance welding and other welding processes. Introduction, principle of injection moulding, injection moulding of instrument panel, moulding of bumpers, reinforced reaction injection moluding, tooling and tooling requirements, manufacture of metal/polymer/metal panels. Adhesives and sealants, leaf spring manufacturing, composite leaf springs, wrap forming of coil springs.

SURFACE COATINGS AND ELECTRICAL COMPONENTS: **9 hrs**

Chemical vapour deposition, physical vapour deposition, sol-gel processing, spraying, plating, paining in paint booth.

Starter motor, alternator, regulator, battery, lamps, control switches, electronic gauges.

L: 45 T: 0 **Total 45 Hrs**

Text Book

1. Philip F. Ostwald & Jairo Munuz, “Manufacturing Processes and Systems”, John Wiley & Sons, New York, 1998.
2. Degarmo E.P., “Materials and process in Manufacturing”, Macmillan Publishing Co., 1997.
3. Heldt P.M., “High Speed Combustion Engines”, Oxford IBH publishing Co., Calcutta, 1996.
4. Kalpakjian, “Manufacturing and Engineering and Technology”, Addison Wesloy, Publishing Company, 1995.
5. Sanjay K Mazumdar, “Composites Manufacturing”, CRC Press, NY, 2003.

U13 AU*T* E25 - DESIGN OF JIGS FIXTURES AND PRESS TOOLS

L	T	P	C
3	0	0	3

(Approved Design Data Book is Permitted)

OBJECTIVES

- To understand the principles, functions and design practices of Jigs, Fixtures and dies for press working
- To understand the Principles of jigs and fixtures design, locating principles, locating elements and clamping Devices.

PURPOSE TYPES AND FUNCTIONS OF JIGS AND FIXTURES 8hrs

Tool design objectives - Production devices - Inspection devices - Materials used in Jigs and Fixtures – Types of Jigs - Types of Fixtures-Mechanical actuation-pneumatic and hydraulic
actuation-Analysis of clamping force-Tolerance and error analysis.

JIGS 9hrs

Drill bushes –different types of jigs-plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-Automatic drill jigs-Rack and pinion operated. Air operated Jigs components. Design and development of Jigs for given components.

FIXTURES 9 hrs

General principles of boring, lathe, milling and broaching fixtures- Grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures- Modular fixtures. Design and development of fixtures for given component

PRESS WORKING TERMINOLOGIES AND ELEMENTS OF DIES AND STRIP LAY OUT 10hrs

Press working terminology-Presses and press accessories-Computation of capacities and tonnage requirements. Elements of progressive combination and compound dies: Die block-die shoe. Bolster plate-punch plate-punch holder-guide pins and bushes – strippers – knockouts-stops –pilots-Selection f standard die sets strip lay out-strip lay out calculations

DESIGN AND DEVELOPMENT OF DIES 9hrs

Design and development of progressive and compound dies for Blanking and piercing operations. Bending dies – development of bending dies-forming and drawing dies-Development of drawing dies. Design considerations in forging, extrusion, casting and plastic dies.

L: 45 T: 0 Total 45 Hrs

Reference Books:

1. Edward G Hoffman, Jigs & Fixture Design, Thomson – Delmar Learning, Singapore 2004
2. Donaldson. C, Tool Design, Tata McGraw-Hill, 1986
3. Kempster, “Jigs & Fixtures Design, The English Language Book Society”, 1978
4. Joshi, P.H., “Jigs & Fixtures, Second Edition”, Tata McGraw-Hill Publishing Company Limited, New Delhi 2004
5. Hiram E Grant, ‘ Jigs and Fixture’ Tata McGraw-Hill, New Delhi, 2003
6. Fundamentals of Tool Design, CEEE Edition, ASTME, 1983
7. PSG College of Technology, Coimbatore - Design Data Handbook.

U13 AU*T* E26 - ROBOTICS

L	T	P	C
3	0	0	3

OBJECTIVES

- At the end of the course, the students will be able to understand about the basics of robots.
- Understanding the usage of Robots in Automotive Industries

FUNDAMENTALS OF ROBOT **7hrs**

Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Their Functions – Need for Robots – Different Applications

ROBOT DRIVE SYSTEMS AND END EFFECTORS **10hrs**

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of all these Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations

SENSORS AND MACHINE VISION **10hrs**

Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, (Binary Sensors, Analog Sensors),Wrist Sensors, Compliance Sensors, Slip Sensors

Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms. Applications – Inspection, Identification, Visual Serving and Navigation.

ROBOT KINEMATICS AND ROBOT PROGRAMMING **10hrs**

Forward Kinematics, Inverse Kinematics and Differences –Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – DH matrices - Deviations and Problems.

Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs

IMPLEMENTATION AND ROBOT ECONOMICS **8 hrs**

RGV, AGV; Implementation of Robots in Industries – Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method

L: 45 T: 0 **Total 45 Hrs**

Reference Books

1. M.P.Groover, “Industrial Robotics – Technology, Programming and Applications”, McGraw-Hill, 2001.
2. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw-Hill Book Co., 1987
3. Yoram Koren, “Robotics for Engineers”, McGraw-Hill Book Co., 1992

U13 AU*T* E27 - COMPOSITE MATERIALS AND STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVES

At the end of the course, the students will be able to understand the fabrication, analysis and design of composite materials & structures.

STRESS STRAIN RELATION **6hrs**

Introduction- Advantages and application of composite materials, reinforcements and matrices – Generalized Hooke's Law – Elastic constants for anisotropic, orthotropic and isotropic materials.

METHODS OF ANALYSIS **12hrs**

Micro mechanics – Mechanics of materials approach, elasticity approach to determine material properties – Macro Mechanics – Stress-strain relations with respect to natural axis, arbitrary axis – Determination of material properties. Experimental characterization of lamina.

LAMINATED PLATES **12hrs**

Governing differential equation for a general laminate, angle ply and cross ply laminates. Failure criteria for composites.

SANDWICH CONSTRUCTIONS **8 hrs**

Basic design concepts of sandwich construction -Materials used for sandwich construction - Failure modes of sandwich panels.

FABRICATION PROCESS **7 hrs**

Various Open and closed mould processes. Manufacture of fibers – Types of resins and properties and applications – Netting analysis.

L: 45 T: 0 **Total 45 Hrs**

Reference Books

1. Calcote, L R. "The Analysis of laminated Composite Structures", Von – Noastrand Reinhold Company, New York 1998.
2. Jones, R.M., "Mechanics of Composite Materials", McGraw-Hill, Kogakusha Ltd., Tokyo, 1985.
3. Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites", John Wiley and sons. Inc., New York, 1995.
4. Lubin, G., "Handbook on Advanced Plastics and Fibre Glass", Von Nostrand Reinhold Co., New York, 1989.

U13 AU*T* E28 – TECHNICAL TEXTILES FOR AUTOMOBILES

L	T	P	C
3	0	0	3

Objective

- To impart knowledge on use of textiles in automotive interior and body.
- Various parts made out of woven and non-woven fabrics in automotive.
- The properties of the textiles which can absorb noise and enhance the performance of vehicle due to textile composite structures etc.

AUTOMOTIVE TEXTILES **9 hrs**

Requirements for automotive textiles, design demands, woven & knitted ,non-woven fabrics used in automotive interiors, Recycling of automotive textiles –Future trends

SMART TEXTILES IN AUTOMOTIVE INTERIORS **9hrs**

Car seats- Types of materials used as cushions. Technology for replacing polyurethane foams in car seats. Smart textiles: definition, textile sensors, textile actuators- heating fabrics for car interior, Shape memory alloys for car seats.

TRANSPORTATION TEXTILES **9hrs**

Materials used in automobiles – tire cord, filter, air bag- future applications , belt, seat cover, acoustic textiles for noise insulation; Design and development of textile reinforced composites in automobile industry

AUTOMOTIVE TEXTILE STRUCTURES & COMPOSITES **9hrs**

2D and 3D textile structures for load bearing applications in automobiles, future trends in applications of textile structures in automobiles, composite structural components

SAFETY APPLICATIONS & FUTURE TRENDS **9 hrs**

Recent developments in fibre/textile reinforcements used in tyres,fibre-rubber adhesion in tyres resent advances in tyre design,

L: 45 T: 0 **Total 45 Hrs**

Reference book

1. R.Shishoo, Textile advances in the automotive industry, Woodhead Publishing Limited, Cambridge, England- 2008

U13 AU*T* E29 – VEHICLE TESTING AND VALIDATION

L	T	P	C
3	0	0	3

MEASUREMENT SYSTEMS **9hrs**

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

TRANSDUCERS, MODIFIERS AND TERMINATING DEVICES **9hrs**

Transducers for Automotive Applications – Amplifiers- filters –data Acquisition-Indicators,

Printers and displays –Signal Analyzing

MECHANICAL MEASUREMENT **9hrs**

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

ENGINE EXPERIMENTAL TECHNIQUES **9hrs**

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

VEHICLE EXPERIMENTAL TECHNIQUES **9hrs**

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

L: 45 T: 0 **Total 45 Hrs**

Reference Book

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

Group 3

Advanced Systems / Automotive Electronics

U13 AU*T* E31 -AUTOMOTIVE SAFETY

L	T	P	C
3	0	0	3

OBJECTIVES

At the end, the student will have good exposure to Automotive safety aspects including safety equipments.

INTRODUCTION **9 hrs**

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

SAFETY CONCEPTS **9 hrs**

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

SAFETY EQUIPMENTS **9 hrs**

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

COLLISION WARNING AND AVOIDANCE **9 hrs**

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

COMFORT AND CONVENIENCE SYSTEM **9 hrs**

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

L: 45 T: 0 **Total 45 Hrs**

Reference books

1. Bosch - “Automotive Handbook” - 5th edition - SAE publication - 2000.
2. Vivek D. “*Ergonomics in the Automotive Design Process”* Bhise publisher CRC press, Taylor and Francis group.
3. 1. Ronald K Jurgen, “Automotive Electronics Handbook” - Second edition- McGraw-Hill Inc., - 1999.
4. Jullian Happian, “Smith An Introduction to Modern Vehicle Design”, SAE, 2002.
5. Johnson W and Mamalis A.G, “Crashworthiness of Vehicles”, MEP, London.
6. Richard Bishop, “Intelligent Vehicle Technology and Trends” – 2005.
7. George A. Peters , Barbara J. Peters, “Automotive Vehicle Safety” – 2002.

U13 AU*T* E32 - M ICROPROCESSOR BASED SYSTEM DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES

- At the end of the course, the students will be able to understand the need of microcontroller 8 bits and 16 bits in a device/ instrument development.
- This course aims in developing the students with adequate knowledge about microprocessors and its importance in Automobile sector.

INTRODUCTION 9hrs

Need for microprocessor based system design – Design cycle – dimensions of the design problem – Hardware design and software design – System integration.

INPUT AND OUTPUT ALGORITHMIC PROCESSES 9 hrs

I/O control – I/O timing – Data buffering with FIFOS – Keyboards and switches – Remote instrument control –Self test hardware. Keyboard parsing – Real time programming – Self test algorithm. Multiplication and division algorithms.

TROUBLESHOOTING SYSTEMS – LOGIC ANALYSERS 9 hrs

Logic state analysers, Logic timing analysers, Display modes, Logic analysers features – Signature analysis, Error detection using signature analysis. Development systems: Basic features – software development aids –Development system architecture – Emulators, system software – Assembler, linker, loader.

8086 /8088 BASED MULTIPROCESSING SYSTEM 9 hrs

Review of Architecture and Instruction Set of 8086 Processor Coprocessor configuration, closely coupled configurations, loosely coupled configurations – 8087 coprocessor: Architecture, Instruction set – 8089 I/O processor.

SYSTEM DESIGN APPLICATIONS 9 hrs

LCR meter – PID controller – DC motor speed control – Digital weighing machine – Temperature control – Controller for a washing machine.

L: 45 T: 0 Total 45 Hrs

Reference Book:

1. John B. Peatman, Microcomputer Based Interfacing, McGraw Hill, 1988.
2. Douglass V. Hall, Microprocessor and Interfacing, McGraw Hill, 1987.
3. Williams, G.B., Troubleshooting on Microprocessor Based Systems, Pergamon Press 1984.
4. Yu-Cheng Liu and Glenn A. Gibson, Microcomputer systems, The 8086/8088 family, Second edition, Prentice Hall of India, 1990.

U13 AU*T* E33 -ELECTRIC AND HYBRID VEHICLES

L	T	P	C
3	0	0	3

OBJECTIVES

To illustrate the electric and hybrid vehicles and their operation and controls

INTRODUCTION TO ELECTRIC VEHICLES 9 hrs

Layout of an electric vehicle, performance of electric vehicles – traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, advantage and limitations, specifications, system components, electronic control system.

HYBRID VEHICLES 8 hrs

Concepts of hybrid electric drive train, types, architecture of series and parallel hybrid electric drive train, merits and demerits, series and parallel hybrid electric drive train design.

ELECTRIC PROPULSION SYSTEMS, GENERATORS, MOTOR CONTROLLERS AND CONTROL SYSTEMS 10hrs

DC motors, AC motors, permanent magnet motors, brushless DC and reluctance motors, characteristics, regenerative braking.

DC generators, AC generators, voltage and frequency regulations.

Control system principles, speed and torque control – DC motors and AC motors.

ENERGY STORAGES 9 hrs

Electromechanical batteries- types of batteries –lead acid batteries, nickel based batteries, lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency, ultracapacitors.

FUEL CELLS & SOLAR CARS 9 hrs

Fuel cell, construction, working, equations, possible fuel sources, fuel reformer, design. Solar cars- photovoltaic cells, tracking, efficiency and cost comparison

L: 45 T: 0 Total 45 Hrs

Text Book

1 Mehrdad Ehsani, Yimin Gao, sebastien E. Gay and Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRS Press, 2004.

2 James Larminie and John Loury, “Electric Vehicle Technology-Explained”, John Wiley & Sons Ltd., 2003.

3 Sandeep Dhameja, “Electric Vehicle Battery Systems”, Butterworth –Heinemann, 2002.

4 Ronald K Jurgen, “Electric and Hybrid – Electric Vehicles”, SAE, 2002.

5 Ron Hodkinson and John Fenton, “Light Weight Electric/Hybrid Vehicle Design”, Butterworth-Heinemann, 2001.

U13 AU*T* E34- INSTRUMENTATION AND CONTROL

L	T	P	C
3	0	0	3

OBJECTIVES

To enable the students to understand the fundamentals of Instrumentation and control available for monitoring/measuring in domestic / industrial applications.

MEASUREMENT OF FORCE, TORQUE AND VELOCITY 9 hrs

Electric balance – different types of load cells – magnets – elastics load cell – strain gauge load cell – different methods of torque measurement Strain gauge, relative regular twist- speed measurement – revolution counter – capacitive tacho – drag up type tacho – D.C and A.C. tacho generators – stroboscope.

MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY 9 hrs

Accelerometers – LVDT, piezo-electric, strain gauge and variable reluctance type accelerometers – mechanical type vibration instruments seismic instruments as an accelerometer and vibrometer – calibration of vibration pick ups – units of density, specific gravity and viscosity used in industries – pressure head type densitometer – float type densitometer – ultrasonic densitometer

MEASUREMENT OF PRESSURE &TEMPERATURE 10hrs

Units of pressure –manometers – different types – elastic type pressure gauges – Bourdon tube bellows –diaphragms – Electrical methods – elastic elements with LVDT and strain gauges – measurement of vacuum – different types- McLeod gauge – testing and calibration of pressure gauges – dead weight tester. Bimetallic thermometers – electrical methods of temperature measurement – RTDs and their - Thermocouples, pyrometers – optical pyrometers – two colour radiation pyrometer.

TRANSFER FUNCTIONS 8 hrs

Definitions, Transfer function – Mathematical modeling of mechanical (translation and rotational), Electrical systems- mechanical-electrical analogies– Block Diagram reduction technique and Signal flow graphs.

RESPONSE AND STABILITY ANALYSIS 9 hrs

Time response of First order & second order systems-concept of stability, necessary condition stability- Routh Stability criterion Polar and Bode plots –Simple Problems.

L: 45 T: 0 Total 45 Hrs

Reference book

1 Ernest O.Doebelin, *Measurement systems Application and Design*, International Student Edition, IV Edition, McGraw-Hill Book Company, 1998.

2 R.K.Jain, *Mechanical and Industrial Measurements*, Khanna Publishers, New Delhi, 1999.

3 Katsuhiko Ogata, *Modern Control Engineering*, 2nd edition, Prentice Hall of India Private Ltd, New Delhi, 1995

U13 AU*T* E35 -FUEL CELLS TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES

To introduce the concept of fuel cells for use in automobiles, analyse the performance characteristics of the various components and compare them with the other powering devices

INTRODUCTION TO FUEL CELLS **9 hrs**

Introduction – working and types of fuel cell – low, medium and high temperature fuel cell, liquid and methanol types, proton exchange membrane fuel cell solid oxide, hydrogen fuel cells – thermodynamics and electrochemical kinetics of fuel cells.

FUEL CELLS FOR AUTOMOTIVE APPLICATIONS **9 hrs**

Fuel cells for automotive applications – technology advances in fuel cell vehicle systems – onboard hydrogen storage – liquid hydrogen and compressed hydrogen – metal hydrides, fuel cell control system – alkaline fuel cell – road map to market.

FUEL CELL COMPONENTS AND THEIR IMPACT ON PERFORMANCE **9 hrs**

Fuel cell performance characteristics – current/voltage, voltage efficiency and power density, ohmic resistance, kinetic performance, mass transfer effects – membrane electrode assembly components, fuel cell stack, bi-polar plate, humidifiers and cooling plates.

FUELING **9hrs**

Hydrogen storage technology – pressure cylinders, liquid hydrogen, metal hydrides, carbon fibers – reformer technology – steam reforming, partial oxidation, auto thermal reforming – CO removal, fuel cell technology based on removal like bio-mass.

FUEL CYCLE ANALYSIS **9hrs**

Introduction to fuel cycle analysis – application to fuel cell and other competing technologies like battery powered vehicles, SI engine fueled by natural gas and hydrogen and hybrid electric vehicle.

L: 45 T: 0 **Total 45 Hrs**

Reference Book

1 Fuel Cells for automotive applications – professional engineering publishing UK. ISBN 1-86058 4233, 2004.

2 Fuel Cell Technology Handbook SAE International Gregor Hoogers CRC Press ISBN 0-8493-0877-1-2003.

U13 AU*T* E36 - PLC AND DATA ACQUISITION SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES

To provide students the fundamentals of PLC and Data acquisition system

On completion of the course the students will be able to

1. Understand the basic of data conversion and data acquisition
2. Understand the fundamental of PLC.

COMPUTER CONTROL-INTRODUCTION 10hrs

Need of computer in a control system-Functional block diagram of a computer control system-Data loggers- Supervisory computer control- Direct digital control-Digital control interfacing-SCADA. (Elementary treatment only).

DATA CONVERTERS 9 hrs

DACs-Basic DAC Techniques-Weighted Resistor, R-2R Ladder and Inverted R-2R ladder type DACs- ADCs – Parallel ADC, Dual slope ADC, Successive Approximation ADC-Comparison of A/D conversion techniques- DAC/ADC specifications - Typical IC's for DAC, ADC – Isolation amplifiers.

DATA ACQUISITION SYSTEMS 10hrs

Sampling theorem – Sampling and digitizing – Aliasing – Sample and hold circuit – Practical implementation of sampling and digitizing – Definition, design and need for data acquisition systems – Interfacing ADC and DAC with Microprocessor / Multiplexer - Multiplexed channel operation –Microprocessor/PC based acquisition systems.

PLC 10hrs

Evolution of PLC's – Sequential and programmable controllers – Architecture-Programming of PLC – Relay logic – Ladder logic – Gates, Flip flops and Timers.

COMMUNICATION IN PLC's 6hrs

Requirement of communication networks of PLC – connecting PLC to computer – Interlocks and alarms – Case study of Tank level control system and Sequential switching of motors.

L: 45 T: 0 Total 45 Hrs

Reference books

1 Petrezeulla, *Programmable Controllers*, McGraw Hill , 1989.
2 Hughes,T., *Programmable Logic Controllers*, ISA Press, 1989.
3 Clayton, G.B., *Data Converters*, The MacMillan Press Ltd., 1982.
4 Curtis D. Johnson., *Process Control Instrumentation Tech*, 8th Edition, Prentice Hall, June 2005.
5 Roy Choudhury. D and Shail B.Jain, *Linear Integrated circuits*, New age International Pvt .Ltd, 2003

U13AU*T* E37 - VIRTUAL INSTRUMENTATION

L	T	P	C
3	0	0	3

INTRODUCTION **9hrs**

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

DATA ACQUISITION IN VI **9hrs**

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

COMMUNICATION NETWORKED MODULES **9hrs**

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

REAL TIME CONTROL IN VI **9hrs**

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

AUTOMOTIVE APPLICATIONS **9hrs**

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

L: 45 T: 0 **Total 45 Hrs**

Reference books:

1. Nadovich, C., “Synthetic Instruments Concepts and Applications”. Elsevier,2005
2. Bitter, R., Mohiuddin, T. and Nawricki, M., “Labview Advanced programming Techniques”, CRC Press, 2nd Edition, 2007.
3. Gupta, S. and Gupta J. P., “PC Interfacing for Data Acquisition and Process Control”, 2nd Edition, Instrument Society of America, 1994.
4. Jamal, R. and Picklik, H., “Labview-Applications and Solutions “, National Instrument Release
5. Johnson, G.,” Labview Graphical programming “ , McGraw-Hill, Newyork,1997.
6. Wells, L.K and Travis, J., “ Labview for Everyone”, Prentice Hall, New Jersey, 1997
7. Buchanan, W., ”Computer Busses ”, CRC Press, 2000

U13 AU*T* E38- EMBEDDED COMMUNICATION SYSTEM PROTOCOLS

L	T	P	C
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UNIT I – EMBEDDED NETWORKING: **9hrs**

Introduction – Serial/Parallel Communication – Serial communication protocols -RS232 standard – RS485 – Synchronous Serial Protocols -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) – PC Parallel port programming -ISA/PCI Bus protocols - Firewire

USB bus – Speed Identification on the bus – USB States – USB bus communication: Packets –Data flow types –Enumeration –Descriptors –PIC 18 Microcontroller USB Interface – C Programs –CAN Bus – Introduction - Frames –Bit stuffing –Types of errors –Nominal Bit Timing – PIC microcontroller CAN Interface –A simple application with CAN

UNIT II - CONTROLLER AREA NETWORK (CAN) PROTOCOL: 9hrs

History and foundation of CAN, CAN Applications, Main characteristics of CAN, CAN in OSI Reference Model, CAN Data Link Layer, Principles of data exchange in CAN, Arbitration, Data Frame, Remote Frame, Error detection and management in CAN, CAN physical Layer, Bit encoding, Bit timing and synchronization, Relationship between data rate and bus length, Single wire and twin wire media, CAN repeaters, Medium-to-medium gateway, Protocol handlers, Micro-controllers and line drivers, Time-Triggered CAN (TTCAN), Comparison with other IVN protocols, CANoe based applications development

UNIT III - LOCAL INTERCONNECT NETWORK (LIN) PROTOCOL 9hrs

Introduction to LIN, LIN consortium, LIN specification, LIN features, Technical overview, Work flow concept, LIN operation, LIN frame format, Scheduling table, Network management of LIN cluster, LIN Transport Layer, LIN node configuration and identification, LIN diagnostics, LIN physical layer, Comparison with other IVN protocols and Case Study

UNIT IV - FLEXRAY PROTOCOL: 9hrs

Future on board systems, Need for FlexRay, Origin of FlexRay, FlexRay consortium, FlexRay Objectives, FlexRay Features, Application requirements, Working of FlexRay, Network topologies, ECU architecture, Segment Configuration, Communication Cycles, FlexRay frame format, Timing of configuration protocol, Error control, and FlexRay core mechanisms, Coding and Decoding, Medium Access Control, Frame and Symbol Processing, Clock Synchronization, FlexRay Components, Comparison with other IVN protocols and Case Study

UNITV-IN VEHICLE NETWORK DIAGNOSTICS: 9hrs

Process of Automotive Fault Diagnostics, Fault Codes, Vehicle Systems (open-loop and closed-loop), On- and Off- Board Diagnostics, OBD-I, OBD-II, Engine Analyzers, Steps taken to diagnose a fault, Diagnostics Protocol-KWP2000, SAE-J1587, SAE-J1708 and Case Study

L: 45 T: 0 Total 45 Hrs

References:

1. Muhammad Ali Mazidi, Danny Causey and Janice Mazidi. (2008) HCS12 Microcontrollers and Embedded Systems, Prentice Hall.
2. Frank Vahid, Givargis ‘Embedded Systems Design: A Unified Hardware/Software Introduction’, Wiley Publications
3. Jan Axelson, ‘Parallel Port Complete’ , Penram publications

Group 4

Management

U13 GS*T* 002- TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES

1. Acquire knowledge on TQM concepts
2. Acquire knowledge on quality systems
3. Develop skills to use TQM tools for domain specific applications

INTRODUCTION **9hrs**

Definition of Quality, Dimensions of Quality, Quality costs, Top Management Commitment, Quality Council, Quality Statements, Barriers to TQM Implementation, Contributions of Deming, Juran and Crosby, Team Balancing

TQM PRINCIPLES **9hrs**

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Continuous Process Improvement,5S, Kaizen, Just-In-Time and TPS

STATISTICAL PROCESS CONTROL **9 hrs**

The seven tools of quality, New seven Management tools, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Concept of six sigma.

TQM TOOLS **9hrs**

Quality Policy Deployment (QPD), Quality Function Deployment (QFD), Benchmarking, Taguchi Quality Loss Function, Total Productive Maintenance (TPM), FMEA

QUALITY SYSTEMS **9hrs**

Need for ISO 9000 and Other Quality Systems, ISO 9001:2008 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, ISO 14001:2004

L: 45 T: 0 Total 45 Hrs

Reference Book

2. Dale H.Besterfiled, “Total Quality Management”, Pearson Education
3. James R.Evans & William M.Lidsay, “The Management and Control of Quality”, South-Western (Thomson Learning), 2008.
4. Feigenbaum.A.V. “Total Quality Management”, McGraw Hill
5. Oakland.J.S. “Total Quality Management”, Butterworth – Hcinemann Ltd., Oxford
6. Narayana V. and Sreenivasan, N.S. “Quality Management – Concepts and Tasks”, New Age International 2007.
7. Zeiri. “Total Quality Management for Engineers”, Wood Head Publishers.

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

CO1 - Understand quality concepts and philosophies of TQM

CO2 - Apply TQM principles and concepts of continuous improvement

CO3- Apply and analyze the quality tools, management tools and statistical fundamentals to improve quality

CO4 - Understand the TQM tools as a means to improve quality

CO5 - Remember and understand the quality systems and procedures adopted

U13 GS*T* 003-PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES

1. To study the importance and functions of management in an organization
2. To study the importance of planning and also the different types of plan
3. To understand the different types of organization structure in management
4. To understand the basis and importance of directing and controlling in management
5. To understand to the importance of corporate governance and social responsibilitie.

MANAGEMENT CONTEXT **9 hrs**

Management – Definition – Importance – Functions – Skills required for managers - Roles and functions of managers – Science and Art of Management –Management and Administration. Evolution of Classical, Behavioral and Contemporary management thoughts.

PLANNING **9 hrs**

Nature & Purpose – Steps involved in Planning – Forms of Planning – Types of plans – Plans at Individual, Department and Organization level - Managing by Objectives. Forecasting – Purpose – Steps and techniques. Decision-making – Steps in decision making

ORGANISING **9 hrs**

Nature and Purpose of Organizing - Types of Business Organization - Formal and informal organization – Organization Chart – Structure and Process – Strategies of Departmentation– Line and Staff authority – Benefits and Limitations. Centralisation Vs De-Centralization and Delegation of Authority.Staffing – Manpower Planning – Recruitment – Selection – Placement – Induction.

DIRECTING & CONTROLLING **9hrs**

Nature & Purpose – Manager Vs. Leader - Motivation - Theories and Techniques of Motivation. Leadership – Styles and theories of Leadership.

Communication – Process – Types – Barriers – Improving effectiveness in Communication.Controlling – Nature – Significance – Tools and Techniques.

CONTEMPORARY ISSUES IN MANAGEMENT **9hrs**

Corporate Governance Social responsibilities – Ethics in business – Recent issues.

American approach to Management, Japanese approach to Management, Chinese approach to Management and Indian approach to Management.

L: 45 T: 0 **Total 45 Hrs**

Reference book

1. Dinkar Pagare, “Principles of Management”, Sultan Chand & Sons, 2000.
2. Tripathy PC And Reddy PN, “Principles of Management”, Tata McGraw-Hill, 4th Edition, 2008.
3. Kanagasapapathi. P (2008) Indian Models of Economy, Business and Management, Prentice Hall of India, New Delhi, ISBN: 978-81-203-3423-6.
4. G.K.Vijayaraghavan and M.Sivakumar, “Principles of Management”, Lakshmi Publications, 5th Edition, 2009.
5. Harold Koontz & Heinz Weihrich, “Essentials of Management – An International perspective”, 8th edition. Tata McGraw-Hill, 2009.
6. Charles W.L. Hill and Steven L McShane – Principles of Management, Tata Mc Graw-Hill, 2009.

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

CO1: Understand the concepts of management, administration and the evolution of management thoughts.

CO2: Understand and apply the planning concepts.

CO3: Analyze the different organizational structures and understand the staffing process.

CO4: Analyze the various motivational and leadership theories and understand the communication and controlling processes.

CO5: Understand the various international approaches to management

U13 GS*T* 004- OPERATIONS RESEARCH

L	T	P	C
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OBJECTIVES

- Apply knowledge of OR techniques to domain specific industrial situations to optimize the quality of decisions
- Conduct investigations by the use of OR techniques

LINEAR MODEL **9hrs**

The phases of OR study – formation of an L.P model – graphical solution – simplex algorithm – artificial variables technique (Big M method, two phase method), duality in simplex

TRANSPORTATION AND ASSIGNMENT PROBLEM **9hrs**

Transportation model – Initial solution by North West corner method – least cost method – VAM. Optimality test – MODI method and stepping stone method.

Assignment model – formulation – balanced and unbalanced assignment problems

PROJECT MANAGEMENT BY PERT & CPM **9 hrs**

Basic terminologies – Constructing a project network – Scheduling computations – PERT - CPM – Resource smoothening, Resource leveling, PERT cost

REPLACEMENT AND SEQUENCING MODELS **9hrs**

Replacement policies - Replacement of items that deteriorate with time (value of money not changing with time) – Replacement of items that deteriorate with time (Value of money changing with time) – Replacement of items that fail suddenly (individual and group replacement policies).

Sequencing models- n job on 2 machines – n jobs on 3 machines – n jobs on m machines, Traveling salesman problem

INVENTORY AND QUEUING THEORY **9hrs**

Variables in inventory problems, EOQ, deterministic inventory models, order quantity with price break, techniques in inventory management.

Queuing system and its structure – Kendall's notation – Common queuing models - M/M/1: FCFS/∞/∞ - M/M/1: FCFS/n/∞ - M/M/C: FCFS/∞/∞ - M/M/1: FCFS/n/m

L: 45 T: 0 **Total 45 Hrs**

Reference book

1. Taha H.A., "Operation Research", Pearson Education
2. Hira and Gupta "Introduction to Operations Research", S.Chand and Co.2002
3. Hira and Gupta "Problems in Operations Research", S.Chand and Co.2008
4. Wagner, "Operations Research", Prentice Hall of India, 2000
5. S.Bhaskar, "Operations Research", Anuradha Agencies, Second Edition, 2004

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

CO1- Apply linear programming model and assignment model to domain specific situations

CO2 - Analyze the various methods under transportation model and apply the model for testing the closeness of their results to optimal results

CO3 - Apply the concepts of PERT and CPM for decision making and optimally managing projects

CO4 - Analyze the various replacement and sequencing models and apply them for arriving at optimal decisions

CO5 - Analyze the inventory and queuing theories and apply them in domain specific situations.

U13 GS*T* 005 ENGINEERING ECONOMICS AND FINANCIAL MANAGEMEN0T

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Objectives:

- Acquire knowledge of economics to facilitate the process of economic decision making
- Acquire knowledge on basic financial management aspects
- Develop the skills to analyze financial statements

ECONOMICS, COST AND PRICING CONCEPTS 9

Economic theories – Demand analysis – Determinants of demand – Demand forecasting – Supply – Actual cost and opportunity cost – Incremental cost and sunk cost – Fixed and variable cost – Marginal costing – Total cost – Elements of cost – Cost curves – Breakeven point and breakeven chart – Limitations of break even chart – Interpretation of break even chart – Contribution – P/V-ratio, profit-volume ratio or relationship – Price fixation – Pricing policies – Pricing methods

CONCEPTS ON FIRMS AND MANUFACTURING PRACTICES 9

Firm – Industry – Market – Market structure – Diversification – Vertical integration – Merger – Horizontal integration

NATIONAL INCOME, MONEY AND BANKING, ECONOMIC ENVIRONMENT 9

National income concepts – GNP – NNP – Methods of measuring national income – Inflation – Deflation – Kinds of money – Value of money – Functions of bank – Types of bank – Economic liberalization – Privatization – Globalization

CONCEPTS OF FINANCIAL MANAGEMENT 9

Financial management – Scope – Objectives – Time value of money – Methods of appraising project profitability – Sources of finance – Working capital and management of working capital

ACCOUNTING SYSTEM, STATEMENT AND FINANCIAL ANALYSIS 9

Accounting system – Systems of book-keeping – Journal – Ledger – Trail balance – Financial statements – Ratio analysis – Types of ratios – Significance – Limitations

TOTAL: 45 HOURS

REFERENCE BOOKS:

1. Prasanna Chandra, " Financial Management (Theory & Practice) TMH
2. Weston & Brigham, " Essentials of Managerial Finance"
3. Pandey, I. M., "Financial Management"
4. Fundamentals of Financial Management- James C. Van Horne.
5. Financial Management & Policy -James C. Van Horne
6. Management Accounting & Financial Management- M. Y. Khan & P. K. Jain
7. Management Accounting Principles & Practice -P. Saravanavel

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

CO1 - Evaluate the economic theories, cost concepts and pricing policies

CO2 - Understand the market structures and integration concepts

CO3 - Understand the measures of national income, the functions of banks and concepts of globalization

CO4 - Apply the concepts of financial management for project appraisal

CO5 - Understand accounting systems and analyze financial statements using ratio analysis

U13 GS*T* 006 PRODUCT DESIGN AND DEVELOPMENT

L	T	P	C
3	0	0	3

Objectives:

- Acquire knowledge on the various stages of a product development process
- Develop skills for using the various tools and techniques for developing products
- Acquire knowledge on project management techniques

INTRODUCTION - DEVELOPMENT PROCESSES AND ORGANIZATIONS - PRODUCT PLANNING 9

Characteristics of successful product development to Design and develop products, duration and cost of product development, the challenges of product development.

A generic development process, concept development: the front-end process, adapting the generic product development process, the AMF development process, product development organizations, the AMF organization.

The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process.

IDENTIFYING CUSTOMER NEEDS - PRODUCT SPECIFICATIONS 9

Gathering raw data from customers, interpreting raw data in terms of customer needs, organizing the needs into a hierarchy, establishing the relative importance of the needs and reflecting on the results and the process.

Specifications, establish specifications, establishing target specifications setting the final specifications.

CONCEPT GENERATION - CONCEPT SELECTION - CONCEPT TESTING 9

The activity of concept generation clarify the problem search externally, search internally, explore systematically, reflect on the results and the process.

Overview of methodology, concept screening, concept scoring, caveats.

Purpose of concept test, choosing a survey population and a survey format, communicate the concept, measuring customer response, interpreting the result, reflecting on the results and the process.

PRODUCT ARCHITECTURE - INDUSTRIAL DESIGN - DESIGN FOR MANUFACTURING 9

Meaning of product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning, related system level design issues.

Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, is assessing the quality of industrial design.

Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on other factors.

PROTOTYPING - PRODUCT DEVELOPMENT ECONOMICS - MANAGING PROJECTS 9

Prototyping basics, principles of prototyping, technologies, planning for prototypes.

Elements of economic analysis, base case financial mode, Sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis.

Understanding and representing task, baseline project planning, accelerating projects, project execution, and postmortem project evaluation.

TOTAL: 45 HOURS

REFERENCE BOOKS:

1. Product Design and Development: Karl. T. Ulrich, Steven D Eppinger,. Irwin McGrawHill.
2. Product Design and Manufacturing: A C Chitale and R C Gupta, PHI
3. New Product Development: Timjones. Butterworth Heinmann,, Oxford. UCI.
4. Product Design for Manufacture and Assembly: Geoffery Boothroyd, Peter Dewhurst and Winston Knight.

COURSE OUTCOMES:

On successful completion of the course, the learner would be able to

1. CO1 - Understand the process to plan and develop products
2. CO2 - Understand the process of collecting information and developing product specifications
3. CO3 - Understand the concept generation, selection and testing processes
4. CO4 - Understand the concepts of product architecture, industrial design and design for manufacture
5. CO4 -Understand the basics of prototyping, economic analysis and project planning and execution processes

U13 AU*T* E41 ENTREPRENEURSHIP DEVELOPMENT

L	T	P	C
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OBJECTIVES

To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

ENTREPRENEURSHIP 9hrs

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur, Multiprener, Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

MOTIVATION 9hrs

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

BUSINESS 9 hrs

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – e-business –Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

FINANCING AND ACCOUNTING 9hrs

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

SUPPORT TO ENTREPRENEURS 9hrs

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

L: 45 T: 0 Total 45 Hrs

References Book

1. Khanka. S.S, "Entrepreneurial Development" S.Chand & Co. Ltd., Ram Nagar, New Delhi,2013.
2. Donald F Kuratko, "Entreprenuership – Theory, Process and Practice", 9th Edition, Cengage Learning, 2014.
3. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.
4. Mathew J Manimala, Enterprenuership theory at cross roads: paradigms and praxis", 2nd Edition, Dream tech, 2005.
5. Rajeev Roy, 'Entrepreneurship', 2nd Edition, Oxford University Press, 2011.
6. EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad, 1986.

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U13 AU*T* E42-PROJECT MANAGEMENT

PROJECT MANAGEMENT CONCEPTS 9hrs

Introduction, project characteristics, taxonomy of projects, project identification and formulation. Establishing the project and goals. Nature & context of project management; phases of PM, A framework for PM issues, PM as a conversion process, project environment & complexity. Organizing human resources, organizing systems & procedures for implementation. Project direction.

PROJECT ORGANIZATION & PROJECT CONTRACTS 9 hrs

Introduction, functional organization, project organization, matrix organization, modified matrix organization, pure project organization, selection of project organization structure, project breakdown structures, project contracts, types of contracts, types of payments to contractors.

PROJECT APPRAISAL & COST ESTIMATION 9 hrs

Introduction, technical appraisal, commercial appraisal, economic appraisal, financial appraisal, management appraisal, social cost/benefit analysis, project risk analysis. Cost analysis of the project, components of capital cost of a project, modern approach to project performance analysis.

PROJECT PLANNING & SCHEDULING 9 hrs

Introduction to PERT & CPM, planning and scheduling networks, time estimation, determination of critical path, CPM model, event slacks & floats, PERT model, expected time for activities, expected length of critical path, calculating the project length and variance, PERT & CPM cost accounting systems, lowest cost schedule, crashing of networks, linear programming formulation of event oriented networks, updating of networks, LOB technique.

MODIFICATION & EXTENSIONS OF NETWORK MODELS 9 hrs

Complexity of project scheduling with limited resources, resource leveling of project schedules, resource allocation in project scheduling - heuristic solution. Precedence networking- examples with algorithm, decision networks, probabilistic networks, computer aided project management- essential requirements of PM software, software packages for CPM. Enterprise- wide PM, using spread sheets for financial projections.

L: 45 T: 0 Total 45 Hrs

Reference book

1. Nagarajan. K*, "Project "Management,* New Age International, 2012.
2. Harvey Maylor, "Project Management", Prentice Hall, 2010.
3. Erik W. Larson, "Project Management": The Managerial Process (Special Indian Edition), Tata McGraw-Hill Education, 2006

U13 AU*T* E43-TRANSPORT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES

After completion of this course the students are able to manage a transport fleet and their related activities for minimizing operational cost.

INTRODUCTION **9hrs**

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

TRANSPORT SYSTEMS **9 hrs**

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings

SCHEDULING AND FARE STRUCTURE **9 hrs**

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

MOTOR VEHICLE ACT **9 hrs**

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

MAINTENANCE **9 hrs**

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout

L: 45 T: 0 **Total 45 Hrs**

Reference Books

1. John Duke - Fleet Management – McGraw-Hill Co, USA -1984.
2. Government Motor Vehicle Act – Eastern Book Company, Lucknow – 1989
3. Kitchin.L.D., - Bus Operation - Illiffee and Sons Co., London, III edition – 1992
4. The motor vehicle Act 1939 - Ejaz Ahemad, Ashok law house, India - 1989.

U13 AU*T* E44 - QUALITY CONTROL & RELIABILITY

L	T	P	C
3	0	0	3

STATISTICAL PROCESS CONTROL **9 hrs**

Quality control – Definition – Quality Assurance Variation in process – Factors – control charts – variables XR and XÃ, - Attributes P, C and U-Chart Establishing and interpreting control charts process capability – Quality rating – Short run SPC.

ACCEPTANCE SAMPLING **9 hrs**

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

EXPERIMENTAL DESIGN & TAGUCHI METHOD **9 hrs**

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

RELAIBILITY AND ITS PREDICTION **9 hrs**

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

FAILURE DATA ANALYSIS **9 hrs**

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

L: 45 T: 0 **Total 45 Hrs**

Reference Books

1. Amita Mitra "Fundamentals of Quality Control and Improvement" Pearson Education, 2002
2. Modares: Reliability & Risk Analysis Marcel Decker Inc. 1993.
3. Bester field D.H., "Quality Control" Prentice Hall, 7th edition 2003
4. Manohar Mahajan, "Statistical Quality Control" Dhanpal Rai & Sons, 2001
5. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publications, 2004.

U13 AU*T* E45 - ENERGY STUDIES

L	T	P	C
3	0	0	3

ENERGY SOURCES **9 hrs**

Fossil fuels, Nuclear fuels, hydel, solar, wind and bio fuels in India, Energy conservation, Nuclear energy through fission and fusion processes.

ENERGY CONVERSION **9 hrs**

Energy conversion from source to utility, Solar, Nuclear, Geothermal, Tide and Wind Energies.

GLOBAL ENERGY SCENARIO **9 hrs**

Role of energy in economic development and social transformation, Overall energy demand, availability and consumption, Depletion of energy resources and its impact on economy, Non proliferation of nuclear energy. International energy policies of G-8, G-20, OPEC and European union countries.

INDIAN ENERGY SCENARIO **9 hrs**

Commercial and noncommercial forms of energy, Utilization pattern in the past, present and also future prediction, Sector wise energy consumption.

ENERGY POLICY **9 hrs**

Energy policy issues at global level, national level and state level, Energy conservation act 2001, Electricity act 2003, Energy pricing and its impact on global variations.

L: 45 T: 0 **Total 45 Hrs**

Reference Books

1. Jose Goldenberg, Thomas Johanson, and Reddy, A.K.N., Energy for Sustainable World, WileyEastern, 2005.
2. Charles E. Brown, World Energy Resources, Springer Publication, New York, 2002.
3. Culp, A.W., Principles of Energy Conversion, McGraw Hill New York, 2004.
4. Bukhootsow, B., Energy Policy and Planning, Prentice Hall of India, New Delhi, 2003.