HINDUSTHAN COLLEGE OF ENGINEERING AND T`ECHNOLOGY

Approved by AICTE, New Delhi, Accredited with 'A' Grade by NAAC

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Coimbatore 641 032

REGULATIONS 2019

CURRICULUM AND SYLLABI

(For students admitted from 2019-2020)

(I TO VIII Semester)

B.E. DEGREE

in

AUTOMOBILE ENGINEERING

R – 2019
B.E. AUTOMOBILE ENGINEERING
I – VIII SEMESTER CURRICULUM AND SYLLABI
SEMESTER I

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE1101	Technical English	HS	2	1	0	3	25	75	100
2	19MA1102	Calculus and Linear Algebra	BS	3	1	0	4	25	75	100
THEORY & LAB COMPONENT										
3	19PH1151	Applied Physics	BS	2	0	2	3	50	50	100
4	19CY1151	Engineering Chemistry	BS	2	0	2	3	50	50	100
5	19CS1151	Python programming and practices	ES	2	0	2	3	50	50	100
6	19ME1152	Engineering Drawing	ES	1	0	4	3	50	50	100
PRACTICAL										
7	19HE1071	Language Competency Enhancement Course - I	HS	1	0	0	1	100	-	100
8	19MC1191	Induction Programme	MC							
			Total	13	2	10	20			700

SEMESTER II

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE2101	Business English for Engineers	HS	2	1	0	3	25	75	100
2	19MA2101	Differential Equations and Complex Variables	BS	3	1	0	4	25	75	100
3	19ME2101	Engineering Mechanics	ES	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
4	19PH2151	Material Science	BS	2	0	2	3	50	50	100
5	19CY2151	Environmental Science	BS	2	0	2	3	50	50	100
6	19IT2151	Programming in C	ES	2	0	2	3	50	50	100
PRACTICAL										
7	19ME2001	Engineering Practices	ES	0	0	4	2	50	50	100
8	19HE2071	Language Competency Enhancement Course - II	HS	1	0	0	1	100	-	100
Total				15	2	10	22			800

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SEMESTER III

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19MA3101	Fourier Series and Statistics	BS	3	1	0	4	25	75	100
2	19AU3201	Fluid and Pneumatic Systems	PC	3	1	0	4	25	75	100
3	19AU3202	Engineering Thermodynamics	PC	3	0	0	3	25	75	100
4	19AU3203	Theory of Automotive Engines*#	PC	3	0	0	3	25	75	100
5	19AC3191	Indian Constitution	HS	2	0	0	0	25	75	100
THEORY & LAB COMPONENT										
6	19AU3251	Automotive Structures and Design	PC	2	0	2	3	50	50	100
PRACTICAL										
7	19AU3001	Computer Aided Drawing Lab##	PC	0	0	3	1.5	50	50	100
8	19AU3002	Automotive Components Lab*#	PC	0	0	3	1.5	50	50	100
Total				16	2	8	20			800

SEMESTER IV

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19MA4101	Numerical Methods	BS	3	1	0	4	25	75	100
2	19AU4201	Mechanism and Machine Theory	PC	3	1	0	4	25	75	100
3	19AU4202	Automotive Engine Components Design*#	PC	3	1	0	4	25	75	100
4	19AU4203	Two and Three Wheelers Technology#	PC	3	0	0	3	25	75	100
5	19AC4191	Essence of Indian Traditional Knowledge	HS	2	0	0	0	25	75	100
THEORY & LAB COMPONENT										
6	19AU4251	Fundamentals of Heat Transfer	PC	2	0	2	3	50	50	100
PRACTICAL										
7	19AU4001	Computer Aided Automotive Engine Components Lab##	PC	0	0	3	1.5	50	50	100
8	19AU4002	Two and Three Wheelers Technology Lab#	PC	0	0	3	1.5	50	50	100
Total				16	3	8	21			800

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SEMESTER V

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19AU5201	Automotive Emission and Pollution Control*#$	PC	3	0	0	3	25	75	100
2	19AU5202	Vehicle Design and Data Characteristics*#	PC	3	1	0	4	25	75	100
3	19AU5203	Automotive Fuels and Lubricants	PC	3	0	0	3	25	75	100
4	19AU53XX	Professional Elective – 1	PE	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
5	19AU5251	Automotive Transmission*	PC	2	0	2	3	50	50	100
6	19AU5252	Automotive Chassis Components Design##	PC	2	0	2	3	50	50	100
PRACTICAL										
7	19AU5001	Engine Performance and Emission Testing Lab*	PC	0	0	3	1.5	50	50	100
8	19AU5002	Automotive Fuels and Lubricants Lab	PC	0	0	3	1.5	50	50	100
Total :				17	1	10	22			800

SEMESTER VI

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19AU6201	Total Quality Management$	HS	3	0	0	3	25	75	100
2	19AU6202	Vehicle Dynamics and Control Systems*#$	PC	3	0	0	3	25	75	100
3	19AU6203	Finite Element Analysis	PC	3	1	0	4	25	75	100
4	19AU63XX	Professional Elective – 2	PE	3	0	0	3	25	75	100
5	19AU6401	Open Elective - 1	OE	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
6	19AU6251	Automotive Vehicle Body and Aerodynamics*	PC	2	0	3	3.5	50	50	100
PRACTICAL										
7	19AU6001	Finite Element Analysis Lab##	PC	0	0	3	1.5	50	50	100
8	19AU6002	Internship Training / Implant Training	EEC	0	0	0	1	100		100
Total :				17	1	6	22			800

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SEMESTER VII

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19AU7201	Advanced Electrical and Electronics*#$	PC	3	0	0	3	25	75	100
2	19AU7202	Engine and Vehicle Management Systems*#$	PC	3	0	0	3	25	75	100
3	19AU73XX	Professional Elective – 3	PE	3	0	0	3	25	75	100
4	19AU7401	Open Elective – 2	OE	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
5	19AU7251	Electric and Hybrid Vehicle$$	PC	2	0	2	3	50	50	100
PRACTICAL										
6	19AU7001	Advanced Electrical and Electronics Lab*#$	PC	0	0	3	1.5	50	50	100
7	19AU7002	Vehicle Maintenance Laboratory*#	PC	0	0	3	1.5	50	50	100
8	19AU7901	Project Work – Phase I	EEC	0	0	4	2	50	50	100
Total				14	0	12	20			800

SEMESTER VIII

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19AU83XX	Professional Elective – 4	PE	3	0	0	3	25	75	100
2	19AU83XX	Professional Elective – 5	PE	3	0	0	3	25	75	100
PRACTICAL										
3	19AU8901	Project Work – Phase II	EEC	0	0	24	12	100	100	200
Total :				6	0	24	18			400

Credit Distribution - Semester Wise

Sem	I	II	III	IV	V	VI	VII	VII	Total
Credits	20	22	20	21	22	22	20	18	165

Total Number of Credits to be Earned for Award of the Degree = 165

Note:

* Subject Integrated with Volvo Eicher
# Subject Integrated with Royal Enfield
$ Subject Integrated with Ashok Leyland Industry Institute Interaction (3i) Cell
Subject Integrated with Autodesk India
$$ Subject integrated with Sri Varu Motors Pvt Ltd (Electric Vehicle Manufacturer)
*#$ Subject Integrated with Ford Vehicle

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LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I									
1	19AU5301	Alternative Fuels and Energy Systems	3	0	0	3	25	75	100
2	19AU5302	Tyre Technology*	3	0	0	3	25	75	100
3	19AU5303	Automotive Materials and Manufacturing Technology	3	0	0	3	25	75	100
4	19AU5304	Battery Technology	3	0	0	3	25	75	100
5	19AU5305	Noise, Vibration and Harshness	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE II									
1	19AU6301	Automotive Aiconditioning	3	0	0	3	25	75	100
2	19AU6302	Fuel Cell Technology	3	0	0	3	25	75	100
3	19AU6303	Ergonomics in Automotive Design	3	0	0	3	25	75	100
4	19AU6304	Tractor and Farm Equipments	3	0	0	3	25	75	100
5	19AU6305	Robotics	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE III									
1	19AU7301	Automotive Vehicle Maintenance*#	3	0	0	3	25	75	100
2	19AU7302	Railway Engineering	3	0	0	3	25	75	100
3	19AU7303	Engine Auxiliary Systems*#	3	0	0	3	25	75	100
4	19AU7304	Tribology and Terotechnology	3	0	0	3	25	75	100
5	19AU7305	Entrepreneurship Development	3	0	0	3	25	75	100

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE IV									
1	19AU8301	Automotive Infotainment*#$	3	0	0	3	25	75	100
2	19AU8302	Computational Fluid Dynamics	3	0	0	3	25	75	100
3	19AU8303	Automotive Painting Technology	3	0	0	3	25	75	100
4	19AU8304	Non Destructive Testing and Materials	3	0	0	3	25	75	100
5	19AU8305	Motorsports Engineering	3	0	0	3	25	75	100

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PROFESSIONAL ELECTIVE V									
1	19AU8306	Automotive Testing and Diagnosis*#$	3	0	0	3	25	75	100
2	19AU8307	Industry 4.0	3	0	0	3	25	75	100
3	19AU8308	Autonomous Vehicle Technology	3	0	0	3	25	75	100
4	19AU8309	Off Road Vehicles	3	0	0	3	25	75	100
5	19AU8310	Unconventional Machining Processes	3	0	0	3	25	75	100
OPEN ELECTIVE (OE)									
1	19AU6401	Basics of Automobile Engineering*	3	0	0	3	25	75	100
2	19AU7402	Automotive Safety*#$	3	0	0	3	25	75	100

Following are the Courses which will be offered in collaboration with the following industries:

S.No	Course code	Course Name	Industry Name
1	19AU3203	Theory of Automotive Engines	Volvo – Eicher & Royal Enfield
2	19AU3001	Computer Aided Drawing Lab	Autodesk India
3	19AU3002	Automotive Components Lab	Volvo – Eicher & Royal Enfield
4	19AU4202	Automotive Engine Components Design	Volvo – Eicher & Royal Enfield
5	19AU4203	Two and Three Wheelers Technology	Royal Enfield
6	19AU4001	Computer Aided Automotive Engine Components Lab	Autodesk India
7	19AU4002	Two and Three Wheelers Technology Lab	Royal Enfield
8	19AU5201	Automotive Emission and Pollution Control	Ford Vehicle
9	19AU5202	Vehicle Design and Data Characteristics	Volvo – Eicher & Royal Enfield
10	19AU5251	Automotive Transmission	Volvo – Eicher
11	19AU5252	Automotive Chassis Components Design	Autodesk India
12	19AU5001	Engine Performance and Emission Testing Lab	Volvo – Eicher
13	19AU6201	Total Quality Management	Ashok Leyland Industry Institute Interaction (3i) Cell
14	19AU6202	Vehicle Dynamics and Control Systems	Ford Vehicle
15	19AU6251	Automotive Vehicle Body and Aerodynamics	Volvo – Eicher
16	19AU6001	Finite Element Analysis Lab	Autodesk India
17	19AU7201	Advanced Electrical and Electronics	Ford Vehicle
18	19AU7202	Engine and Vehicle Management Systems	Ford Vehicle
19	19AU7251	Electric and Hybrid Vehicle	Sri Varu motors
20	19AU7001	Advanced Electrical and Electronics Lab	Ford Vehicle
21	19AU7002	Vehicle Maintenance Laboratory	Volvo – Eicher & Royal Enfield
22	19AU5302	Tyre Technology	Volvo – Eicher
23	19AU7301	Automotive Vehicle Maintenance	Volvo – Eicher & Royal Enfield
24	19AU7303	Engine Auxiliary Systems	Volvo – Eicher & Royal Enfield
25	19AU8301	Automotive Infotainment	Ford Vehicle
26	19AU8306	Automotive Testing and Diagnosis	Ford Vehicle
27	19AU6401	Basics of Automobile Engineering	Volvo – Eicher

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28	19AU7402	Automotive Safety	Ford Vehicle

Following are the audit course for semester - III

S.No	Course code	Course Name	L	T	P	C
1	19AC3191	Indian Constitution	2	0	0	0

Following are the audit course for semester - IV

S.No	Course code	Course Name	L	T	P	C
1	19AC4191	Essence of Indian Traditional Knowledge	2	0	0	0

SUMMARY

S.No.	Subject Category	Credits Distribution on each Semester								Credits Total	Percentage %
		I	II	III	IV	V	VI	VII	VIII		
1	HS	4	4	-	-	-	3	-	-	11	6.66
2	BS	10	10	4	4	-	-	-	-	28	16.96
3	ES	6	8	-	-	-	-	-	-	14	8.45
4	PC	-	-	16	17	19	12	12		76	46.06
5	PE	-	-	-	-	3	3	3	6	15	9.09
6	OE	-	-	-	-	-	3	3	-	6	3.63
7	EEC	-	-	-	-	-	1	2	12	15	9.09
8	NCM	-	-	G	G	-	-	-	-	-	-
	Total	**20**	**22**	**20**	**21**	**22**	**22**	**20**	**18**	**165**	

NCM- Non Credit Mandatory Course, G – Given

Non – Credit Mandatory Course (Extra Credit)

S.No.	Semester	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	I	Soft Skills & Aptitude – I	NCM	1	0	0	1	25	75	100
2	II	Soft Skills & Aptitude – II	NCM	1	0	0	1	25	75	100
3	III	Soft Skills & Aptitude – III	NCM	1	0	0	1	25	75	100
4	IV	Soft Skills & Aptitude – IV	NCM	1	0	0	1	25	75	100
5	V	Programming Aspects & Technical Aptitude - I	NCM	1	0	0	1	25	75	100
6	VI	Programming Aspects & Technical Aptitude - II	NCM	1	0	0	1	25	75	100

Note: Non-Credit Course results will not consider for Award of Degree

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19HE1101	TECHNICAL ENGLISH (COMMON TO ALL BRANCHES)	L	T	P	C
		2	1	0	3

Course Objectives

1. To facilitate students to communicate effectively with coherence.
2. To train the learners in descriptive communication
3. To introduce professional communication
4. To enhance knowledge and to provide the information on corporate environment
5. To equip the trainers with the necessary skills on critical thinking

UNIT I LISTENING AND SPEAKING (9)

Opening a conversation, maintaining coherence, turn taking, closing a conversation (excuse, general wishes, positive comments and thanks) Reading –Reading articles from newspaper, Reading comprehension Writing Chart analysis, process description, Writing instructions Grammar and Vocabulary- Tenses, Regular and irregular verb, technical vocabulary.

UNIT II LISTENING AND SPEAKING (9)

Listening to product description, equipment & work place (purpose, appearance, function) Reading- Reading technical articles Writing- Letter phrases, writing personal letters, Grammar and Vocabulary-articles, Cause & effect, Prepositions.

UNIT III LISTENING AND SPEAKING (9)

Listening to announcements Reading- Reading about technical inventions, research and development Writing- Letter inviting a candidate for interview, Job application and resume preparation Grammar and Vocabulary- Homophones and Homonyms.

UNIT IV LISTENING AND SPEAKING (8)

Practice telephone skills and telephone etiquette (listening and responding, asking questions).Reading- Reading short texts and memos Writing- invitation letters, accepting an invitation and declining an invitation Grammar and Vocabulary- Modal verbs, Collocation, Conditionals, Subject verb agreement and Pronoun-Antecedent agreement.

UNIT V LISTENING AND SPEAKING (9)

Listening to technical group discussions and participating in GDs Reading- reading biographical writing - Writing- Proposal writing, Writing definitions, Grammar and Vocabulary- Abbreviation and Acronym, Prefixes & suffixes, phrasal verbs.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Trained to maintain coherence and communicate effectively.
CO2: Practiced to create and interpret descriptive communication.
CO3: Introduced to gain information of the professional world.
CO4: Acquired various types of communication and etiquette.
CO5: Taught to improve interpersonal and intrapersonal skills.

Text Books

T1 Norman Whitby, “Business Benchmark-Pre-intermediate to Intermediate”,Cambridge University Press, 2014.
T2 Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, 2005.

References

R1 Meenakshi Raman and Sangeetha Sharma. “Technical Communication- Principles and Practice”, Oxford University Press, 2009.
R2 Raymond Murphy, “English Grammar in Use”- 4th edition Cambridge University Press, 2004.
R3 Kamalesh Sadanan “A Foundation Course for the Speakers of Tamil-Part-I &II”, Orient Blackswan, 2010.

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		L	T	P	C
19MA1102	**CALCULUS AND LINEAR ALGEBRA (COMMON TO AERO, AUTO, MECH, MCT, FOOD, AGRI & CIVIL)**	**3**	**1**	**0**	**4**

Course Objectives

1. Understand the concept of differentiation
2. Evaluate the functions of several variables which are needed in many branches of engineering.
3. Understand the concept of double integrals.
4. Understand the concept of triple integrals
5. Develop the skill to use matrix algebra techniques that is needed by engineers for practical applications

UNIT I DIFFERENTIAL CALCULUS (12)

Rolle‟s Theorem – Lagrange‟s Mean Value Theorem- Maxima and Minima – Taylor‟s and Maclaurin‟s Theorem.

UNIT II MULTIVARIATE CALCULUS (DIFFERENTIATION) (12)

Total derivatives - Jacobians – Maxima, Minima and Saddle points - Lagrange‟s method of undetermined multipliers – Gradient, divergence, curl and derivatives

UNIT III DOUBLE INTEGRATION (12)

Double integrals in Cartesian coordinates – Area enclosed by the plane curves (excluding surface area) – Green‟s Theorem (Simple Application) - Stoke‟s Theorem – Simple Application involving cubes and rectangular parellopiped.

UNIT IV TRIPLE INTEGRATION (12)

Triple integrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates. Gauss Divergence Theorem – Simple Application involving cubes and rectangular parellopiped.

UNIT V MATRICES (12)

Eigen values and Eigen vectors – Properties of Eigen values and Eigen vectors (without proof) - Cayley - Hamilton Theorem (excluding proof) - Reduction of a quadratic form to canonical form by orthogonal transformation.

TOTAL: 60 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Apply the concept of differentiation in any curve.
CO2: Identify the maximum and minimum values of surfaces.
CO3: Apply double integrals to compute area of plane curves.
CO4: Evaluation of triple integrals to compute volume of solids
CO5: Calculate Eigen values and Eigen vectors for a matrix which are used to determine the natural frequencies (or Eigen frequencies) of vibration and the shapes of these vibration modes.

Text Books

T1 Erwin Kreyszig, “Advanced Engineering Mathematics”, 10th Edition, Wiley India Private Ltd., New Delhi, 2018.
T2 Veerarajan T, “Engineering Mathematics ”, McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016.

References

R1 Thomas & Finney “ Calculus and Analytic Geometry” , Sixth Edition,,Narosa Publishing House, New Delhi.
R2 Bali N.P & Manish Goyal, “A Text book of Engineering Mathematics”, 8th Edition, Laxmi Pub. Pvt. Ltd. 2011.
R3 Grewal B.S, “Higher Engineering Mathematics”, 42nd Edition, Khanna Publications, Delhi, 2012.

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19PH1151	APPLIED PHYSICS (COMMON TO ALL BRANCHES)	L	T	P	C
		2	0	2	3

Course Objectives

1. Enhance the fundamental knowledge in properties of matter
2. Analysis the oscillatory motions of particles.
3. Extend the knowledge about wave optics.
4. Gain knowledge about laser and their applications.
5. Conversant with principles of optical fiber, types and applications of optical fiber.

UNIT I PROPERTIES OF MATTER (9)

Elasticity – Hooke„s law – Stress-strain diagram - Poisson„s ratio – Bending moment – Depression of a cantilever – Derivation of Young„s modulus of the material of the beam by Uniform bending theory and experiment.

Determination of Young's modulus by uniform bending method.

UNIT II OSCILLATONS (9)

Translation motion –Vibration motion – Simple Harmonic motion – Differential Equation of SHM and its solution – Damped harmonic oscillation - Torsion stress and deformations – Torsion pendulum: theory and experiment. ***Determination of Rigidity modulus – Torsion pendulum***.

UNIT III WAVE OPTICS (12)

Conditions for sustained Interference – air wedge and it"s applications - Diffraction of light – Fresnel and Fraunhofer diffraction at single slit –Diffraction grating – Rayleigh"s criterion of resolution power - resolving power of grating. ***Determination of wavelength of mercury spectrum – spectrometer grating. Determination of thickness of a thin wire – Air wedge method***.

UNIT IV LASER AND APPLICATIONS (9)

Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein„s coefficients (A&B) – Type of lasers – Nd:YAG laser and CO2 laser- Laser Applications – Holography – Construction and reconstruction of images.

Determination of Wavelength and particle size using Laser.

UNIT V FIBER OPTICS AND APPLICATIONS (6)

Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index, modes and materials) – Fiber optical communication link – Fiber optic sensors – Temperature and displacement sensors.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Illustrate the fundamental properties of matter.
CO2: Discuss the Oscillatory motions of particles.
CO3: Analyze the wavelength of different colors.
CO4: Understand the advanced technology of LASER in the field of Engineering.
CO5: Develop the technology of fiber optical communication in engineering field

Text Books

T1 Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
T2 Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P)Ltd., 2015.

References

R1 Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015.
R2 MN Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., 2016
R3 Dr. G. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2016.

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19CY1151	ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES)	L	T	P	C
		2	0	2	3

Course Objectives

1. The boiler feed water requirements, related problems and water treatment techniques
2. The principles of polymer chemistry and engineering applications of polymers and composites
3. The principles of electrochemistry and with the mechanism of corrosion and its control
4. The principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells
5. The important concepts of spectroscopy and its applications

UNIT I WATER TECHNOLOGY (9)

Hard water and soft water- Disadvantages of hard water- Hardness: types of hardness, simple calculations, estimation of hardness of water – EDTA method – Boiler troubles - Conditioning methods of hard water – External conditioning - demineralization process - desalination: definition, reverse osmosis – Potable water treatment – breakpoint chlorination. ***Estimation of total, permanent and temporary hardness of water by EDTA***.

UNIT II POLYMER & COMPOSITES (6)

Polymerization – types of polymerization – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, properties and uses of commercial plastics – PVC, Bakelite – moulding of plastics (extrusion and compression); Composites: definition, types of composites – polymer matrix composites (PMC) –FRP.

UNIT III ELECTROCHEMISTRY AND CORROSION (15)

Electrochemical cells – reversible and irreversible cells - EMF- Single electrode potential – Nernst equation (derivation only) – Conductometric titrations. Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types –galvanic corrosion – differential aeration corrosion – corrosion control – sacrificial anode and impressed cathodic current methods - protective coatings – paints – constituents and functions***. Conductometric titration of strong acid vs strong base (HCl vs NaOH). Conductometric titration (Mixture of strong acid and base). Conductometric precipitation titration using BaCl2 and Na2SO4)***

UNIT IV ENERGY SOURCES AND STORAGE DEVICES (6)

Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- lithium battery- fuel cell H2 -O2 fuel cell applications.

UNIT V ANALYTICAL TECHNIQUES (9)

Beer-Lambert‟s law – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (block diagram only) – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy.

Determination of iron content of the water sample using spectrophotometer (1,10 phenanthroline / thiocyanate method).

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Differentiate hard and soft water and to solve the related problems on water purification and its significance in industries and daily life.

CO2: Acquire the basic knowledge of polymers, composites and FRP and their significance.

CO3: Develop knowledge on the basic principles of electrochemistry and understand the causes of corrosion, its consequences to minimize corrosion to improve industrial design.

CO4: Develop knowledge about the renewable energy resources and batteries along with the need of new materials to improve energy storage capabilities.

CO5: Identify the structure and characteristics of unknown/new compound with the help of spectroscopy.

Text Books

T1 P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi (2018).

References

R1 B.Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2012).

R2 S.S.Dara “A Text book of Engineering Chemistry” S.Chand & Co. Ltd., New Delhi (2017).

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19CS1151	PYTHON PROGRAMMING AND PRACTICES	L	T	P	C
		2	0	2	3

Course Objectives

1. To know the basics of algorithmic problem solving.
2. To read and write simple Python programs.
3. To develop Python programs with conditionals and loops and to define Python functions and call them.
4. To use Python data structures ― lists, tuples, dictionaries.
5. To do input/output with files in Python

UNIT I ALGORITHMIC PROBLEM SOLVING (9)

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS (7+2)

Python interpreter and interactive mode; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments.

Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS (5+4)

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays.

Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES (3+6)

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension;

Illustrative programs: selection sort, insertion sort, merge sort, histogram.

UNIT V FILES, MODULES, PACKAGES (5+4)

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages.

Illustrative programs: word count, copying file contents.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Develop algorithmic solutions to simple computational problems.
CO2: Read, write, execute by hand simple Python programs.
CO3: Structure simple Python programs for solving problems and Decompose a Python program into functions.
CO4: Represent compound data using Python lists, tuples, dictionaries.
CO5: Read and write data from/to files in Python Programs.

Text Books

T1 Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
T2 S.Annadurai, S.Shankar, I.Jasmine Selvakumari Jeya, M.Revathi, Fundamentals of Python Programming, McGraw Hill Publications., 2018.

References

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R1 Charles Dierbach, ―Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.

R2 Timothy A. Budd, ―Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd., 2015.

R3 Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

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19ME1152	ENGINEERING DRAWING	L	T	P	C
		1	0	4	3

Course Objectives

1. To gain the knowledge of Engineer‟s language of expressing complete details about objects and construction of conics and special curves.
2. To learn about the orthogonal projections of straight lines and planes.
3. To acquire the knowledge of projections of simple solid objects in plan and elevation.
4. To learn about the projection of sections of solids and development of surfaces.
5. To study the isometric projections of different objects.

UNIT I PLANE CURVES (12)

Importance of engineering drawing; drafting instruments; drawing sheets – layout and folding; Lettering and dimensioning, BIS standards, scales. Geometrical constructions, Engineering Curves Conic sections – Construction of ellipse, parabola and hyperbola by eccentricity method. Construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT II PROJECTIONS OF POINTS, LINES AND PLANE SURFACES (12)

Introduction to Orthographic projections- Projection of points. Projection of straight lines inclined to both the planes, Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method (First angle projections only).

UNIT III PROJECTIONS OF SOLIDS (12)

Centroids of simple plane areas, composite areas, determination of moment of inertia of composite plane figures, polar moment of inertia-radius of gyration – mass moment of inertia of simple solids.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES (12)

Sectioning of simple solids with their axis in vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinder and cone. Development of lateral surfaces of truncated solids.

UNIT V ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS (12)

Isometric views and projections simple and truncated solids such as - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions. Free hand sketching of multiple views from a pictorial drawing. Basics of drafting using AutoCAD software.

TOTAL: 60 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Understand and interpret the engineering drawings in order to visualize the objects and draw the conics and special curves.
CO2: Draw the orthogonal projections of straight lines and planes.
CO3: Interpret the projections of simple solid objects in plan and elevation.
CO4: Draw the projections of section of solids and development of surfaces of solids.
CO5: Draw the isometric projections and the perspective views of different objects.

Text Books

T1 K.Venugopal, V.Prabu Raja, “Engineering Drawing, AutoCAD, Building Drawings”, 5thedition New Age International Publishers, New delhi 2016.
T2 K.V.Natarajan, “A textbook of Engineering Graphics”, Dhanlaksmi Publishers, Chennai.

References

R1 Basant Agrawal and C.M.Agrawal, “Engineering Drawing”, Tata McGraw Hill Publishing company Limited,New Delhi 2008.
R2 N.S. Parthasarathy, Vela Murali, “Engineering Drawing”, Oxford University PRESS, India 2015.

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19HE2101	BUSINESS ENGLISH FOR ENGINEERS (COMMON TO ALL BRANCHES)	L	T	P	C
		2	1	0	3

Course Objectives

1. To introduce to business communication.
2. To train the students to react to different professional situations.
3. To make the learner familiar with the managerial skills.
4. To empower the trainee in business writing skills.
5. To learn to interpret and expertise different content.

UNIT I LISTENING AND SPEAKING (9)

listening and discussing about programme and conference arrangement Reading –reading auto biographies of successful personalities Writing Formal & informal email writing, Recommendations Grammar and Vocabulary- Business vocabulary, Adjectives & adverbs.

UNIT II LISTENING AND SPEAKING (9)

Listening to TED talks Reading- Making and interpretation of posters Writing- Business letters: letters giving good and bad news, Thank you letter, Congratulating someone on a success" Grammar and Vocabulary- Active & passive voice, Spotting errors (Tenses, Preposition, Articles).

UNIT III LISTENING AND SPEAKING (9)

Travel arrangements and experience Reading- travel reviews Writing- Business letters (Placing an order, making clarification & complaint letters). Grammar and Vocabulary- Direct and Indirect speech.

UNIT IV LISTENING AND SPEAKING (8)

Role play Reading- Sequencing of sentence Writing- Business report writing (marketing, investigating) Grammar and Vocabulary- Connectors, Gerund & infinitive.

UNIT V LISTENING AND SPEAKING (9)

Listen to Interviews & mock interview Reading- Reading short stories, reading profile of a company - Writing- Descriptive writing (describing one"s own experience) Grammar and Vocabulary- Editing a passage(punctuation, spelling & number rules).

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Introduced to different modes and types of business communication.
CO2: Practiced to face and react to various professional situations efficiently.
CO3: Learnt to practice managerial skills.
CO4: Familiarized with proper guidance to business writing.
CO5: Trained to analyze and respond to different types of communication.

Text Books

T1 Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate",Cambridge University Press, 2014.
T2 Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2013.

References

R1 Michael Mc Carthy, "Grammar for Business", Cambridge University Press, 2009.
R2 Bill Mascull, "Business Vocabulary in use: Advanced 2nd Edition", Cambridge University Press, 2009.
R3 Frederick T. Wood, "Remedial English Grammar For Foreign Students", Macmillan publishers, 1986.

19MA2101	DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES (Common to AERO, AUTO, MECH, MCT, FT & AGRI)	L	T	P	C
		3	1	0	4

Course Objectives

1. Describe some methods to solve different types of first order differential equations.
2. Solve ordinary differential equations of certain types using Wronskian technique.
3. Use the effective mathematical tools for the solutions of partial differential equations.
4. Describe the construction of analytic functions and conformal mapping.
5. Illustrate Cauchy‟s integral theorem and calculus of residues.

UNIT I FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS (12)

Equations of the first order and of the first degree – Homogeneous equations – Exact differential equations – Linear equations – Equations reducible to the linear form – Bernoulli‟s equation.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER (12)

Second order linear differential equations with constant and variable co-efficients – Cauchy – Euler equations – Cauchy – Legendre equation – Method of variation of parameters.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS (12)

Formation of partial differential equations by the elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations of the form f(p,q)=0, Clairaut‟s type : z = px+qy +f(p,q) – Lagrange‟s linear equation.

UNIT IV COMPLEX DIFFERENTIATION (12)

Functions of complex variables – Analytic functions – Cauchy‟s – Riemann‟s equations and sufficient conditions (excluding proof) – Construction of analytic functions – Milne –Thomson‟s method – Conformal mapping w = A+z , Az, 1/z and bilinear transformations.

UNIT V COMPLEX INTEGRATION (12)

Cauchy‟s integral theorem – Cauchy‟s integral formula –Taylor‟s and Laurent‟s series (statement only) –Residues - Cauchy‟s Residue theorem.

TOTAL: 60 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Apply few methods to solve different types of first order differential equations.
CO2: Develop sound knowledge of techniques in solving ordinary differential equations.
CO3: Solve Partial Differential Equations using various methods.
CO4: Infer the knowledge of construction of analytic functions and conformal mapping.
CO5: Evaluate real and complex integrals over suitable closed paths or contours.

Text Books

T1 Ravish R Singh, Mukul Bhatt, “Engineeing Mathematics”, McGraw Hill education (India) Private Ltd.,Chennai,2017.
T2 Veerarajan T, “Engineering Mathematics”, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2016.

References

R1 Bali N.P & Manish Goyal, “A Text book of Engineering Mathematics”, 8th Edition, Laxmi Pub. Pvt. Ltd. 2011.
R2 Grewal B.S, “Higher Engineering Mathematics”, 42nd Edition, Khanna Publications, Delhi, 2012.
R3 Peter V. O'Neil, “Advanced Engineering Mathematics”, 7th Edition, Cengage learning,2012.

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19ME2101	ENGINEERING MECHANICS	L	T	P	C
		3	0	0	3

Course Objectives

1. To understand basic concepts and force systems in a real world environment.
2. To understand the static equilibrium of particles and rigid bodies both in two dimensions.
3. To understand the moment of surfaces and solids.
4. To understand the effect of static friction on equilibrium.
5. To understand the dynamic equilibrium equation.

UNIT I STATICS OF PARTICLES (9)

Introduction to engineering mechanics - Classifications, force vector, Law of mechanics, System of forces, transmissibility, Force on a particle – resultant of two forces and several concurrent forces – resolution of a force – equilibrium of a particle — forces in space – equilibrium of a particle in space.

UNIT II EQUILIBRIUM OF RIGID BODIES (9)

Free body diagram, moment of a force – varignon„s theorem – moment of a couple – resolution of a force and a couple. Support reactions of the beam.

UNIT III CENTROID, CENTRE OF GRAVITY AND MOMENT OF INERTIA (9)

Centroids of simple plane areas, composite areas, determination of moment of inertia of composite plane figures, polar moment of inertia-radius of gyration – mass moment of inertia of simple solids.

UNIT IV FRICTION (9)

Laws of dry friction – angles of friction- angle of repose-coefficient of static and kinetic friction — Friction in inclined plane, Ladder friction, Screw friction– rolling resistance – belt friction.

UNIT V DYNAMICS OF PARTICLES (9)

Rectilinear and Curve linear motion, -Newton„s II law – D„Alembert„s principle- Energy - potential energy kinetic energy-conservation of energy-work done by a force - work energy method, Impulse momentum method, Impact of bodies, Translation and rotation of the particles.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Define and illustrate the basic concepts of force system.
CO2: Identify the resultant force and couple, support reactions of the beam.
CO3: Calculate the Centre of gravity and moment of inertia of an object.
CO4: Examine the friction force of particles and objects for Impending Motion.
CO5: Determine the Displacement, velocity and acceleration of particles and objects

Text Books

T1 F.P.Beer, and Jr. E.R.Johnston., “Vector Mechanics for Engineers (In SI Units): Statics and Dynamics”, 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
T2 NH.Dubey, “Engineering Mechanics”, Tata Mcraw Hill, New Delhi, 2016.

References

R1 R.C.Hibbeller, and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 11th Edition, Pearson Education 2010.
R2 S.S.Bhavikatti, and K.G.Rajashekarappa, “Engineering Mechanics”, New Age International (P) Limited Publishers, 1998.
R3 P. Jaget Babu, “Engineering Mechanics”, Pearson Publisher, India Ltd, 2016.

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19PH2151	PHYSICS OF MATERIALS (COMMON TO ALL BRANCHES)	L	T	P	C
		2	0	2	3

Course Objectives

1. Acquire fundamental knowledge of semiconducting materials which is related to the engineering program.
2. Extend the knowledge about the magnetic materials.
3. Explore the behavior of super conducting materials.
4. Gain knowledge about Crystal systems.
5. Understand the importance of ultrasonic waves.

UNIT I SEMICONDUCTING MATERIALS (12)

Introduction – Intrinsic semiconductor – Compound and elemental semiconductor - direct and indirect band gap of semiconductors. Carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination. Optical properties of semiconductor – Light through optical fiber(Qualitative). ***Determination of band gap of a semiconductor. Determination of acceptance angle and numerical aperature in an optical fiber.***

UNIT II MAGNETIC MATERIALS (9)

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites and its applications.
B – H curve by Magnetic hysteresis experiment.

UNIT III SUPERCONDUCTING MATERIALS (6)

Superconductivity : properties(Messiner effect, effect of magnetic field, effect of current and isotope effects) – Type I and Type II superconductors – High Tc superconductors – Applications of superconductors –Cryotron and magnetic levitation.

UNIT IV CRYSTAL PHYSICS (6)

Crystal systems - Bravais lattice - Lattice planes - Miller indices - Interplanar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC and FCC crystal structures.

UNIT V ULTRASONICS (12)

Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Cavitations – Viscous force – co-efficient of viscosity. Industrial applications – Drilling and welding – Non destructive testing – Ultrasonic pulse echo system.
Determination of velocity of sound and compressibility of liquid – Ultrasonic wave. Determination of Coefficient of viscosity of a liquid –Poiseuille's method.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Understand the purpose of acceptor or donor levels and the band gap of a semiconductor.
CO2: Interpret the basic idea behind the process of magnetism and its applications in everyday.
CO3: Discuss the behavior of super conducting materials.
CO4: Illustrate the types and importance of crystal systems.
CO5: Evaluate the production of ultrasonics and its applications in NDT.

Text Books

T1 Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
T2 Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P)Ltd., 2015.

References

R1 Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015.
R2 MN Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., 2016
R3 Dr. G. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2016.

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19CY2151	ENVIRONMENTAL SCIENCE (COMMON TO ALL BRANCHES)	L	T	P	C
		2	0	2	3

Course Objectives

1. The natural resources, exploitation and its conservation.
2. The importance of environmental education, ecosystem and biodiversity.
3. The knowledge about environmental pollution – sources, effects and control measures of environmental pollution.
4. Scientific, technological, economic and political solutions to environmental problems.
5. An awareness of the national and international concern for environment and its protection.

UNIT I NATURAL RESOURCES (6)

Renewable and Non renewable resources - Forest resources: Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forests and tribal people - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – Energy resources: Renewable and non renewable energy sources – Solar energy and wind energy - role of an individual in conservation of natural resources.

UNIT II ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY (6)

Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem - energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the forest and ponds ecosystem – Introduction to biodiversity definition: types and value of biodiversity – hot-spots of biodiversity – threats to biodiversity– endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT III ENVIRONMENTAL POLLUTION (15)

Definition – causes, effects and control measures of: Air pollution- Water pollution – Water quality parameters- Soil pollution - Noise pollution- Nuclear hazards – role of an individual in prevention of pollution.

Determination of Dissolved Oxygen in sewage water by Winkler's method. Estimation of alkalinity of water sample by indicator method. Determination of chloride content of water sample by argentometric method.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT (9)

From unsustainable to sustainable development – urban problems related to energy- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- Municipal solid waste management. Global issues – Climatic change, acid rain, greenhouse effect and ozone layer depletion – Disaster Management – Tsunami and cyclones. ***Determination of pH in beverages.***

UNIT V HUMAN POPULATION AND THE ENVIRONMENT (9)

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – effect of heavy metals – human rights – value education – HIV / AIDS – women and child welfare – Environmental impact analysis (EIA)- GIS-remote sensing-role of information technology in environment and human health. ***Estimation of heavy metal ion (copper) in effluents by EDTA.***

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Develop an understanding of different natural resources including renewable resources.
CO2: Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
CO3: Understand the causes of environmental pollution and hazards due to manmade activities.
CO4: Demonstrate an appreciation for need for sustainable development and understand the various social issues and solutions to solve the issues.
CO5: Gain knowledge about the importance of women and child education and know about the existing Technology to protect environment

Text Books

T1 Anubha Kaushik and C. P. Kaushik, "Perspectives in Environmental studies", Sixth edition, New Age International Publishers, New Delhi, 2019.
T2 S.Annadurai and P.N. Magudeswaran, "Environmental studies", Cengage Learning India Pvt.Ltd, Delhi, 2018.

References

R1 Erach Bharucha, "Textbook of environmental studies" University Press (I) Pvt.ltd, Hyderabad, 2015.
R2 G.Tyler Miller, Jr and Scott E. Spoolman"Environmental Science" Thirteenth Edition, Cengage Learning, 2010.

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R3 Gilbert M. Masters and Wendell P. Ela "Introduction to Environmental Engineering and Science", 3rd edition, Pearson Education, 2013.

19IT2151 **PROGRAMMING IN C**

L	T	P	C
2	0	2	3

Course Objectives

1. To develop C Programs using Basic programming constructs
2. To develop C programs using Arrays and Strings
3. To develop applications in C using Functions , Pointers and Structures
4. To do Input / Output and File handling in C

UNIT I BASICS OF C PROGRAMMING (9)

Structure of C program - C programming: Data Types –Keywords – Variables - Operators: Precedence and Associativity - Expressions – Input / Output statements Decision making statements - Looping statements – Pre-processor directives - Compilation process.

Programs using decision - making and Looping Constructs.

UNIT II ARRAYS AND STRINGS (9)

Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays – String operations and String functions.

Programs Using Arrays and string functions.

UNIT III FUNCTIONS AND POINTERS (9)

Introduction to functions: Function prototype, function definition, function call - Parameter passing: Pass by value, Pass by reference – Recursion – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers — Pointer to pointers – pointer to strings. ***Programs Using Functions and Pointers***

UNIT IV STRUCTURES AND UNIONS (9)

Structure - Nested structures – Pointer to Structures – Array of structures – Self-referential structures – Dynamic memory allocation – Type def-Unions – Union of Structures. ***Programs Using Structures and Unions.***

UNIT V FILE PROCESSING (9)

Files – Types of file processing: Sequential access, Random access – Sequential access file - Random access file – Command line arguments. ***Programs Using File concepts***

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Select appropriate data types and control structures for solving a given problem.
CO2: Develop applications using arrays and strings
CO3: Understand the importance of functions, pointers and dynamic memory allocation.
CO4: Understand the Concepts of structures to develop applications in C using
CO5: Understand the sequential and random access file processing and develop applications in C

Text Books

T1 E. Balagurusamy,"Programming in ANSI C", Tata McGraw Hill, 7th Edition,2016
T2 ReemaThareja,"Programming in C", Oxford University Press, Second Edition, 2016

References

R1 Ashok.N.Kamthane,RajKamal ," Computer Programming and IT", Pearson Education (India),2012.
R2 Paul Deitel, Harvey Deitel, —"C How to Program", Eighth edition,2012, Pearson Publication.
R3 Kernighan, B.W and Ritchie,D.M, —The C Programming language, Second Edition, Pearson Education, 2012
R4 Yashavant P. Kane tkar. " Let Us C", BPB Publications, 15th Edition , July 2016.

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19ME2001	ENGINEERING PRACTICES	L	T	P	C
		0	0	4	2

Course Objectives

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

GROUP A (CIVIL & MECHANICAL)

CIVIL AND MECHANICAL ENGINEERING PRACTICES

1. Preparation of Single pipe line and Double pipe line connection by using valves, taps, couplings, unions, reducers and elbows.
2. Arrangement of bricks using English bond for 1brick thick wall and 11/2 brick thick wall for right angle corner junction.
3. Arrangement of bricks using English bond for 1brick thick wall and 11/2 brick thick wall for T junction.
4. Preparation of arc welding of Butt joints, Lap joints and Tee joints.
5. Practice on sheet metal Models– Trays and funnels
6. Hands-on-exercise in wood work, joints by sawing, planning and cutting.
7. Practice on simple step turning, taper turning and drilling.
8. Demonstration on Smithy operation.
9. Demonstration on Foundry operation.
10. Demonstration on Power tools.

GROUP B (ELECTRICAL)

ELECTRICAL ENGINEERING PRACTICES

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring.
4. Measurement of Electrical quantities – voltage, current, power & power factor in single phase circuits.
5. Measurement of energy using single phase energy meter.
6. Soldering practice using general purpose PCB.
7. Measurement of Time, Frequency and Peak Value of an Alternating Quantity using CRO and Function Generator.
8. Study of Energy Efficient Equipment‟s and Measuring Instruments.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Fabricate wooden components and pipe connections including plumbing works.

CO2: Fabricate simple weld joints.

CO3: Fabricate different electrical wiring circuits and understand the AC Circuits.

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19MA3101	FOURIER SERIES AND STATISTICS (COMMON TO AERO, AUTO, MECH & MCT)	L	T	P	C
		3	1	0	4

Course Objectives

1. Analyze Fourier series which is central to many applications in engineering.
2. Solve boundary value problems by applying Fourier series.
3. Demonstrate knowledge of large-sample statistical properties.
4. Apply basic concepts of statistical methods for testing the hypothesis.
5. Analyze design of experiment techniques to solve various engineering problem.

UNIT I FOURIER SERIES (12)

Dirichlet‟s conditions- General Fourier Series – Odd and Even Functions – Half range sine and cosine series – Change of Interval - Parseval‟s Identity - Harmonic analysis.

UNIT II BOUNDARY VALUE PROBLEMS (12)

Classification – Solution of one dimensional wave equation – One dimensional heat equation - Fourier series solution in Cartesian coordinates.

UNIT III TESTS BASED ON LARGE SAMPLES (12)

Large sample tests based on Normal distribution –Test of significance for single proportion- Test of significance for difference of proportions - Test of significance for single means -Test of significance for difference of means.

UNIT IV TESTS BASED ON SMALL SAMPLES (12)

Tests based on t (for single mean and difference of means) - F distribution for testing difference of variance, Chi – Square test for Contingency table (Test for Independency) – Goodness of fit.

UNIT V ANOVA (12)

Introduction, assumptions of analysis of variance - Completely randomized design – Randomized block design – Latin square design.

TOTAL: 60 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Understand the mathematical principles of Fourier series which would provide them the ability to formulate and solve some of the physical problems of engineering
CO2: Apply the concept of application of Fourier series in solving the heat and wave equations.
CO3: Understand the mix proportioning techniques for field applications.
CO4: Understand the concepts of statistical methods for testing the hypothesis.
CO5: Apply design of experiment techniques to solve various engineering problem.

Text Books

T1 Veerarajan. T.,”Transforms and Partial Differential Equations”, Tata McGraw Hill Education Pvt. Ltd., Reprint, New Delhi, 2016.
T2 Gupta, S.C., & Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Reprint 2019

References

R1 C.Ray Wylie “ Advanced Engineering Mathematics” Louis C. Barret, 6th Edition, Mc Graw Hill Education, India Private Limited, New Delhi 2003.
R2 Kandasamy P., Thilagavathy K. and Gunavathy K.,”Engineering Mathematics Volume III”, S.Chand & Company Ltd., New Delhi, 2015.
R3 Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2018.

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19AU3201	FLUID AND PNEUMATIC SYSTEMS	L	T	P	C
		3	1	0	4

Course Objectives

1. To Understand the Properties of Fluid, Fluid Pressure and its Measurement.
2. To learn about boundary layer concepts and flow through pipes.
3. To learn about selection of hydraulic machinery for relevant applications.
4. To learn about various hydraulic systems.
5. To gain knowledge about various pneumatic systems.

UNIT I FLUID PROPERTIES AND FLUID PRESSURE MEASUREMENT (10+2)

Units and dimensions- Properties of fluids–Flow characteristics – concept of control volume – application of continuity equation, energy equation and momentum equation– Fluid pressure – Pascal‟s law – Definitions of absolute, gauge-atmospheric and vacuum pressures – Pressure measurement – Devices (**Theory only**).

UNIT II FLOW THROUGH CIRCULAR CONDUITS (9+3)

Hydraulic and energy gradient – Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes-minor losses – Flow through pipes in series and parallel.

UNIT III HYDRAULIC MACHINES (Theory Only) (9+3)

Hydraulic turbines –Classification – Construction and working principle – Concept of cavitation in turbines– governing of turbines – Pumps Classification – Construction and working principle of Centrifugal pumps–priming-multistage centrifugal pump. Reciprocating pump, Submersible Pump- Construction and working.

UNIT IV HYDRAULIC SYSTEM (9+3)

Hydraulic systems-layout of oil hydraulic systems-components-advantages-pumps- vane pump, gear pump, screw pump-valves-working and symbols of pressure control valve- pressure relief valves, directional control valves–3/2,5/2 valves-Sequence valves-Flow control valves-Actuators-Linear actuators-Cylinders-Single acting, Double acting-Hydraulic motors-Accumulators-Types

UNIT V PNEUMATIC SYSTEM (9+3)

Pneumatic system– Layout–Components–Advantages-Compressors-Types– Construction and working–FRL unit-Control valves-flow control valves, pressure regulating valves, directional control valves– Actuators- Cylinders-Single acting, Double acting-Pneumatic motors–pneumatic Symbols-ports and positions.

TOTAL: 60 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Analyze the application of mass, momentum and energy equation in fluid flow.
CO2: Compare flow rates, pressure changes, minor and major head losses for viscous flows through pipes.
CO3: Evaluate the performance and operation of hydraulic turbines and pumps
CO4: Apply knowledge and select, operate and maintain various hydraulic systems
CO5: Understand various pneumatic systems for automation applications in suitable manufacturing system

Text Books

T1 R.K.Bansal, “Fluid Mechanics and Hydraulic Machines”, Laxmi Publication, 9th Edition, 2015.
T2 R.S.Khurmi ,” Fluid Mechanics and Machinery” , S.Chand and Company , Reprint, 2015
T3 Shanmugasundaram.K, “Hydraulic and Pneumatic controls”, S.Chand & Co, 2010.

References

R1 Ramamritham S “Hydraulic Fluid Mechanics and Fluid Machines” Dhanpat Rai & Sons,Delhi,Reprint,2015
R2 K.S.Sundaram“Pneumatic and Pneumatic Controls”, S.Chand and Company, Reprint,2015

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19AU3202	ENGINEERING THERMODYNAMICS (Common to AUTO & MECH)	L	T	P	C
		3	0	0	3

(Use of Standard and approved Steam Tables, Mollier, Compressibility and Psychrometric Charts permitted)

Course Objectives

1. To learn and quantify the energy conversion.
2. To understand the energy degradation in thermodynamic systems.
3. To understand the behavior of pure substances and working principle of steam power cycles.
4. To understand the thermodynamic relations.
5. To understand the properties of atmospheric air and its applications.

UNIT I BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS (9)

Basic concepts - concept of continuum, microscopic and macroscopic approach, path and point functions. Intensive and extensive, total and specific quantities, thermodynamic system, equilibrium, state, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer, definition and comparison, sign convention. Displacement work and other modes of work .P-V diagram. Zeroth law of thermodynamics – concept of temperature and thermal equilibrium. First law of thermodynamics –application to closed and open systems.

UNIT II SECOND LAW OF THERMODYNAMICS (9)

Heat Reservoir, source and sink. Heat Engine, Refrigerator, and Heat pump. Statements of second law and its corollaries. Carnot cycle Reversed Carnot cycle, Performance. Clausius inequality. Concept of entropy, T-s diagram, Tds Equations, entropy change for - pure substance, ideal gases – different processes, principle of increase in entropy and Availability.

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE (9)

Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. P-v-T surface. Use of Steam Table and Mollier Chart. Determination of dryness fraction. Application of I and II law for pure substances. Ideal and actual Rankine cycles, Cycle Improvement Methods - Reheat and Regenerative cycles.

UNIT IV THERMODYNAMIC RELATIONS AND GAS MIXTURES (9)

Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule-Thomson Coefficient, Clausius Clapeyron equation. Properties of Ideal and real gases, Equations of state, Vander Waals equation for ideal and real gases, reduced properties, Compressibility factor, Generalized Compressibility Chart and its use. Gas mixtures – mole and mass fractions, Dalton's law and gas constant.

UNIT V PSYCHROMETRY (9)

Psychrometric properties, Property calculations of air vapour mixtures using psychrometric chart and expressions. Psychrometric process: sensible heating and cooling, humidification, dehumidification, adiabatic saturation, adiabatic mixing of two streams.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Demonstrate the thermodynamic principles and its applications.
CO2: Quantify the energy conversion in various thermal systems.
CO3: Identify the losses and inefficient components in the thermodynamic system.
CO4: Apply the thermodynamic principles for predicting the properties of steam, gas and gas mixtures.
CO5: Apply the psychrometric principles for design of air conditioning systems.

Text Books

T1 Nag.P.K., "Engineering Thermodynamics", 4th Edition, Tata McGraw-Hill, New Delhi, 2017.
T2 Cengel .Y.and Boles.M,"Thermodynamics –An Engineering Approach",8th Edition, Tata McGraw Hill,2010.

References

R1 Holman.J.P., "Thermodynamics", 3rd Edition. McGraw-Hill, 2014.
R2 Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", Anuragam Publications, 2012.

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		L	T	P	C
19AU3203	**THEORY OF AUTOMOTIVE ENGINES** (Courses offered in Collaborations with Hindusthan – Eicher and Royal Enfield Centre of Excellence Regional Competency Development Centre)	**3**	**0**	**0**	**3**

Course Objectives

1. To impart knowledge on various engine components and working cycles
2. To acquire knowledge in injection and ignition system
3. To understand the combustion phenomena and design consideration in SI engine
4. To understand the combustion phenomena and design consideration in CI engine
5. To identify the nature of pollutant formation and control techniques

UNIT I INTERNAL COMBUTION ENGINES (9)

Introduction - Construction and Working of Two & Four stroke SI and CI engines - Comparison of SI and CI engines and four stroke SI and CI engines - Engine classification-firing order - Otto cycle, diesel cycle and dual cycles-problems.

UNIT II INJECTION AND IGNITION SYSTEMS (9)

Diesel fuel injection systems-types-Function- Fuel Injection Pump, Jerk distributor, mechanical and Pneumatic speed governor-Fuel Injector-Types of nozzle-CRDI.

Air fuel ratio–Carburetion–types of Carburetor-Spark plug-Ignition Systems–battery coil- magneto coil-Electronic type-Petrol injection system-MPFI.

UNIT III COMBUSTION IN S.I. ENGINES (9)

SI Engine combustion - Combustion chambers - Stages of Combustion – Knocking–Factors affecting flame propagation-Detonation – Types of Injection in SI Engines, Flame structure and speed, Lean burn combustion, Stratified charge combustion systems.

UNIT IV COMBUSTION IN C.I. ENGINES (9)

CI Engine Combustion–Fuel spray formation, Air motion, Swirl Combustion, Stages of Combustion-Factors affecting Ignition delay-knocking- comparison of knock in CI & SI engine- types of Injection in CI engines.

UNIT V ENGINE PERFORMANCE AND EMISSION STANDARD (9)

Indicated power, Brake power, Engine Torque ,Mechanical Efficiency, Air standard Efficiency -Emissions-Types-CO,HC,NOx,SO_2 - Emission control measures for IC engines, Barat Stage (BS) & Norms, BS - I,II,III,IV&VI - Engines-Effect of emissions on environment and human beings.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Illustrate the fundamental concepts and functions of an automotive engine and working cycles.
CO2: Identify the type of injection and ignition systems.
CO3: Gain in depth knowledge in combustion phenomena in SI engines
CO4: CI engines combustions were studied for getting wide knowledge in combustion.
CO5: Apply the knowledge to measure the pollution and control.

Text Books

T1 John B.Heywood , " Internal Combustion Engines" , McGraw-Hill Book Company
T2 M.L. Mathur and R.P.Sharma, Internal Combustion Engine, Dhanpath Rai Publications (P) Ltd, New Delhi
T3 V. Ganesan, Internal Combustion Engines, Tata-McGraw Hill Publishing Co., New Delhi

References

R1 K. K. Ramalingm, internal Combustion Engines, Scitech publications, Chennai, 2003.
R2 Heldt, P.M., High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta
R3 Obert, E.F., Internal Combustion Engine analysis and Practice, International Text Book Co.,Scranton, Pennsylvania, 1988.

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19AC3191	INDIAN CONSTITUTION	L	T	P	C
		2	0	0	2

Course Objectives

1. Sensitization of student towards self, family (relationship), society and nature.
2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals.
3. Strengthening of self reflection.
4. Development of commitment and courage to act.

UNIT I BASIC FEATURES AND FUNDAMENTALE PRINCIPLES (4)

Meaning of the constitution law and constitutionalism – Historical perspective of the constitution of India – salient features and characteristics of the constitution of India.

UNIT II FUNDAMENTAL RIGHTS (4)

Scheme of the fundamental rights – fundamental duties and its legislative status – The directive principles of state policy – its importance and implementation - Federal structure and distribution of legislative and financial powers between the union and states.

UNIT III PARLIAMENTARY FORM OF GOVERNMENT (4)

The constitution powers and the status of the president in India. – Amendment of the constitutional powers and procedures – The historical perspective of the constitutional amendment of India – Emergency provisions : National emergency, President rule, Financial emergency.

UNIT IV LOCAL GOVERNANCE (4)

Stages of combustion, vapourisation of fuel droplets and spray formation, air motion, swirl combustion, knock and engine variables, Features and design considerations of combustion chambers, delay period correlations.

UNIT V INDIAN SOCIETY (4)

Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

TOTAL: 20 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Illustrate the functions of the Indian government

CO2: Illustrate the the rules of the Indian constitution.

Text Books

T1 Durga Das Basu, “Introduction to the Constitution of India “, Prentice Hall of India, New Delhi.

T2 R.C.Agarwal, “Indian Political System”, S.Chand and Company, New Delhi, 1997.

T3 Maciver and Page, “ Society: An Introduction Analysis “, Mac Milan India Ltd., New Delhi.

T4 K.L.Sharma, “Social Stratification in India: Issues and Themes”, Jawaharlal Nehru University, New Delhi,1977

References

R1 Sharma, Brij Kishore, “ Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.

R2 U.R.Gahai, “Indian Political System “, New Academic Publishing House, Jalaendhar.

R3 R.N. Sharma, “Indian Social Problems “, Media Promoters and Publishers Pvt. Ltd.

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19AU3251	AUTOMOTIVE STRUCTURES AND DESIGN	L	T	P	C
		2	0	2	3

Course Objectives

1. To study the principles simple stresses strains and deformation in components.
2. To assess stresses and deformations in beams through shear force and bending moment diagrams.
3. To learn about effect of torsion in shafts and springs
4. Gain knowledge about deflection on beams
5. Learn about the stresses in pressure vessels and effect of strain energy for various loading

UNIT I STRESS STRAIN AND DEFORMATION OF SOLIDS (9)

Rigid and Deformable bodies – Mechanical properties–Stress- Strain Curve – Tension, Compressive and Shear stresses – Deformation of simple and compound bars – Thermal stress – Elastic constants – Volumetric strains- Principal planes & Stresses.

Determination of Tensile test on mild steel rod.

UNIT II BEAMS - LOADS AND STRESSES (9)

Types of beams – Supports and Loads – Shear force and Bending Moment in beams – Cantilever and Simply supported beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Transverse Shear stresses in beams.

Measurement of Stress due to bending using a strain gauge.

UNIT III TORSION OF SHAFTS AND SPRINGS (9)

Torsion Equation-Stress and Deformation in Solid and hollow circular shafts – Stepped shaft –Deflection in shaft subjected to various boundary conditions–Stresses in helical coil springs – Design of helical coil springs, Leaf Springs.

Determine the Torsion test on mild steel rod, Determine Compression test on helical springs.

UNIT IV DEFLECTION OF BEAMS (9)

Double integration method, Macaulay Method, and Moment-area Method –Conjugate beam for computation of slopes and deflection in beams.

Deflection Test on Simply Supported Beams.

UNIT V STRESS IN THIN CYLINDERS AND IMPACT LOADING (9)

Stress due to internal Pressure – Circumferential and Longitudinal stresses and deformation – Thin cylinders– Introduction–Strain energy stored in a body- Gradual-Sudden-Impact loads.

Determine the Impact test on metal specimen–Charpy and Izod.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Illustrate the behavior of materials for different loading conditions.
CO2: Classify the types of beams and various loads acting on it.
CO3: Summarize the concept of torsion loads acting on shafts.
CO4: Illustrate the concept of deflection and its significance
CO5: Calculate the stresses in thin cylinders and impact loading on machine components.

Text Books

T1 James M Gere, Barry J Goodno, "Mechanics of Materials, SI Edition", Ninth Edition, Cengage Learning, 2018
T2 S.S.Rattan ,"Strength of Materials" , McGraw Hill Education , Second Edition , 2015
T3 R.K.Rajput, 'Strength of Materials', S Chand; 4th Rev. Edition 2007.

References

R1 Beer F. P. and Johnston R, "Mechanics of Materials", McGraw-Hill Book Co, 7th Edition, 2014
R2 Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 2011.
R3 Russell C. Hibbeler, "Mechanics of Materials", Tenth Edition, Pearson education, 2017

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19AU3001	COMPUTER AIDED DRAWING LAB (Courses offered in Collaborations with Autodesk India)	L	T	P	C
		0	0	3	1.5

Course Objectives

1. To familiarize the students to use modeling software and advanced tools.
2. To apply the basic drawing knowledge to develop various views.
3. To make the students familiar with various dimensioning and text methods.
4. To develop skills on diagram reading and modelling.
5. To make them study the 3D printing functionality.

LIST OF EXPERIMENTS

1. Basic and Advanced Modelling commands and tools practice
2. Creation of 2D elevation, Plan and Side views with industry ready template
3. Modeling and view generation of Sleeve and Cotter Joints
4. Modeling and view generation of Knuckle Joint
5. Modeling and view generation of Screw Jack
6. Modeling and view generation of Universal Coupling
7. Modeling and view generation of Flange Coupling
8. Modeling and view generation of Piston with Connecting Rod
9. Modeling and view generation of Gear Box Cover
10. Introduction to 3D Printing

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Ability to use the drafting software for machine elements drawing.
CO2: Illustrate the correlated the various view.
CO3: Students can have capable of mark the notation on various parts with uniform styling
CO4: Students able to develop the view from isometric modeling.
CO5: Enrich the knowledge on 3D printing applications

LIST OF EQUIPMENT

S.No.	Name of the Equipment	QTY
1	Computer Nodes	30 Nos.
2	Drafting Modelling Software	30 License

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		L	T	P	C
19AU3002	**AUTOMOTIVE COMPONENTS LABORATORY** (Courses offered in Collaborations with Hindusthan – Eicher & Royal Enfield Centre of Excellence Regional Competency Development Centre)	**0**	**0**	**3**	**1.5**

Course Objectives

1. To Understand the function petrol and diesel engines
2. To acquire knowledge of fuel supply systems in petrol and diesel engines
3. To study the commercial vehicle frame chassis
4. To understand the working and function of axles and differentials
5. To understand the function of clutch and gearbox arrangements

LIST OF EXPERIMENTS

1. Dismantling and study of Multi-cylinder Petrol Engine
2. Assembling of Multi-cylinder Petrol Engine
3. Dismantling and study of Multi-cylinder Diesel Engine
4. Assembling of Multi-cylinder Diesel Engine
5. Study of petrol engine fuel system
6. Study of diesel engine fuel system
7. Study and measurement of light and heavy commercial vehicle frame
8. Study, dismantling and assembling of front and rear axles
9. Study, dismantling and assembling of differential
10. Study, dismantling and assembling of Clutch
11. Study, dismantling and assembling of Gear Box
12. Study of steering system

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Differentiate the function of petrol and diesel engines
CO2: Illustrate the petrol and diesel fuel supply system functions
CO3: Determine the length, width and other functional parts location on both heavy and light duty vehicle frame
CO4: Acquire knowledge the various parts function in axles and differentials
CO5: Gain knowledge on clutch and gear box arrangements and functions

LIST OF EQUIPMENTS

S.No.	NAME OF THE EQUIPMENTS	QTY
1	Multi Cylinder Petrol Engine	2
2	Multi Cylinder Diesel Engine	2
3	Petrol and Diesel Fuel System Each	2
4	Heavy Duty Vehicle Chassis Frame	1
5	Light Duty Vehicle Chassis Frame	1
6	Front Axle	2
7	Rear Axle	2
8	Differential	2
9	Clutch and Gear Box (Light & Heavy Duty) Each	2
10	Steering Systems with different Gear Boxes	Each 1

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19MA4113	NUMERICAL METHODS (Common to AERO, AUTO, MECH, MCT, EEE & EIE)	L	T	P	C
		3	1	0	4

Course Objectives

1. Solve algebraic, transcendental and system of linear equations by using various techniques.
2. Analyze various methods to find the intermediate values for the given data.
3. Explain concepts of numerical differentiation and numerical integration of the unknown functions.
4. Explain single and multi step methods to solve Ordinary differential equations.
5. Describe various methods to solve ordinary differential equations and partial differential equations.

UNIT I SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS (12)

Solution of Algebraic and Transcendental equations: Newton Raphson method. Solution of linear system: Gauss Elimination - Gauss Jordan method -Gauss seidel method. Matrix inversion by Gauss Jordan method.

UNIT II INTERPOLATION (12)

Interpolation - Newton‟s forward and backward difference formulae – Newton‟s divided difference formula and Lagrangian interpolation for unequal intervals.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION (12)

Numerical Differentiation: Newton‟s forward and backward interpolation formulae for equal intervals –Newton‟s divided difference formula for unequal intervals. Numerical integration: Trapezoidal and Simpson‟s 1/3 rule - Double integration using Trapezoidal and Simpson‟s rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS (12)

Single step methods for solving first order equations: Taylor‟s series method – Euler and Modified Euler methods – Fourth order Runge-kutta method -Multi step method: Milne‟s predictor and corrector method.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS (12)

Solution of second order ordinary differential equation by Finite difference method – Solution of partial differential equation: one dimensional heat equation by Bender schmidt method – One dimensional Wave equation by Explicit method– Poisson Equations by Finite difference method.

TOTAL: 60 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Solve the system of linear algebraic equations which extends its applications in the field of engineering.
CO2: Apply various methods to find the intermediate values for the given data.
CO3: Identify various methods to perfrom numerical differentiation and integration.
CO4: Classify and solve ordinary differential equations by using single and multi step methods.
CO5: Illustrate various methods to find the solution of ordinary and partial differential equations.

Text Books

T1 Sankara Rao K, “Numerical Methods for Scientists and Engineers”, 3rd edition, Prentice Hall of India Private limited, New Delhi,2008.
T2 M.K.Jain,S.R.K.Iyengar, R.K.Jain “Numerical methods for Scientific and Engineering Computation”, Fifth Edition, New Age International publishers 2010.

References

R1 Kreyszig.E.“Advanced Engineering Mathematics”, Tenth Edition, John Wiley and sons (Asia) limited,2017.
R2 Grewal B.S. and Grewal J.S. “ Numerical Methods in Engineering and Science”, 6th Edition, Khanna publishers, New Delhi 2015.
R3 S.K.Gupta, Numerical Methods for Engineers” , New Age International Pvt.Ltd Publishers,2015.

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19AU4201	MECHANISM AND MACHINE THEORY	L	T	P	C
		3	1	0	4

Course Objectives

1. To know different types of inversions in the mechanisms
2. Study about the working principle of gears and cams
3. To know the frictional forces acting and how to resolve the friction
4. To study the forces acting on various members in a mechanism
5. To know the importance of vibration acting on systems

UNIT I INTRODUCTION TO MECHANISMS (11)

Mechanisms-terminology and definitions-Grashoff‟s law-Grueblers criteria –kinematics inversions of four bar and slide crank chain-determination of velocity and acceleration-simple mechanisms.

UNIT II GEARS AND CAMS (13)

Gear profile and geometry –nomenclature of spur and helical gears –gear trains: simple, compound gear trains and Epicyclic gear trains and –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.

UNIT III FRICTION (12)

Sliding and rolling friction – bearings- friction clutches -friction drives-belt and rope drives.

UNIT IV BALANCING (12)

Static and dynamic balancing of rotating masses in different planes-balancing of rotors –balancing of machines-partial balancing of reciprocating masses of inline.

UNIT V VIBRATION (12)

Free and damped vibrations of single degree of freedom systems-longitudinal, transverse and torsional-forced vibration –harmonic excitation-magnification factor-vibration isolation and transmissibility. Introduction to vibrations of multi-degree freedom systems.

TOTAL: 60 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Understand the velocity and acceleration of various links of simple mechanisms.
CO2: Analyze and apply the concepts for designing the gear trains and cam mechanisms for transmission of power and torque.
CO3: Analyze and to solve the friction causing in the machine members
CO4: Apply the knowledge of balancing concepts in designing the rotating and reciprocating machine components.
CO5: Evaluate and analyze the various vibrations a machine member.

Text Books

T1 Bansal R.K., “Theory of Machines”, Laxmi Publications Pvt Ltd., New Delhi, 20th edition 2009.
T2 R.S.Khurmi & J.K.Gupta., Theory of Machines, S.Chand & Co.Ltd., New Delhi Reprint 2015.
T3 Rattan S.S., "Theory of Machines", 4th Edition, McGraw Hill Education, New Delhi, 2017.

References

R1 Ghosh.A and A.K.Mallick, Theory and Machine, Affiliated East-West Pvt.Ltd., New Delhi, 3rd Edition, 2014.
R2 S.S.Ratan,”Theory of Machines “Tata McGrawhill,4th Edition,2014
R3 Shigley J.E.,Pennock G.R and Uicker J.J.,Theory of Machines and Mechanisms, Oxford University Press,4th Edition,2014

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		L	T	P	C
19AU4202	**AUTOMOTIVE ENGINE COMPONENTS DESIGN** (Courses offered in Collaborations with Hindusthan – Eicher and Royal Enfield Centre of Excellence Regional Competency Development Centre)	**3**	**1**	**0**	**4**

Course Objectives

1. To build the students understand the design concepts of various engine components like cylinder, piston, connecting rod, crankshaft, flywheels, and valve mechanisms.
2. To understand the energy conversion and various loads acting on the engine components.
3. To develop the students familiar in balancing of rotating masses.
4. To craft the students to understand the motion study of gyratory components
5. To make the students to design the engine components according to engineering materials and industry standards.

UNIT I INTRODUCTION (12)

Engineering materials-Introduction endurance limit-notch sensitivity-Tolerances and fits –types-design considerations for interference fits-surface finish-surface roughness-Rankine‟s formula- Tetmajer‟s formula-Johnson formula-design of pushrods.

UNIT II DESIGN OF CYLINDER, PISTON AND CONNECTING ROD (12)

Cylinder and piston-material-design of cylinder-piston-piston pin-piston rings-piston failures- lubrication of piston assembly. Connecting rod-Material-determining minimum length of connecting rod- design of small end-shank-big end-cap bolts.

UNIT III DESIGN OF CRANKSHAFT (12)

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

UNIT IV DESIGN OF FLYWHEELS (12)

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

UNIT V DESIGN OF VALVES AND VALVE TRAIN (12)

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

TOTAL: 60 PERIODS

Note: (Use of P S G Design Data Book is permitted in the University examination)

Course Outcomes

At the end of this course students will be able to:

CO1: Impart knowledge in automotive engine component materials and stress strain acting on it.
CO2: Compute the design dimensions of various engine components.
CO3: Identify optimal design solutions and to develop their own ideas in compliance with industry standards.
CO4: Familiarize and to demonstrate the engine balancing of rotating masses.
CO5: Command over the automotive engines design with modern system tools.

Text Books

T1 Khurmi R.S. & Gupta J.K, "A Text Book of Machine Design", 14th Edition, Eurasia Publishing House Pvt. Ltd., 2005.
T2 Robert C. Juvinall and Kurt M. Marshek, “Fundamentals of Machine component Design”,6th Edition, Wiley, 2017

References

R1 Jain.R.K, “Machine Design”, Khanna Publishers, New Delhi, 2005.
R2 Giri.N.K, "Automobile Mechanics", Khanna Publishers, New Delhi, 2014.
R3 “Design Data Hand Book”, PSG College of Technology, Coimbatore, 2013.

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		L	T	P	C
19AU4203	**TWO AND THREE WHEELER TECHNOLOGY** (Courses offered in Collaborations with Hindusthan – Royal Enfield Centre of Excellence Regional Competency Development Centre)	**3**	**0**	**0**	**3**

Course Objectives

1. To know and understand the constructional details, operating characteristics and regulations of two and three wheelers.
2. To obtain knowledge of vehicle frame structure and analyze it in two wheelers.
3. To Demonstrate the transmission and braking systems.
4. To acquire a knowledge in design of three wheelers for different application
5. To know about recent development and advancement in Two and Three Wheelers.

UNIT I THE ENGINE AND FUEL SUPPLY SYSTEM (9)

Two Wheeler – Types – Layouts - Engine – Two and Four stroke – Selection Criteria – Design Consideration – Carburetor – Different Circuits – Two Wheeler Carburetor – Fuel injection systems – Layout - Pump – Injector – ECU.

UNIT II VEHICLE FRAME AND WHEELS (9)

Frame – Load – Design Consideration – Components – Mounting method – types of frame – frame material – Ergonomics – Wheel Types – Tyre – Designation – Requirements – Cross & Radial Ply – Tube – Tubeless Tyres.

UNIT III TRANSMISSION AND BRAKING SYSTEM (9)

Transmission Layout – Primary Reduction – Clutch – Single, Multi and Centrifugal – Gear Box – Constant Mesh – Sequential – CVT – Final Drive – Brake action – Theory – Design Consideration – Drum & Disc Brake – Control System – Mechanical – Hydraulic – Master Cylinder – ABS.

UNIT IV THREE WHEELER VEHICLES (9)

Three Wheeler – Types – Layout – Loading Auto Rickshaws – Types –Engines types – Drive Train – Suspension – Rear – Passenger – Loading Auto – Braking System – Master Cylinder – Wheel Cylinder – Hand Brake – Frame and Body.

UNIT V CASE STUDY & RECENT DEVELOPMENTS (9)

Case study of – Bike – Auto - Sports bike -Electric Bike- All terrain bike - Recent developments – ABS, DTSi, DTS-Si, CVTi, CDI, ATFT, Triple Spark, Self balancing vehicles, Engine electronics, Exhaust TEC, Ecothrust Technology.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Summarize the various subsystem of two and three wheeler.
CO2: Illustrate parts with vehicle frame of two wheelers.
CO3: Organize the Transmission and braking System of two wheelers.
CO4: Rephrase the three wheelers systems and functionality.
CO5: Outline the various new advancements in two and three wheelers technology.

Text Books

T1 Dhruv U Panchal,"Two and Three Wheeler Technology", PHI Learning Pvt., Ltd., 2015
T2 Ramalingam. K. K., "Two Wheelers", Scitech publications, 2016.

References

R1 John Robinson, "Service Manuals of Manufacturers of Indian Two & Three wheelers.
R2 Butterworth-Heinemann, "Motorcycle Tuning: Chassis", 2001.

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19AC4191	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L	T	P	C
		2	0	0	0

Course Objectives

1. The course aims at imparting basic principles of thought process, reasoning and inference.
2. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
3. Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
4. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view, basic principles of Yoga and holistic health care system, Indian philosophical traditions,Indian linguistic tradition and Indian artistic tradition.

UNIT I	**BASIC STRUCTURE OF INDIAN KNOWLEDGE SYSTEM**	**(4)**
UNIT II	**MODERN SCIENCE AND INDIAN KNOWLEDGE SYSTEM**	**(4)**
UNIT III	**YOGA AND HOLISTIC HEALTH CARE**	**(4)**
UNIT IV	**PHILOSOPHICAL TRADITION INDIAN LINGUISTIC TRADITION (PHONOLOGY, MORPHOLOGY, SYNTAX AND SEMANTICS)**	**(4)**
UNIT V	**INDIAN ARTISTIC TRADITION AND CASE STUDIES**	**(4)**

TOTAL: 20 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Ability to understand the structure of Indian system of life.

CO2: Connect up and explain basics of Indian Traditional knowledge in modern scientific perspective.

References

R1 V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.

R2 V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan,

R3 Fritzof Capra, The wave of Life.

R4 V N Jha (Eng. Trans,), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation, Velliarnad, Amakuam

R5 Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta.

R6 GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi, 2016.

R7 RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016.

R8 R Sharma (English translation), Shodashang Hridayam.

19AU4251	FUNDAMENTALS OF HEAT TRANSFER	L	T	P	C
		2	0	2	3

Course Objectives

1. Understand the mechanisms of heat transfer under steady and transient conditions.
2. To understand the concepts of heat transfer through extended surfaces.
3. To learn the thermal analysis and sizing of heat exchangers.
4. To understand the concepts of Radiation heat transfer.
5. To understand the basic concepts of Refrigeration and Air-conditioning.

(Use of standard Heat and Mass Transfer data book, Refrigeration table and phychrometric chart is permitted)

UNIT I CONDUCTION (10)

General Differential equation of Heat Conduction– Cartesian and Polar Coordinates – One Dimensional Steady State Heat Conduction — plane and Composite Systems – Conduction with Internal Heat Generation –Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis –Semi Infinite and Infinite Solids –Use of Heisler‟s charts.

Determine the Heat transfer coefficient in composite walls.

UNIT II CONVECTION (9)

Free and Forced Convection - Hydrodynamic and Thermal Boundary Layer. Free and Forced Convection during external flow over Plates and Cylinders and Internal flow through tubes.

Determination of heat transfer coefficient under natural convection from a vertical cylinder.

Determination of heat transfer coefficient under forced convection from a tube.

UNIT III BOILING,CONDENSATION AND HEAT EXCHANGERS (9)

Nusselt‟s theory of condensation - Regimes of Pool boiling and Flow boiling. Correlations in boiling and condensation. Heat Exchanger Types - Overall Heat Transfer Coefficient – Fouling Factors -Analysis – LMTD method - NTU method.

Determine the Effectiveness of Parallel and counter-flow heat exchanger.

UNIT IV RADIATION (9)

Black Body Radiation – Grey body radiation - Shape Factor – Electrical Analogy – Radiation Shields. Radiation through gases. ***Determination of emissivity of a grey surface.***

UNIT V REFRIGERATION AND AIR – CONDITIONING (9)

Vapour compression refrigeration cycle, Effect of Superheat and Sub-cooling, Performance calculations, working principle of air cycle, vapour absorption system, and thermoelectric refrigeration. Air conditioning systems, concept of RSHF, GSHF and ESHF, Cooling load calculations.

Determination of COP of a refrigeration system.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Apply heat conduction equations to different surface configurations under steady state and transient conditions and solve problems.

CO2: Apply free and forced convective heat transfer correlations to internal and external flows through various surface configurations and solve problems

CO3: Apply LMTD and NTU methods of thermal analysis to different types of heat exchanger configurations and solve problems

CO4: Explain basic laws for Radiation and apply these principles to radiative heat transfer between different types of surfaces to solve problems

CO5: Solve problems using refrigerant table / charts and psychrometric charts.

Text Books

T1 Nag P.K., "Heat Transfer", Tata McGraw Hill, New Delhi, Third Edition, Reprint, 2011.

T2 Yunus A. Cengel, "Heat Transfer A Practical Approach", Tata McGraw Hill, 5th Edition 2015.

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Principal / Dean (Academics)

References

R1 Frank P. Incropera and David P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley & Sons, 8th Edition, 2010.

R2 Kothandaraman, C.P., "Fundamentals of Heat and Mass Transfer", New Age International, New Delhi,4th Edition, Reprint, 2015.

R3 Holman, J.P., "Heat and Mass Transfer", Tata McGraw Hill, 10th Edition, 2011.

R4 R.C. Sachdeva, “Fundamentals of Engineering Heat & Mass transfer”, New Age International Publishers, 5th Edition, Reprint, 2018.

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		L	T	P	C
19AU4001	**COMPUTER AIDED AUTOMOTIVE ENGINE COMPONENTS DESIGN LABORATORY** (Courses offered in Collaborations with Autodesk India)	0	0	3	1.5

Course Objectives

1. To familiarize the students to use modeling software to model engine components, chassis components
2. To apply the basic design knowledge for designing the engine and chassis components
3. Students able to study and understand the loads and stresses acting on the engine components
4. To make the students know about balancing of the rotating components
5. Able to make assembly and simulation of the engine components

LIST OF EXPERIMENTS

1. Modeling practice on advanced modeling tool
2. Drawing and assembly of piston and its components
3. Drawing and assembly of Connecting rod
4. Drawing of crank shafts and crank webs
5. Balancing weight calculations for rotating masses
6. Drawing of flywheel and ring gear teeth assembly
7. Drawing and assembly of intake and exhaust manifolds
8. Drawing and assembly of inlet and exhaust valves
9. Design and modelling of propeller shaft with universal joint.
10. Introduction to animation and the assembly

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Use the drafting and modeling software for automobile components design
CO2: Solve the engine components design calculation
CO3: Validate the selection of material and standard of the components according to the design aspects
CO4: Synthesize, analyse and document the design of various components
CO5: Forecast the faults by means of simulation of assembly

LIST OF EQUIPMENT

S.No.	Name of the Equipment	QTY
1	Computer Nodes	30 Nos.
2	Drafting Modelling Software	30 License

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		L	T	P	C
19AU4002	**TWO AND THREE WHEELERS LABORATORY** (Courses offered in Collaborations with Hindusthan – Royal Enfield Centre of Excellence Regional Competency Development Centre)	**0**	**0**	**3**	**1.5**

Course Objectives

1. To conduct performance test of a two wheeler using chassis dynamometer
2. To conduct performance test of a shock absorber and coil spring
3. To dismantle and assemble the two and three wheeler gear box and to find gear ratio
4. To study about the three wheeler chassis frame and power transmission system
5. To study about the three wheeler chassis frame, steering and power transmission systems

LIST OF EXPERIMENTS

1. Performance test of a two wheeler using chassis dynamometer.
2. Performance test on shock absorber
3. Performance test on coil spring.
4. Two wheeler chain test
5. Brake and Clutch adjustment as per specification.
6. Dismantling and assembling of two wheeler gear box and finding gear ratios
7. Dismantling and assembling of three wheeler box and finding gear ratios
8. Three wheeler brake and clutch play adjustment
9. Dismantling and assembling of three wheeler steering system.
10. Study of three wheeler chassis frame and power transmission system

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Simplify the engine components and conduct performance test on two and three wheelers.
CO2: Analyze the various testing procedure of two wheelers using chassis dynamometer
CO3: Identify the performance of Shock Absorber by using shock absorber test rig
CO4: Make use of suitable tools to dismantle & assemble of gearbox of two and three wheelers and drawing of power flow diagram from Input shaft to output shaft
CO5: Make use suitable tools to dismantle & assemble three wheeler steering system and rectifying it.

LIST OF EQUIPMENT

S.No.	Name of the Equipment	QTY
1	Two wheeler chassis dynamometer	1
2	Coil spring test rig	1
3	Chain tension test rig	1
4	Shock absorber test rig	1
5	Two-wheeler gearbox	2
6	Two-wheeler clutch	2
7	Three-wheeler brake assembly	2
8	Three-wheeler steering assembly	2
9	Three-wheeler gear box	2

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		L	T	P	C
19AU5201	**AUTOMOTIVE EMISSION AND POLLUTION CONTROL** (Courses offered in Collaborations with Hindusthan – Eicher Centre of Excellence Regional Competency Development Centre)	**3**	**0**	**0**	**3**

Course Objectives

1. To create an awareness on the various environmental pollution aspects and issues.
2. To analyze the formation of major pollutants like CO, NO_x in SI Engine.
3. To design various control techniques to reduce pollutants in CI Engine combustion.
4. To determine the various after treatment process to minimize emissions.
5. To impart knowledge on various emission instruments and techniques.

UNIT I INTRODUCTION (7)

Sources of Pollution. Various emissions from Automobiles — Formation — Effects of pollutants on environment human beings. Emission control techniques – Emission standards-BS IV and BS VI Standards.

UNIT II EMISSION FROM SPARK IGNITION ENGINE AND ITS CONTROL (10)

Emission formation in SI Engines- Carbon monoxide- Unburned hydrocarbon, NOx, Smoke —Effects of design and operating variables on emission formation – controlling of pollutants –Catalytic converters — Charcoal Canister — Positive Crank case ventilation system, Secondary air injection, thermal reactor, Laser Assisted Combustion.

UNIT III EMISSION FROM COMPRESSION IGNITION ENGINE AND ITS CONTROL (10)

Formation of White, Blue, and Black Smokes, NOx, soot, sulphur particulate and Intermediate Compounds – Physical and Chemical delay — Significance Effect of Operating variables on Emission formation — Fumigation, EGR, HCCI, Particulate Traps, SCR — Cetane number Effect.

UNIT IV NOISE POLLUTION FROM AUTOMOBILES (9)

Sources of Noise — Engine Noise, Transmission Noise, vehicle structural noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction — Silencer Design.

UNIT V TEST PROCEDURE, INSTRUMENTATION & EMISSION MEASUREMENT (9)

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dyno - Seven mode and thirteen mode cycles for Emission Sampling — Sampling problems — Emission analyzers —NDIR, Flame ionization detectors, Chemiluminescent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Demonstrate the fundamentals of formation of automobile pollutions in IC Engines.
CO2: Design the control techniques for minimizing emissions in SI Engine.
CO3: Demonstrate the fundamentals of formation of emission and control in CI Engines.
CO4: Identify the various methods to reduce the noise emissions.
CO5: Experiment with the various methods of test procedures and measurement in automotive engines.

Text Books

T1 G.P.Springer and D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York, 1986.
T2 Pundir. B.P., " IC Engines Combustion and Emissions" Narosa Publishers, Second edition, 2017
T3 D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985

References

R1 Ronald M. Heck, Robert J. Farrauto, Suresh T. Gulati ,"Catalytic Air Pollution Control: Commercial Technology", 3rd Edition,April 2012, Wiley.
R2 Ganesan,V., "Internal Combustion Engines", Tata McGraw Hill Co., 2010
R3 J. Robert Mondt," Cleaner Cars: The History and Technology of Emission Control",Annotation c. Book News, Inc., Portland,2000.
R4 L.Lberanek, 'Noise Reduction', Mcgrawhill Company., New York 2019.

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		L	T	P	C
19AU5202	**VEHICLE DESIGN AND DATA CHARACTERISTICS** (Courses offered in Collaborations with Hindusthan – Eicher and Royal Enfield Centre of Excellence Regional Competency Development Centre)	**3**	**1**	**0**	**4**

Course Objectives

1. To define the selection procedure of various vehicle specifications for design.
2. To acquire knowledge about the resistance offered to a vehicle and its effects in performance.
3. To understand the effects of performance characteristics over design in a vehicle.
4. To understand the method of designing an engine.
5. To understand about the working of fuel systems in a modern vehicle.

UNIT I INTRODUCTION (12)

Study and selection of vehicle specifications - Choice of Cycle, fuel, speed, cylinder arrangement, method of cooling, material, design and operating variables affecting performance and emission.

UNIT II RESISTANCE TO VEHICLE MOTION (12)

Air and Rolling Resistances at various vehicle speed, Grade Resistance, Calculation and Plotting of Driving force, Power requirement for different loads and acceleration, Maximum Power calculation.

UNIT III PERFORMANCE CURVES (12)

Torque and Mechanical Efficiency, Interpolation of Pressure – Volume diagram, Calculation of frictional Mean Effective Pressure, Calculation of Engine Cubic Capacity.

UNIT IV ENGINE DESIGN (12)

Derivation of connecting rod length to Crank Radius Ratio - Resultant force against Crank Angle, Turning Moment and Side Thrust against Crank Angle.

UNIT V FUEL SYSTEMS (12)

SI engine fuel supply system – types –Air and Fuel flow in carburetor – Critical velocity – relationship curve for engine speed, fuel and air flows - CI engine fuel supply system – Injector – velocity and work force calculation.

TOTAL: 60 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Demonstrate the design requirements of a vehicle design and procedure.
CO2: Apply the resistance offered to the vehicle and its ability to propel.
CO3: Acquired the performance of the engine and its capacity.
CO4: Approach design concepts of an engine and understand the forces acting within the engine.
CO5: Interpret the working and effectiveness of the fuel systems of a vehicle.

Text Books

T1 Giri. N. K., "Automotive Mechanics", Khanna Publishers, New Delhi, 2015
T2 Heldt, P.M., "High Speed Combustion Engines", Oxford and I.B.H. Publishing Co., Kolkata, 2015.

References

R1 Gupta. R.B., "Automobile Engineering", SathyaPrakashan, 2016.

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19AU5203	AUTOMOTIVE FUELS AND LUBRICANTS	L	T	P	C
		3	0	0	3

Course Objectives

1. To understand the manufacture of fuels and lubricants for the design and operation of the I.C engines.
2. To understand the different types of lubrication used in the automotive fuels and lubricants
3. To summarize the properties, additives and mechanism of lubricants.
4. To study the combustion characteristics of fuels in I.C. Engines
5. To Illustrate the combustion and fuel rating.

UNIT I MANUFACTURE OF FUELS AND LUBRICANTS (9)

Fuels-Structure of petroleum-refining process-Thermal cracking, catalytic cracking, polymerization, alkylation, isomerisation, blending- Manufacture of lubricating oil base stocks and finished automotive lubricants.

UNIT II THEORY OF LUBRICATION (9)

Engine friction- Introduction- Mechanical efficiency-Mechanical friction-Blow by losses-Pumping loss-factors affecting mechanical friction- Lubrication-function-mechanism -hydrodynamic lubrication, boundary lubrication, bearing lubrication.

UNIT III LUBRICANTS (9)

Specific requirements for automotive lubricants-oxidation deterioration and degradation of lubricants-additives and additive mechanism-classification of lubricating oils- properties of lubricating oils-tests on lubricants- Grease-classification- properties.

UNIT IV COMBUSTION OF FUELS (9)

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

UNIT V COMBUSTION AND FUEL RATING (9)

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

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Gain knowledge on the importance and manufacturing methods in fuels and lubricants.
CO2: Utilize the importance of theory of lubrication.
CO3: Summarize the properties, additives and mechanism of lubricants.
CO4: Show the combustion characteristics of fuels in IC engine
CO5: Inference the combustion of fuels and fuel rating in IC engines

Text Books

T1 Ganesan.V, “Internal Combustion Engineering”, Tata McGraw-Hill Publishing Co., 2012.
T2 Mathur. M.L., Sharma. R.P. “A course in internal combustion engines”, Dhanpatrai publication, 2016.
T3 George E. Totten, Editor, Fuels and Lubricants Handbook: Technology, Properties, Performance, and Testing, ASTM International.

References

R1 Paul Richards “Automotive fuels reference book” SAE International, Third edition 2014
R2 Roger Frederick Haycock, John Hillier, Arthur J. Caines “Automotive lubricants Reference book”, SAE International, Second edition 2004

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	AUTOMOTIVE TRANSMISSION	L	T	P	C
19AU5251	(Courses offered in Collaborations with Hindusthan – Eicher Centre of Excellence Regional Competency Development Centre)	**2**	**0**	**2**	**3**

Course Objectives

1. To compare types of Clutches and Gear Box, its principle and applications.
2. To impart the construction, principle and the concept of Fluid Coupling & Torque Convertor.
3. To define the various transmission and drive line units of automobiles
4. To demonstrate the various types of hybrid and electric drives
5. To list out the applications of automatic transmission

UNIT I CLUTCH AND GEAR BOX (9)

Types of clutches–Principle & Construction of Single plate, Diaphragm, Multi Plate, Centrifugal ,Electronic clutch, Semi-Centrifugal and Dual Clutch–Gear box–Construction and operation–Sliding mesh, Constant mesh and Synchromesh gearboxes

Dismantling and assembly of two &three wheeler gear box and calculation of gear ratios

UNIT II FLUID COUPLING AND TORQUE CONVERTERS (9)

Fluid coupling-Principle-Constructional details–Torque capacity–Performance characteristics–Reduction of drag torque in fluid coupling–Torque converter-Principle-constructional details, performance characteristics–Multistage torque converters and Polyphase torque converters-Torque converter with lock-up and gear change friction clutches.

Study to determine the %slip of torque convertor for different speeds

UNIT III TORQUE TRANSFER SYSTEMS (9)

Principles of Counter shaft transmissions- Planetary gear trains –Transfer gear boxes- Final drive system – differential unit-dual clutch transmission - Hydraulic control system for Automatic Transmission

Dismantling and Assembly of differential gear unit

UNIT IV HYBRID AND ELECTRIC DRIVES (9)

Concept of Hybrid Electric Drive Trains - Architectures of Hybrid Electric Drive Trains -Series Hybrid Electric Drive Trains -Parallel Hybrid Electric Drive Trains -Torque-Coupling Parallel Hybrid Electric Drive Trains-Speed-Coupling Parallel Hybrid Electric Drive Trains -Torque-Coupling and Speed-Coupling Parallel Hybrid Electric Drive Trains - Electric drive-types- Principle of early and modified Ward Leonard Control system-Advantages & limitations-Architecture of Electric drives-Types

To determination of Gear Ratio for Series and parallel Hybrid Electric Drive Train(Analytically)

UNIT V AUTOMATIC TRANSMISSION APPLICATIONS (9)

Automatic transmission– merits and demerits–Wilson Gear box – Cotal electromagnetic transmission- Four speed longitudinally mounted automatic transmission–Chevrolet turbo glide transmission–ZF gear box–Electronically Controlled Transmission– CVT-Types, Operation

Dismantling and assembly of CVT of a two wheeler

TOTAL: 45 PERIODS

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Course Outcomes

At the end of this course students will be able to:

CO1: Analyze the clutches, gear ratios, Tractive effort, Engine speed & Power and acceleration.
CO2: Summarize the Fluid coupling and torque converters.
CO3: Acquire the knowledge about torque transfer system.
CO4: Categorize the various types of hydrostatic drives and types of Electric drive.
CO5: Analyze the various application of automatic transmission in automobile industry.

Text Books

T1 Heinz Heisler, Advanced Vehicle Technology,2nd Edition,2002, Butterworth-Heinemann
T2 Mehrdad Ehsani**,** Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, Fundamentals, Theory, and Design,CRC Press,2005.
T3 Motor Vehicle, T. K. Garrett K. Newton W. Steeds, 13th Edition, 2000, Butterworth-Heinemann

References

R1 Heldt,P.M., Torque converters, Chilton Book Co., 1962
R2 Crouse,W.H., Anglin,D.L., Automotive Transmission and Power Trains construction, McGraw Hill, 1976.
R3 Iqbal Husain, Electric And Hybrid Vehicles Design Fundamentals, CRC PRESS Boca Raton London New York Washington, D.C.

LIST OF EQUIPMENT

Sl.No.	Name of the Equipment	Quantity
1.	Two wheeler gearbox	01
2.	Three Wheeler gearbox	01
3.	Differential Unit	01
4.	CVT of a two wheeler	01

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19A5252	AUTOMOTIVE CHASSIS COMPONENTS DESIGN (Courses offered in Collaborations with Autodesk India)	L	T	P	C
		2	0	2	3

Course Objectives

1. To introduce vehicle frames and structures along with its design elements.
2. To broaden the understanding of components of steering systems and perform practical experiments.
3. To impart knowledge in driveline and final drives systems with practical troubleshooting and remedies.
4. To broaden the importance of conventional and advanced braking systems with practical exposure.
5. To introduce automotive suspension systems and to study its dynamic capabilities.

UNIT I VEHICLE FRAMES (9)

Layout with reference to prime mover location and drive. Frames, Constructional details – Materials – Testing of frames – Integrated body construction- Study of loads, moments and stresses on frame members.

Computer Aided Design of frame elements for passenger and commercial vehicles.

UNIT II STEERING SYSTEM (9)

Front Axle types - Construction details – Materials - Front wheel geometry - Conditions for true rolling motion. Steering geometry - Ackermann and Davis steering - Constructional details of steering linkages - Different types of steering gear boxes - Turning radius, wheel wobble and shimmy. Power and power assisted steering – Electric steering – Steer by wire.

Align the wheel geometry using Wheel alignment

UNIT III DRIVELINE AND FINAL DRIVE (9)

Design of propeller shaft, Design of final drive gearing, Design of full floating, semi-floating and three-quarter floating rear shafts and rear axle housings. Types of wheels - Construction of wheel assembly - Types of tires and constructional details - Static and rolling properties of pneumatic tires.

Tyre removal, fixing and repair in tubeless/ tubed tyres and wheels.

UNIT IV BRAKING SYSTEM (9)

Types of brakes - Drum brakes and disc brakes - Constructional details, materials. Braking torque developed -Brake actuating system – mechanical, hydraulic, pneumatic. Factors affecting brake performance - power assisted brakes - Retarded engine brakes, eddy retarders, Regenerative braking system – Brake by wire.

Dismantling, assembling and testing of brakes.

UNIT V SUSPENSION SYSTEM (9)

Types of suspension. Suspension springs – leaf spring, shackle and mounting brackets, coil and torsion bar springs. Spring materials, Independent suspension – front and rear. Active suspension system. Shock absorbers – Magneto Rheological fluids.

Dynamic testing of shock absorber and helical coil suspension spring.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Impart the knowledge of vehicle frame and able to design it.

CO2: Acquire the knowledge about steering system, its components, functions and wheel alignment along with balancing.

CO3: Comprehend about the various driveline systems, wheels and tires with its troubleshooting solutions.

CO4: Identify the suitable braking systems based on load conditions, performance and factors with the skills to dismantle, assemble and test it.

CO5: Interfere the automotive suspension systems with its dynamic capabilities.

Text Books

T1 Kirpal Singh, “Automobile Engineering – Volume 1”, Standard Publishes-Distributors, Delhi, 2017.

T2 R.K. Rajput, “A Textbook of Automobile Engineering”, Laxmi Publications Private Limited, 2018.

T3 N.K. Giri, “Automotive Mechanics” Khanna Publishers, New Delhi, 2010.

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References

R1 Heinz Hazler, Modern Vehicle Technology, Butterworth, London, 2005.
R2 Heldt P.M., Automotive Chassis, Chilton Co., New York, 1990
R3 Newton Steeds and Garret, Motor Vehicles, 13th Edition, Butterworth, London, 2005.
R4 William. H. Crows – Work shop Manuel – 2005

LIST OF EQUIPMENTS

S.No.	Name of the equipment	Quantity
1	Computer workstations with modeling software like Solidworks, Creo, etc. with license	15 No.
2	Computerized wheel alignment setup	1 No.
3	TyreRemover	1 No.
4	Tube/tubeless Tyre puncture kit	1 No.
5	Drum brake with master and wheel cylinders	1 No.
6	Shock absorber / Coil spring test rig	1 No.

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		L	T	P	C
19AU5001	**ENGINE PERFORMANCE AND EMISSION TESTING LABORATORY**	**0**	**0**	**4**	**2**

(Courses offered in Collaborations with Hindusthan – Eicher and Royal Enfield Centre of Excellence Regional Competency Development Centre)

Course Objectives

1. To acquire the basic knowledge of different dynamometers, valve and port timing diagram.
2. To Conduct the Performance and emission Test on the multi cylinder CI and SI engines.
3. To conduct retardation test on IC engine.
4. To conduct heat balance and Morse test on multi cylinder petrol and diesel engines.
5. To understand the P-θ and P-V Diagrams.

LIST OF EXPERIMENTS

1. Study of Hydraulic, Electrical and Eddy Current Dynamometers
2. Valve Timing and Port Timing Diagram
3. Performance and Emission Test on Two-Wheeler SI Engine
4. Performance and Emission Test on Automotive Multi-Cylinder SI Engine
5. Performance and Emission Test on Automotive Multi-Cylinder CI Engine
6. Retardation Test on I.C. Engines.
7. Heat Balance Test on Automotive Multi-Cylinder SI Engine
8. Heat Balance Test on Automotive Multi-Cylinder CI Engine
9. Morse Test on Multi-Cylinder SI Engine
10. P-θ and P-V Diagrams for IC Engine with Piezo-Electric Pick Up, Charge Amplifier, Angle Encoder and PC

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Perform tests using different dynamometers, valve and port timing diagram.

CO2: Experiment with the Performance and emission Test on the multi cylinder CI and SI engines

CO3: Interpret the retardation test on IC engines

CO4: Perform heat balance and Morse test on multi cylinder petrol and diesel engines

CO5: Plot and summarize the P-θ and P-V Diagrams.

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LIST OF EQUIPMENTS

Sl.No.	Name of the equipment	Quantity
1.	Hydraulic Dynamometer	1 No.
2.	Eddy current dynamometer	1 No.
3.	Electrical dynamometer	1 No.
4.	Single cylinder two stroke cut section Engine	1 No.
5.	Single cylinder four stroke cut section Engine	1 No.
6.	Two-wheeler engine test rig.	1 No.
7.	Automotive multi cylinder SI engine test rig with heat balance arrangement	1 No.
8.	Automotive multi cylinder CI engine test rig with heat balance arrangement	1 No.
9.	Emission Measuring Instruments for Petrol & Diesel Engines	1 No. Each
10.	Piezo-electric pick up, Charge Amplifier, Angle Encoder and PC	1 Set

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19AU5002	AUTOMOTIVE FUELS AND LUBRICANTS LABORATORY	L	T	P	C
		0	0	3	1.5

Course Objectives

1. To do independent experiments to find out the properties of fuels and lubricants
2. To grasp the importance of viscosity in the fuels and lubricants
3. To be familiar with the calorific value of liquids and gaseous fuels.
4. To conduct experiment on carbon, copper residue and ash content test
5. To conduct experiment on drop point and mechanical penetration test of grease.

LIST OF EXPERIMENTS

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

TOTAL: 45 PERIODS

Course Outcomes.

At the end of this course students will be able to:

CO1: Develop to produce high focused independent practical skill on fuels and lubricants.

CO2: Identify how they can be involved in doing experiments

CO3: Construct an in-depth analysis related with any fuel / lubricant.

CO4: Describe how the temperature and friction can influence the properties of fuels and lubricants

CO5: Experiment with the properties of grease.

LIST OF EQUIPMENTS

Sl.No.	Name of the equipment	Quantity
1.	Flash and fire point apparatus (for Petrol)	1
2.	Aniline point Apparatus	1
3.	Reid vapor pressure test Apparatus	1
4.	Bomb and Gas Calorimeters	1
5.	Carbon Residue Test Apparatus	1
6.	Copper Strip Corrosion Test Apparatus	1
7.	Cloud and Pour point Apparatus	1
8.	Redwood Viscometer	1
9.	Saybolt Viscometer	1
10.	ASTM distillation test Apparatus	1
11.	Ash content Test Apparatus	1
12.	Drop point and penetration Apparatus for grease	1

		L	T	P	C
19AU6201	**TOTAL QUALITY MANAGEMENT**				
	(Courses offered in Collaborations Ashok Leyland Industry Institute Interaction (3i) Cell)	**3**	**0**	**0**	**3**

Course Objectives

1. To Understand the basic concepts of TQM.
2. To understand the functioning and application of TQM Principles
3. To understand the quality design procedures.
4. To understand the concepts of Taguchi's Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
5. To demonstrate the various types of quality and environmental systems

UNIT I FOUNDATIONS OF TQM (9)

Understanding quality- competitiveness and customers- building quality chains- managing quality- models and frame works for total quality management- Contributions of Deming, Juran and Crosby -Early TQM frameworks – quality award models – the four Ps and three Cs of TQM - a new model for TQM

UNIT II TQM PRINCIPLES (9)

Planning –Strategic planning - Leadership-Characteristics –Ethics – Quality Council –- Customer Satisfaction – Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal--Continuous process improvement –Juran Trilogy, PDSA cycle, 5S and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III DESIGN FOR QUALITY (9)

The seven traditional tools of quality - New management tools - Six-sigma Process Capability- Bench marking – Reasons to benchmark, Benchmarking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Benchmarking - FMEA - Intent , Documentation, Stages: Design FMEA and Process FMEA.

UNIT IV QUALITY ENGINEERING (9)

Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function - orthogonal arrays-Signal to noise ratio (S/N)-Parameter design-Tolerance design- TPM – Concepts, improvement needs – Performance measures-Cost of Quality - BPR.

UNIT V QUALITY AND ENVIRONMENTAL MANAGEMENT SYSTEMS (9)

Benefits of ISO registration - ISO 9000 series of standards – sector specific standards –ISO 9001 requirements – implementation – documentation – writing the documents – internal audits – registration - ISO 14000 series standards – concepts of ISO 14001 – requirements of ISO 14001 – benefits of EMS – integrating ISO 14000 with ISO 9000 – relationship between health and safety

TOTAL: 45 PERIODS

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Course Outcomes

At the end of this course students will be able to:

CO1: Interpret the TQM framework and Implement Deming, Juran and Crosby Philosophies.

CO2: Illustrate various statistical tools to measure quality and customer satisfaction and implement relationship between employee and the organization

CO3: Implement Benchmarking, FMEA tools for improving quality for design.

CO4: Defend the quality circles and discover the application of QFD and taguchi's quality for engineering.

CO5: Execute the QMS and EMS to improve quality standards in any organization.

Text Books

T1 Dale H. Besterfield, Carol Besterfield-Michna, Glen H. Besterfield, Mary Besterfield-Sacre, Hemant Urdhwareshe, Rashmi Urdhwarshe , Total Quality Management, Pearson Education, 2012.

T2 Mary B. Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013

T3 D.R. Kiran, Total Quality Management, Butterworth-Heinemann,2016

References

R1 Joel.E. Ross, "Total Quality Management – Text and Cases", Routledge.,2017.

R2 Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.

R3 Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006

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19AU6202	VEHICLE DYNAMICS AND CONTROL SYSTEMS (Course offered with Ford EcoSport)	L	T	P	C
		3	0	0	3

Course Objectives

1. To acquire the knowledge about the vibration and responses.
2. To understand the importance of tire and its dynamics.
3. To understand the ride properties of the vehicle.
4. To obtain knowledge on the longitudinal vibration and their control.
5. To Understand the Handling techniques of the vehicles.

UNIT I VIBRATIONS (9)

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

UNIT II TIRES (9)

Tyre axis system, tyre forces and moments, tyre marking, tyre structure, hydroplaning, wheel and rim. Rolling resistance, factors affecting rolling resistance, Longitudinal and Lateral force at various slip angles, Tractive and cornering property of tire. Performance of tire on wet surface. Ride property of tyres. Various test carried on a tyre.

UNIT III RIDE AND CONTROL (9)

Human response to vibration, Sources of Vibration. Suspension requirements – types. State Space Representation. Design and analysis of Passive, semi active and Active suspension using Quarter car, Bicycle Model, half car and full car vibrating model. Influence of suspension stiffness, suspension damping, and tire stiffness. – Control systems – Vehicle Response Properties –Air suspension system - Suspension optimization techniques.

UNIT IV LONGITUDINAL DYNAMICS AND CONTROL (9)

Aerodynamic forces and moments. Equation of motion. Load distribution for three-wheeler and four-wheeler. Calculation of maximum acceleration, tractive effort, and reaction forces for different drive vehicles. Power limited acceleration and traction limited acceleration. Estimation of CG location. Stability of vehicles resting on slope. Driveline dynamics. Braking and Driving torque. Prediction of Vehicle performance. ABS, stability control, Traction control.

UNIT V HANDLING AND CONTROL (9)

Steady state handling characteristics. Steady state response to steering input – Yaw velocity gain, Lateral acceleration gain, curvature response gain. Testing of handling characteristics. Transient response characteristics. Steering dynamics. Direction control of vehicles. Roll center, Roll axis –Vehicle under side forces –Stability of vehicle – Effect of suspension on cornering - Minuro Plot for Lateral Transient Response.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Develop physical and mathematical models to predict the dynamic response of vehicles.
CO2: Recognize the proper tires for better performance of vehicle on all the road surfaces
CO3: Summarize the dynamic analyses in the design of vehicles.
CO4: Evaluate the longitudinal dynamics and control in an automobile.
CO5: Explain the handling and control of lateral vibrations of the vehicle.

Text Books

T1 Rajesh Rajamani, "Vehicle Dynamics and Control", 1st edition, Springer, 2005
T2 Wong. J. Y., "Theory of Ground Vehicles", 3rd Edition, Wiley-Interscience, 2008
T3 Thomas D. Gillespie, "Fundamentals of Vehicle Dynamics", Society of Automotive Engineers Inc, 2014

References

R1 Singiresu S. Rao, "Mechanical Vibrations", 5th Edition, Prentice Hall, 2010
R2 Hans B Pacejka, "Tire and Vehicle Dynamics", 2nd edition, SAE International, 2005

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R3 Dean Karnopp, "Vehicle Dynamics, Stability, and Control", Second Edition, CRC Press, 2013

19AU6203	FINITE ELEMENT ANALYSIS	L	T	P	C
		3	1	0	4

Course Objectives

1. To Understand and perform engineering analysis of structural members using FEM.
2. To Apply concepts of Finite Element Analysis to solve one dimensional problem.
3. To understand the field variables for two dimensional scalar variable problems
4. To derive field variables for two-dimensional vector variable problems.
5. To Imply knowledge towards Isoparametric transformation and the use of numerical integration.

UNIT I INTRODUCTION (9)

Historical Background – Mathematical Modeling of field problems in Engineering –Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

UNIT II ONE-DIMENSIONAL PROBLEMS (9)

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors-Assembly of Matrices - Solution of problems from solid mechanics including thermal stresses-heat transfer. Natural frequencies of longitudinal vibration and mode shapes. Fourth Order Beam Equation – Transverse deflections and Transverse Natural frequencies of beams.

UNIT III TWO-DIMENSIONAL SCALAR VARIABLE PROBLEMS (9)

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation –Finite Element formulation – Triangular elements and Quadrilateral elements- Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion of Non circular shafts.

UNIT IV TWO-DIMENSIONAL VECTOR VARIABLE PROBLEMS (9)

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Constitutive matrices and Strain displacement matrices – Stiffness matrix – Stress calculations - Plate and shell elements

UNIT V ISOPARAMETRIC FORMULATION AND ADVANCED TOPICS (9)

Natural co-ordinate systems – Isoparametric elements – Shape functions for isoparametric elements – One and two dimensions – Serendipity elements – Numerical integration - Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software- Introduction to Non-Linearity.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Develop mathematical models for Boundary Value Problems and their numerical solution.

CO2: Evaluate and interpret FEA analysis results for design and evaluation purposes

CO3: Solve Field, thermal, and structural problems by relating scalar variable functions

CO4: Deduce the expression of field variables for two-dimensional plate and shell element problems.

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CO5: Determine the need for Isoparametric transformation and the use of numerical integration.

Text Books

T1 Reddy. J.N., "An Introduction to the Finite Element Method", 4th Edition, Tata McGraw-Hill, 2018

T2 Seshu.P, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2012.

T3 Rao, S.S., "The Finite Element Method in Engineering", 6th Edition, Butterworth Heinemann, 2018.

References

R1 Logan, D.L., "A first course in Finite Element Method", 5th Edition, CL Engineering, 2010.

R2 Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, Wiley Student Edition, 2004.

R3 Tirupathi.R. Chandrapatha and Ashok D. Belegundu – Introduction to Finite Elements in Engineering – International Edition, Pearson Education Limited,, 2014.

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	AUTOMOTIVE VEHICLE BODY AND AERODYNAMICS	L	T	P	C
19AU6251	(Courses offered in Collaborations with Hindusthan – Eicher Centre of Excellence Regional Competency Development Centre)	2	0	3	3.5

Course Objectives

1. To give exposure to body materials, trim, mechanisms, and body repair.
2. To impart knowledge in car body design details.
3. To get well versed in the design and construction of buses.
4. To acquire knowledge in commercial vehicle body and regulations.
5. To understand the vehicle aerodynamics and tests.

UNIT I BODY MATERIALS, TRIM, MECHANISMS AND BODY REPAIR (7)

Body construction-Types-materials used-Steel sheet-timber-plastics-GRP-properties-Body trim items-body mechanisms-Hand tools-power tools- corrosion- Anticorrosion methods-Modern painting process procedure-paint problems spray paint gun.

UNIT II CAR BODY DETAILS (8)

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

UNIT III BUS BODY DETAILS (8)

Types: minibus, single decker, double-decker, two level and articulated bus. Bus body layout; floor height, engine location, entrance and exit location, Regulations-Constructional details-Conventional and integral-driver seat design-Safety aspect of bus body.

UNIT IV COMMERCIAL VEHICLE DETAILS (10)

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

Study of light commercial vehicle and its structure.

Study of heavy commercial vehicle body construction details and its structure.

UNIT V VEHICLE AERODYNAMICS (12)

Objectives-Vehicle drag-types-forces and moments-Effects of forces and moments-Side wind effects-body optimization techniques for minimum drag-Wind tunnels-Principle of operation. Aerodynamics and race cars, aerodynamics and vehicle performance, complete vehicle aerodynamics.

Smoke flow visualization studies of proto type car in subsonic flows.

Determination of lift force for the give automotive vehicle body in the wind tunnel test.

Determination of drag force for the give automotive vehicle body in the wind tunnel test.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Evaluate the tools used in body repairs and command over vehicle body engineering applications

CO2: Compare and familiar with different aspects of car body and its types.

CO3: Demonstrate the vehicle body regulations to build the bus body.

CO4: Discover some new commercial vehicle body and ergonomics designs.

CO5: Associate the role of various aerodynamic forces and moments and its measuring instruments.

Text Books

T1 Powloski, J., "Vehicle Body Engineering", Business Books Ltd., 1998.

T2 James E Duffy, "Body Repair Technology for 4-Wheelers", Cengage Learning, 2009.

T3 Presentation techniques by Dick Powell, Little, Brown Book Group (12 July 1990).

T4 Race Car Aerodynamics: Designing for Speed (Engineering and Performance) Bentley Publishers; 2nd ed. edition (March 8, 1996)

References

R1 Giles, G.J., "Body construction and design", Illiffe Books Butterworth & Co., 1991.

R2 John Fenton, "Vehicle Body layout and analysis", Mechanical Engg. Publication Ltd., London, 1992.

R3 Braithwaite, J.B., "Vehicle Body building and drawing", Heinemann Educational Books Ltd., London,1997.

R4 Dieler Anselm., The passenger car body, SAE International, 2000.

LIST OF EQUIPMENT

Sl.No.	Name of the equipment	Quantity
1.	Subsonic flow wind tunnel test apparatus	1 No.
2.	Light commercial vehicle	1 No.
3.	Heavy commercial vehicle	1 No.

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19AU6001 **FINITE ELEMENT ANALYSIS LABORATORY** **L T P C**

(Courses offered in Collaborations with Autodesk India) **0 0 3 1.5**

Course Objectives

1. To give exposure to software tools needed to analyze automobile field problems.
2. To expose the students to different applications of simulation and analysis tools in vehicle components.
3. To impose knowledge in the behavior our automotive components in real time.
4. To analyze the engine and its components for its thermal behavior.
5. To perform modal analysis on suspension system to understand its work cycle.

LIST OF EXPERIMENTS

1 Force and Stress analysis on elements in vehicular frames and cross members.
2 Stress and deflection analysis in vehicle ladder frame with different loading conditions.
3 Stress analysis of vehicle shell and body components.
4 Stress analysis of Axis – Symmetric components like piston, etc..
5 Thermal stress and heat transfer analysis of firewall.
6 Thermal stress analysis of engine cylinder.
7 Vibration analysis of suspension systems.
8 Modal analysis of suspension springs.
9 Harmonic, transient and spectrum analysis of suspension systems.
10 Dynamic Analysis of suspension springs.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Model and analyze experiments to meet real world system of various automotive components.
CO2: Perform thermal analysis for automotive engines and various parts related to it.
CO3: Carryout modal analysis of suspension system
CO4: Study the behavior of suspension system and its dynamic behavior.
CO5: Simulate the stress and deflection analysis of vehicular components.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	QTY.
1	Computer Workstation	15
2	Multi Body Dynamic Software Suitable for Mechanism simulation and analysis	15 Licenses

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		L	T	P	C
19AU6002	**INTERNSHIP TRAINING / INPLANT TRAINING**	**0**	**0**	**0**	**1**

Course Prerequisites	Completion of minimum of three semesters
Course Objectives	Designed to expose the students to industry environment and work there as trainees.
Duration	Undergo industrial training/internship for a period of not exceeding six weeks.
Records to be Maintain	1. Students must maintain a written record of the assignments, progress, and accomplishments. **2.** Students must submit an individual report along with attendance and training completion certificate from the company at end of the training.
Evaluation	A three-member Departmental Committee, constituted by Head of the Department will evaluate the report, conduct viva voce examination and award appropriate grades and the credit points earned will depend on the duration of the industrial training/internship.
Course Outcomes	Acquire knowledge on real time industry expectation, operations and working environment

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19AU7201	ADVANCED ELECTRICAL AND ELECTRONICS (Courses offered with Ford EcoSport)	L	T	P	C
		3	0	0	3

Course Objectives

1. To understand the fundamentals, operating principles of batteries and starting systems.
2. To illustrate the functionality of charging and lighting systems.
3. To comprehend the concepts of ignition and injection systems.
4. To know about safety electronics convenience features.
5. To acquire knowledge about drive by wire and basic microcontroller programming.

UNIT I BATTERY AND STARTING SYSTEM (9)

Battery – principle – Lead acid battery – characteristics - rating - efficiency of batteries – tests conducted on battery – charging methods –maintenance - free batteries - starter motor - principle - construction - drive mechanisms – maintenance – starter switches.

UNIT II CHARGING AND LIGHTING SYSTEM (9)

DC generators and alternators in vehicles - cut out relay- regulators – three-unit regulator - Positive & negative earth systems - vehicle interior and exterior lighting system – headlight & fog light design - Adaptive Lighting system - LED lighting system.

UNIT III INJECTION AND IGNITION SYSTEMS (9)

Electronic ignition control - battery coil, magneto and electronic ignition systems – Programmed ignition - Spark plugs - electronic fuel injection - throttle body fuel injection - multi point fuel injection - gasoline direct injection - common rail direct injection - L- Jetronic fuel injection- engine mapping-on-board diagnostics.

UNIT IV ELECTRONIC SAFETY AND CONVENIENCE SYSTEMS (8)

Safety electronic systems – Anti lock braking system - Traction Control System - Electronic stability program - Cruise Control System - Collision Avoidance - Radar warning Systems - Heads Up display - Navigation – Navigation Sensors - Radio Navigation - Signpost navigation - dead reckoning navigation - Voice Recognition - Automatic driving Control - Key less entry and go system.

UNIT V DRIVE BY WIRE AND BASIC MICROCONTROLLER PROGRAMMING (9)

Drive-by-wire: Challenges and opportunities of X-by-wire system and design requirements, steer-by-wire, brake-by-wire, electronic throttle including adaptive cruise control, shift-by-wire. Basics of microprocessor programming with Arduino and Raspberry Pi

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Demonstrate the functions of batteries and charging system.
CO2: Explain about the charging and lighting system.
CO3: Describe the various ignition and injection systems.
CO4: Access the various electronic safety and convenience features.
CO5: Simulate the drive by wire technology and interface with sensors and actuators using microcontroller programming

Text Books

T1 Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th Edition, 2007, ISBN No: 9783658017835
T2 Tom Denton., “Automobile Electrical and Electronics Systems”, Elsevier Butterworth-Heinemann Linacre House, 2004.
T3 Judge. A.W., “Modern Electrical Equipment of Automobiles”, Chapman & Hall, London, 1992.

References

R1 Barry Holembeak, “Automotive Electrical and Electronics” , Delmar Publishers, Clifton Park,USA,2010
R2 William Ribbens, "Understanding Automotive Electronics - An Engineering Perspective," 7th Edition, Elsevier Butterworth-Heinemann Publishers, 2012.
R3 James D Halderman, “ Automotive Electrical and Electronics” , Prentice Hall, USA, 2013

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		L	T	P	C
19AU7202	**ENGINE AND VEHICLE MANAGEMENT SYSTEM** (Courses offered in Collaborations with Hindusthan – Eicher Centre of Excellence Regional Competency Development Centre)	3	0	0	3

Course Objectives

1. Students able to get exposure in microprocessor architecture and fuzzy logic.
2. Understand the fundamental of sensors and actuators.
3. To impart the knowledge of electronics in SI engine management system.
4. Acquire knowledge of CI engine management systems.
5. To build strong base in vehicle management system.

UNIT I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS (9)

Microprocessor architecture-open and closed loop control strategies-PID control-Look up tables-A/D and D/A converters. Introduction to modern control strategies like Fuzzy logic- Parameters to be controlled in SI and CI engines and in the other parts of the automobile.

UNIT II SENSOR TECHNOLOGIES (9)

Inductive, crank shaft position, steering torque, cam position, steering position, hot wire, engine and wheel speed, thermistor, piezo electric, knock piezo resistive based sensors-throttle position, fuel level, air mass flow, engine temperature, manifold temperature and pressure sensors. Tire pressure, brake pressure, crash, exhaust oxygen level (two step and linear lambda), Solenoid, relay, stepper motor.

UNIT III SI ENGINE MANAGEMENT (9)

Smart hybrid technology, Group and sequential injection- Fuel control maps-open loop control fuel injection and closed loop lambda control. Closed loop control of knock, VVT, gasoline turbo direct injection system. Distributor less ignition, Introduction to LASER Ignition system.

UNIT IV CI ENGINE MANAGEMENT (9)

Fuel injection system-parameters affecting combustion-noise and emissions in CI engines-Pilot- main-advanced post injection-retarded post injection-common rail fuel injection system (CRDi) -Fuel injector-fuel pump-rail pressure limiter-flow limiter-EGR valves Three-way catalytic converter-conversion efficiency versus lambda, ammonia injection.

UNIT V VEHICLE MANAGEMENT SYSTEMS (9)

ABS, EBD, TCS, ESP system-need-working. Electronic control of suspension-Damping Control-Electric power steering-hill hold control, Supplementary Restraint System- seat belt tightening-cruise control-Vehicle security systems-alarms vehicle tracking system-On board diagnostics-Collision avoidance Radar warning system - Automotive Infotainment Systems.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Describe the microprocessor application in automobiles.
CO2: Explain their competent in-depth knowledge in autotronics.
CO3: Explain about gasoline engine management system.
CO4: Find faults and troubleshoot in SI engine management systems.
CO5: Illustrate the knowledge in vehicle control system.

Text Books

T1 Bosch, "Automotive Sensors", Robert Bosch GmbH, 2001.
T2 William Ribbens, "Understanding Automotive Electronics - An Engineering Perspective," 7th Edition, Elsevier Butterworth-Heinemann Publishers, 2012.
T3 Diesel Maintenance, Tune-up and Engine Management, Volume 1-EP.D050 Rennicks October 16, 2004.
T4 Engine Management: Optimizing Modern Fuel and Ignition Systems (Haynes High- Performance Tuning Series) Haynes Publishing; Har/Cdr edition January 25, 2002.

References

R1 Gasoline Engine Management: Motronic Systems: Bosch Technical Instruction Robert Bosch GmbH November 1, 2003.
R2 Engine Management: Advanced Tuning 1st Edition CarTech; 1st edition April 10, 2007.

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19AU7251	ELECTIC AND HYBRID VEHICLE (Courses offered in Collaborations SRIVARU Motors Pvt Ltd.,)	L	T	P	C
		3	0	0	3

Course Objectives

1. To comprehend general aspects of Electric and Hybrid Vehicles (EHV), including architectures, modeling, sizing, sub system design and hybrid vehicle control.
2. To Understand about vehicle dynamics
3. To Design the required energy storage devices
4. To Select the suitable electric propulsion systems
5. To Understand of hybrid electric vehicles

UNIT I NEED FOR ALTERNATIVE SYSTEM (9)

Need for hybrid and electric vehicles – main components and working principles of a hybrid and electric vehicles, Different configurations of hybrid and electric vehicles. Comparative study of diesel, petrol, hybrid and electric Vehicles. Advantages and Limitations of hybrid and electric Vehicles. Case study on specification of electric and hybrid vehicles.

UNIT II DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES (9)

Design requirement for electric vehicles- Range, maximum velocity, acceleration, power requirement, mass of the vehicle. Various Resistance- Transmission efficiency- Electric vehicle chassis and Body Design, Electric Vehicle Recharging and Refueling Systems.

UNIT III ENERGY SOURCES (9)

Battery Parameters- - Different types of batteries – Lead Acid- Nickel Metal Hydride - Lithium ion- Sodium based- Metal Air. Battery Modeling- Equivalent circuits, Battery charging- Quick Charging devices. Fuel Cell- Fuel cell Characteristics- Fuel cell types-Half reactions of fuel cell. Ultra-capacitors. Battery Management System.

UNIT IV MOTORS AND CONTROLLERS (9)

Types of Motors, Characteristic of DC motors, AC single phase and 3-phase motor, PM motors, switched reluctance motors, Motor Drives and speed controllers, Torque Vectoring, Regenerative Braking. Rectifiers, Inverters, DC/DC converters.

UNIT V SUBSYSTEMS OF HYBRID AND ELECTRIC VEHICLES (9)

Power Split devices for Hybrid Vehicles - Operation modes - Control Strategies for Hybrid Vehicle- Economy of hybrid Vehicles. Steering and Suspension system. Choice of Tires.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Summarize the electric and hybrid vehicle operation and architectures
CO2: Design and develop the systems of hybrid and electric vehicles
CO3: Demonstrate the energy requirement for vehicles
CO4: Model and simulate the vehicle characteristics, operating modes, and performance parameters of the vehicle
CO5: Explain the different subsystems of hybrid and electric vehicles

Text Books

T1 Iqbal Husain, “Electric and Hybrid Vehicles-Design Fundamentals”, CRC Press, 2003
T2 Mehrdad Ehsani, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles”, CRC Press,2005.

References

R1 Sandeep Dhameja, “Electric Vehicle Battery Systems” NEWNES, 2002
R2 James Larminie and John Lowry, “Electric Vehicle Technology Explained “John Wiley & Sons, 2003
R3 Ron Hodkinson, “Light Weight Electric/ Hybrid Vehicle Design”, Butterworth Heinemann Publication,2005

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		L	T	P	C
19AU7001	**ADVANCED ELECTRICAL AND ELECTRONICS LABORATORY** (Courses offered with Ford EcoSport)	0	0	3	1.5

Course Objectives

1. To do testing and maintenance of batteries, starting motors and generators
2. To perform testing of regulators and cut-outs relays.
3. To diagnose of ignition system faults.
4. To study the automobile electrical wiring system.
5. To gain a wide knowledge in the basic electronic components and circuits and programming.

LIST OF EXPERIMENTS

a. 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

b. Electronics Laboratory

1. Study of rectifiers, Logic gates, SCR timer
2. Interfacing of analog sensors like RTD, LVDT, and Load Cell with micro-controller
3. Interfacing of actuators like stepper motor with micro-controller
4. Study of Analog to Digital and Digital to Analog converters
5. Micro Processor programming and interfacing
6. Programming of sensors like ultrasonic, IR, gyroscopic and temperature sensors with Arduino and/or Raspberry Pi
7. Programming of actuators like stepper, servo motors and linear actuators with Arduino and/or Raspberry Pi

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Comprehend the working and troubleshooting of battery, regulators and cut-out relays.

CO2: Demonstrate and diagnose the ignition system.

CO3: Interface the sensors and actuators with microcontroller.

CO4: Observe and troubleshoot the automotive electrical circuits and systems.

CO5: Get exposure in the state-of-the-art electronic technologies in testing and controlling of vehicles.

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19AU7002	VEHICLE MAINTENANCE LABORATORY (Courses offered in Collaborations with Hindusthan – Eicher Centre of Excellence Regional Competency Development Centre)	L	T	P	C
		0	0	3	1.5

Course Objectives

1 To understand the complete knowledge of the vehicle maintenance procedures
2 To acquire skills in handling situations where the vehicle is likely to fail
3 To understand various types of maintenance of vehicles, features and applications
4 To apply the knowledge in servicing vehicle components
5 To analyze the fault in modern engine using engine analyzer

LIST OF EXPERIMENTS

STUDY EXPERIMENTS:

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

EXPERIMENTS:

1. Minor and major tune up of gasoline and diesel engines
2. Calibration of Fuel pump
3. Engine fault diagnosis using scan tool
4. Fault diagnosis and service of transmission system
5. Fault diagnosis and service of driveline system
6. Fault diagnosis and service of braking system
7. Fault diagnosis and service of suspension system
8. Fault diagnosis and service of steering system
9. Fault diagnosis and service of electrical system like battery, starting system, charging system, lighting system etc.
10. Fault diagnosis and service of vehicle air conditioning system
11. Practice the following:
    a. Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play.
    b. Air bleeding from hydraulic brakes, air bleeding of diesel fuel system.
    c. Wheel bearings tightening and adjustment.
    d. Adjustment of head lights beam.
    e. Removal and fitting of tire and tube.
    f. Study and checking of wheel alignment - testing of camber, caster.
    g. Testing kingpin inclination, toe-in and toe-out
    h. Cylinder reboring – checking the cylinder bore, Setting the tool and reboring.
    i. Valve grinding, valve lapping-Setting the valve angle, grinding and lapping and checking for valve leakage
    j. Tinkering and painting of passenger car door

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Describe the minor and major tuning of diesel and petrol engines
CO2: Dismantle, study, perform corrections and assemble the vehicle systems
CO3: Perform the wheel alignment procedure and tyre removal procedure, etc.
CO4: Define the procedures of valve grinding, lapping, reboring calibration of fuel injection pump, etc.
CO5: Find faults, and rectify them to perform maintenance of automotive systems

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LIST OF EQUIPMENT

S.No.	NAME OF THE EQUIPMENT	QTY
1	Engine Analyze	1
2	Cylinder Compression Pressure Gauge	1
3	Vacuum Gauge	1
4	Spark Plug Cleaner and Tester	1
5	Cam Angle and RPM Tester	1
6	Tachometer	1
7	Wheel Alignment Apparatus	1
8	Gas Welding Equipment	1
9	Tyre Remover	1
10	Bearing Puller	1
11	Head Light Alignment Gauge	1
12	Service manuals of Petrol, Diesel Engines	1 Each
13	Cylinder Reboring Machine	1
14	Valve Grinding Machine	1
15	Valve Lapping Machine	1
16	Fuel injection calibration test bench with nozzle tester	1
17	HRD tester, Clamp on meter, Hydrometer	1 Each
18	Tinkering kit	2
19	Surface polisher	2
20	Paint spray gun	2
21	Air compressor	1

		L	T	P	C
19AU7901	**PROJECT WORK – PHASE I**	**0**	**0**	**4**	**2**

Course Objectives

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

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

The student 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 prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. 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. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the COE / Head of the Department.

Course Outcomes

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

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		L	T	P	C
19AU8901	**PROJECT WORK – PHASE II**	**0**	**0**	**24**	**12**

Course Objectives

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

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

The student 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 prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. 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. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the COE / Head of the Department.

Course Outcomes

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

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19AU5301	ALTERNATIVE FUELS AND ENERGY SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

1. To acquire complete knowledge on availability of possible alternate fuels and their properties to use as fuel in CI and SI engines.
2. To develop knowledge all, the possible way of using alcohols as a fuel IN IC engines.
3. To understand the challenges and difficulties in using vegetable oil as an alternative fuel in internal combustion engines.
4. To identify the uses of hydrogen as fuel in IC engines as an alternative for fossil fuels.
5. To understand the usefulness of natural acquiring gases towards IC engines.

UNIT I ALTERNATIVE FUELS, PROPERTIES AND TESTING METHODS OF FUELS (9)

Need for alternative fuels. World and Indian energy scenario on alternative fuels. Production technologies for biofuels for internal combustion engines- Pyrolysis, gasification, digestion.

UNIT II ALCOHOLS AS FUELS (9)

Alcohols as fuels. Production methods of alcohols. Properties of alcohols as fuels. Methods of using alcohols in CI and SI engines. Blending, dual fuel operation, surface ignition and oxygenated additives. Performance emission and combustion characteristics in CI and SI engines.

UNIT III VEGETABLE OILS AS FUELS (9)

Various vegetable oils and their important properties. Different methods of using vegetable oils engines – Blending, preheating Transesterification and emulsification of Vegetable oils - Performance in engines – Performance, Emission and Combustion Characteristics in diesel engines. Role of Nano fluids, additives and cetane improvers for performance improvement of vegetable oils as fuel.

UNIT IV HYDROGEN AS ENGINE FUEL (9)

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

UNIT V BIOGAS, NATURAL GAS AND LPG AS FUELS (9)

Production methods of Biogas, Natural gas and LPG. Properties studies. CO2 and H2S 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.

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Explain the availability of possible alternate fuels and their properties to use as fuel in CI and SI engines.
CO2: Justify the possible ways of using alcohols as a fuel in IC engines.
CO3: Infer the challenges and difficulties in using vegetable oil as an alternative fuel in internal combustion engines.
CO4: Identify the uses of hydrogen as fuel in IC engines as an alternative for fossil fuels.
CO5: Relate the usefulness of natural acquiring gases towards IC engines.

Text Books

T1 Dr. G. Devaradjane., Dr. M. Kumaresan., "Automobile Engineering", AMK Publishers, 2013.

T2 AyhanDemirbas, 'Biodiesel A Realistic Fuel Alternative for Diesel Engines', Springer-Verlag London Limited 2008, ISBN-13: 9781846289941

References

R1 Gerhard Knothe, Jon Van Gerpen, Jargon Krahl, The Biodiesel Handbook, AOCS PressChampaign, Illinois 2005.

R2 Transactions of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc.).

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		L	T	P	C
19AU5302	**TYRE TECHNOLOGY** (Courses offered in Collaborations with Hindusthan – Eicher Centre of Excellence Regional Competency Development Centre)	**3**	**0**	**0**	**3**

Course Objectives

1. Understand the working of pneumatic tyre.
2. To understand the Manufacturing process of different types of tyre.
3. To learn about the physical properties of tyre cords made of different fabric and their structure, tyre shape, tread design and tyre size determination.
4. To understand the performance of tyres.
5. To understand the importance of tubes, flaps and retreading

UNIT I STRUCTURE OF THE PNEUMATIC TYRE (9)

Functions of the pneumatic tyre, tube & assembly, Construction of tyre tread casing & bead general features, Principles of Cross-ply, radial & bias-belted construction, tubeless tyre, Tyre construction methods, Cord path and Aspect ratio.

UNIT II TYRE MANUFACTURE (9)

Composition of tyre, compounding of tyre tread cap tread base, carcass, bead, sidewall, inner liner etc. Raw materials for tyre, Mixing, Dipping, Calendaring, Extrusion, stock preparation, tyre building, green tyre preparation, tyre curing, PCI, finishing of tyre. Manufacturing process of radial tyre.

UNIT III TYRE CORD & CORD TO RUBBER BONDING AND TYRE DESIGN (9)

Physical properties of tyre cords from cotton, rayon, nylon etc. Outline of bonding methods. Tyre structure, tyre shape, treads design. Tyre size determination

UNIT IV TYRE PERFORMANCE ANALYSIS (9)

Analysis of tyre for different performance criteria like tyre stresses & deformation, tyre stiffness, tyre noise, rolling resistance, aquaplaning etc.

UNIT V TUBES, FLAPS AND RETREADING (9)

Principles of tube design, mfg. tubes, extrusion, valve jamming, inflation & Curing in presses, tube testing. Flaps: Properties, Compounding, Manufacturing and testing of flaps. Retreading: Criteria for retreading, methods of retreading.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Infer about the Functions of the pneumatic tyre
CO2: Explain the manufacturing process of different types of tyre
CO3: Relate the importance of Physical properties of tyre cords made of different fabric and Tyre structure, tyre shape, tread design and tyre size determination
CO4: Analyze about the tyre performance
CO5: Summarize about importance of tubes, flaps and retreading.

Text Books

T1 The Pneumatic Tire, (ed) A N Gent & J D Walter, The University of Akron, August. 2005, published by NHTSA, DOT, USA
T2 Rubber Products Manufacturing Technology, Anil K. Bhowmick Malcolm M. Hall Henry A. Benarey, Routledge Publisher, 2018.

References

R1 Science and Technology of Rubber, James E Mark, Burak Erman, Fredrick. Eirich, Academic Press, Second edition, 1994.
R2 Tire card, Kirk-Othmer Encyclopedia of Chemical Technology.
R3 Systematic Review of Tyre Technology, Yasuhiro Ishikawa,National Museum of Nature and Science Vol.16,2011

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16AU5303 AUTOMOTIVE MATERIALS AND MANUFACTURING TECHNOLOGY

L	T	P	C
3	0	0	3

Course Objectives

1. To impart the knowledge about the spectrum of engineering alloys.
2. To learn concept of surface modification techniques to enhance properties of materials.
3. To infer about the various advance materials and their applications in Automotive sector.
4. To understand the concepts of gear manufacturing, finishing and inspection methods involved.
5. To know about the recent technologies involved in manufacturing of components based on automotive applications.

UNIT I ENGINEERING ALLOYS (9)

Ferrous alloys-Iron-Iron carbide phase diagram with all phases & critical temperatures-steel, Types of steels-Effect of alloying elements on physical and chemical properties-Automotive applications cast iron-Types-properties-factors affecting structures of cast iron-Automotive application.

Nonferrous alloys- Al, Cu, Tinbased alloys, Light metal alloys(Mg and Ti)

UNIT II SURFACE MODIFICATION OF MATERIALS (9)

Mechanical surface treatment and coating- case hardening and hard facing-thermal spraying-Vapor deposition-ion implantation-diffusion coating-Electroplating and Electro-less plating-Conversion Coating-Ceramic and Organic coating-Diamond coating-Laser surface treatment-Selection of coating for Automotive applications

UNIT III MODERN MATERIALS AND ALLOYS (9)

Super alloys-super plastic alloys for auto body panels-refractory metals-shape memory alloys-dual phase steels-micro alloyed steels-high strength low alloy steels-smart materials – Composite materials-ceramic –plastics-introduction, overview of processing, their characteristic features, Types and automotive application- Nano-materials-Introduction and automotive applications.

UNIT IV GEAR MANUFACTURING (9)

Gear milling, Hobbing and shaping, planning- Bevel gear production - Gear finishing and inspection.

UNIT V RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS (9)

Powder injection molding - Production of aluminum MMC liners for engine blocks - Plasma spray coated engine blocks and valves - Recent developments in auto body panel forming - Squeeze casting of pistons – aluminum composite brake rotors. Sinter diffusion bonded idler sprocket- Gas injection molding of window channel - cast con process for auto parts.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Identify the suitable material for automotive applications from the array of alloys.
CO2: Infer the surface treatment techniques used for enhancing the material properties.
CO3: Summarize about the latest materials used in automotive applications and its suitability.
CO4: Compare the methods involved in gear manufacturing, finishing and inspection.
CO5: Analyze the modern technologies involved in automotive components manufacturing.

Text Books

T1 Callister W.D., “Material Science and Engineering- An introduction”, 9th Edition Wiley –Eastern, 2013.
T2 Haslehurst.S.E., " Manufacturing Technology ", ELBS, London, 1990.

References

R1 Kenneth Budinski, “Surface Engineering for wear resistance", Prentice Hall, 1988
R2 Hiroshi Yamagata,” The Science and Technology of Materials in Automotive Engines”, Woodhead Publishing,2005
R3 Flinn R. A. and Trojan P. K., “Engineering Materials and their Applications”, Jaico, 1999.
R4 Sabroff.A.M. & Others, " Forging Materials & Processes ", Reinhold Book Corporation, New York,1988.

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R5 Gladius Lewis, “Selection of Engineering Materials”, Prentice Hall Inc. New Jersey USA, 1995.

19AU5304	BATTERY TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives

1. Understand the working of pneumatic tyre.
2. To understand the Manufacturing process of different types of tyre.
3. To learn about the physical properties of tyre cords made of different fabric and their structure, tyre shape, tread design and tyre size determination.
4. To understand the performance of tyres.
5. To understand the importance of tubes, flaps and retreading

UNIT I INTRODUCTION (9)

Batteries: Lead Acid Battery, Nickel based batteries, Sodium based batteries, Lithium based batteries – Li-ion & Li-poly, Metal Air Battery, Zine Chloride battery; Ultra capacitors; Flywheel Energy Storage System; Hydraulic Energy Storage System; Comparison of different Energy Storage System.

UNIT II BATTERY PERFORMANCE (9)

Cells and Batteries- conversion of chemical energy to electrical energy- Battery Specifications: Variables to characterize battery operating conditions and Specifications to characterize battery nominal and maximum characteristics; Efficiency of batteries; Electrical parameters Heat generation- Battery designPerformance criteria for Electric vehicles batteries- Vehicle propulsion factors- Power and energy requirements of batteries- Meeting battery performance criteria- setting new targets for battery performance.

UNIT III BATTERY MODELLING (9)

General approach to modelling batteries, simulation model of a rechargeable Li-ion battery, simulation model of a rechargeable NiCd battery, Parameterization of the NiCd battery model, Simulation examples.

UNIT IV BATTERY MANAGEMENT SYSTEM (9)

Selection of battery for EVs & HEVs, Traction Battery Pack design, Requirement of Battery Monitoring, Battery State of Charge Estimation methods, Battery Cell equalization problem, thermal control, protection interface, SOC Estimation, Energy & Power estimation, Battery thermal management system, Battery Management System: Definition, Parts: Power Module, Battery, DC/DC Converter, load, communication channel, Battery Pack Safety, Battery Standards & Tests.

UNIT V BATTERY TESTING, DISPOSAL & RECYCLING (9)

Chemical & structure material properties for cell safety and battery design, battery testing, limitations for transport and storage of cells and batteries , Recycling, disposal and second use of batteries. Battery Leakage: gas generation in batteries, leakage path, leakage rates. Ruptures: Mechanical stress and pressure tolerance of cells, safety vents, Explosions: Causes of battery explosions, explosive process, Thermal Runway: High discharge rates, Short circuits, charging and discharging. Environment and Human Health impact assessments of batteries, General recycling issues and drivers, methods of recycling of EV batteries.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Infer about the Functions of the pneumatic tyre
CO2: Explain the manufacturing process of different types of tyre
CO3: Relate the importance of Physical properties of tyre cords made of different fabric and Tyre structure, tyre shape, tread design and tyre size determination
CO4: Analyze about the tyre performance
CO5: Summarize about importance of tubes, flaps and retreading.

Text Books

T1 Ibrahim Dinçer, Halil S. Hamut and Nader Javani, “Thermal Management of Electric Vehicle Battery Systems”, JohnWiley& Sons Ltd., 2016.
T2 Guangjin Zhao, “Reuse and Recycling of Lithium-Ion Power Batteries”, John Wiley & Sons. 2017. (ISBN: 978-1-1193-2185-9)

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References

R1 Chris Mi, Abul Masrur& David Wenzhong Gao, “Hybrid electric Vehicle- Principles & Applications with Practical Properties”, Wiley, 2011.

R2 G. Pistoia, J.P. Wiaux, S.P. Wolsky, “Used Battery Collection and Recycling”, Elsevier, 2001. (ISBN: 0-444-50562-8)”

19AU5305	NOISE, VIBRATION AND HARSHNESS	L	T	P	C
		3	0	0	3

Course Objectives

1 To develop the basic knowledge in vibration and noise
2 Understanding the effect of noise for human comfort and environment
3 To gain knowledge on noise and vibration created by the transportation vehicles
4 To interpret the sources of interior transportation noise and vibration
5 To illustrate various methods of vibration and noise measurement

UNIT I FUNDAMENTALS OF ACOUSTICS, NOISE AND VIBRATION (9)

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

UNIT II EFFECT OF NOISE, BLAST, VIBRATION AND SHOCK ONPEOPLE (9)

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

UNIT III TRANSPORTATION NOISE AND VIBRATION – SOURCES, PREDICTION AND CONTROL (9)

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

UNIT IV INTERIOR TRANSPORTATION NOISE AND VIBRATION –PREDICTION AND CONTROL (9)

Interior Transportation Noise and Vibration Sources–Bus and Truck– Prediction and Control, Noise and Vibration in Off-Road Vehicle Interiors–Prediction and Control.

UNIT V NOISE AND VIBRATION TRANSDUCERS, ANALYSISEQUIPMENT, SIGNAL PROCESSING AND MEASURINGTECHNIQUES (9)

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

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Differentiate the various types of vibration with damping and without damping.
CO2: Assess various sources of noises and its characteristics.
CO3: Process techniques and measurement methods to control and solve complex Vehicle vibrations behavior.
CO4: Identify methods to predict and reduce low noise and vibration levels.
CO5: Demonstrate the methods for control of engine noise, combustion noise, mechanical noise, predictive analysis.

Text Books

T1 Allan G. Piersol ,Thomas L. Paez ―Harris‘ shock and vibration hand book, McGraw-Hill, New Delhi, 2010
T2 Clarence W. de Silva , ―Vibration Monitoring, Testing, and Instrumentation, CRC Press,2007

References

R1 Colin H Hansen ―Understanding Active Noise Cancellation, Spon Press, London. 2003
R2 Matthew Harrison ―Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles, Elsevier Butterworth-Heinemann, Burlington, 2004

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19AU6301	AUTOMOTIVE AIR-CONDITIONING	L	T	P	C
		3	0	0	3

Course Objectives

1. To understand the fundamentals of air conditioning system
2. To understand the basic of vehicle air-conditioning system, its components, working principle and control mechanism.
3. To Understand air-conditioning controls, delivery system and refrigerants
4. To understand the automatic temperature control like sensors and actuators
5. To Infer the system servicing and testing.

UNIT I AUTOMOTIVE AIRCONDITIONING FUNDAMENTALS (9)

Purposes of Heating, Ventilation and Air Conditioning- Environmental Concerns- Ozone layer depletion- Location of air conditioning components in a car – Schematic layout of a vehicle refrigeration system. Psychrometry – Basic terminology and Psychrometric mixtures- Psychrometric Chart- Related problems

UNIT II AUTOMOTIVE COOLING AND HEATING SYSTEM (9)

Vehicle Refrigeration System and related problems- Fixed thermostatic and Orifice tube system-Variable displacement thermostatic and Orifice tube system- Vehicle air conditioning operation Types of compressor- Compressor Clutches- Compressor Clutch electrical circuit- Compressor lubrication- Condensers- Evaporators- Expansion devices- Evaporator temperature and pressure controls- receiver-drier- Accumulators- refrigerant hoses, Connections and other assemblies- Heating system

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

Types of Control devices- Preventing Compressor damage- Preventing damage to other systems-Maintaining drivability- Preventing Overheating Ram air ventilation- Air delivery Components- Control devices- Vacuum Controls Containers – Handling refrigerants – Discharging, Charging & Leak detection – Refrigeration system diagnosis – Diagnostic procedure – Ambient conditions affecting system pressures.

UNIT IV AUTOMATIC TEMPERATURE CONTROL (9)

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

UNIT V SYSTEM SERVICING AND TESTING (9)

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

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

- CO1: Illustrate the components of the automotive air-conditioning and their fundamentals.
- CO2: Describe the working principles of the components of the automotive air conditioning system
- CO3: Understand air-conditioning controls, delivery system and refrigerants
- CO4: Identify and describe the current developments relating to the automotive air conditioning
- CO5: Infer the system servicing and testing

Text Books

- T1 Warren Farnell and James D.Halderman, "Automotive Heating, Ventilation, and AirConditioning systems", Classroom Manual, Pearson Prentice Hall, 2004
- T2 Warren Farnell and James D.Halderman, "Automotive Heating, Ventilation, and AirConditioning systems", Shop Manual, Pearson Prentice Hall, 2004

References

- R1 Mitchell Information Services, Inc., "Mitchell Automatic Heating and Air Conditioning Systems", Prentice Hall Inc., 1989.
- R2 Paul Weisler, "Automotive Air Conditioing", Reston Publishing Co. Inc., 1990.

19AU6302	FUEL CELL TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives

1 To define the concept, principle and working of fuel cells.
2 To comprehend the process design for fuel cells.
3 To understand the fuel processing techniques for fuel cells.
4 To evaluate about the performance of various fuel cell components.
5 To analyze the automotive applications of fuel cells.

UNIT I INTRODUCTION TO FUEL CELLS (9)

Fuel cells - introduction – working – types – low, medium and high temperature fuel cells - liquid and methanol types - proton exchange membrane fuel cell - solid oxide - hydrogen fuel cells - thermodynamics and electrochemical kinetics of fuel cells.

UNIT II FUEL CELL PROCESS DESIGN (9)

Fuel cell process design - Main PEM fuel cell components – materials - properties processes – membrane – electrode - gas diffusion layer - Fuel cell operating conditions – pressure – temperature - flow rates – humidity.

UNIT III FUEL CELL COMPONENTS AND THEIR IMPACT ON PERFORMANCE (9)

Fuel cell performance characteristics – current - voltage - voltage efficiency - power density - ohmic resistance - kinetic performance - mass transfer effects - membrane electrode assembly components - fuel cell stack – bi polar plate - humidifiers - cooling plates.

UNIT IV FUEL PROCESSING (9)

Hydrogen storage technology - pressure cylinders - carbon fibers – reformer technology – steam reforming - partial oxidation - auto thermal reforming - CO removal - fuel cell technology based on removal.

UNIT V FUEL CELLS FOR AUTOMOTIVE APPLICATIONS (9)

Fuel cells for automotive applications – technology advancements – onboard hydrogen storage – liquid hydrogen - compressed hydrogen – metal hydrides - fuel cell control system – alkaline fuel cell – road map to market.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Summarize the concepts, principle and working of fuel cells.
CO2: Comprehend the process design for fuel cells.
CO3: Assess the fuel processing techniques for fuel cells.
CO4: Interpolate the performance of various fuel cell components.
CO5: Paraphrasse the various automotive applications of fuel cells.

Text Books

T1 Viswanathan B. and Scibioh Aulice M, “Fuel Cells: Principles and Applications”, University Press, 2008.
T2 Fuel Cells for automotive applications, R.H.Thring – Professional Engineering publishing UK. 200.

References

R1 Frano Barbir, “PEM Fuel Cells: Theory and Practice”, Elsevier Academic Press, USA, 2012.
R2 Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRS Press, 2009.
R3 Fuel Cell Technology Handbook SAE International Grego rHoogers CRC Press, 2003.

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19AU6303	ERGONOMICS IN AUTOMOTIVE DESIGN	L	T	P	C
		3	0	0	3

Course Objectives

1. To able to convert their creativity into concept styling and design.
2. To familiarize the knowledge on form studies and clay modeling.
3. To acquire knowledge in ergonomics fundamentals.
4. To familiarize the concept of vehicle ergonomics.
5. To acquire knowledge in vehicle packing.

UNIT I INTRODUCTION TO STYLING (9)

Car Design - Fundamentals of perspective drawing - Automotive Sketching - Styling process - Car proportions – Aerodynamics - Crashworthiness and its influence on body design - Designing of Interiors.

UNIT II FORM STUDIES (9)

Form studies - Speed Forms - Clay Modeling - 2D systems - 3D systems.

UNIT III FUNDAMENTALS OF ERGONOMICS (9)

Dimension Determination - Anthropometry – Need - Data collection methodology - Different postural considerations - Measuring Procedures Subject and Sampling size selection - Measurement of Hands/Feet/Full posture - Applying Anthropometry data - Application of percentile curves.

UNIT IV VEHICLE ERGONOMICS (8)

Passenger Compartment - Floor Pan - Technical requirements - Dash board equipments arrangement - Positioning of operational controls - Force Analysis - Seating and position (ECE Regulations) - Human Factors - Navigation systems - pedal positioning.

UNIT V VEHICLE PACKING (9)

R-Point – AHP - Manikin positioning of 2-D pattern - car entry/exit - Sight – All round visibility - View of Instruments - Mirror design - Logical formation of cockpit - Boot lid packaging - Loading/Unloading analysis.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Design a sketch of automobile with new style.
CO2: Create clay models of the car and study the model.
CO3: Apply the basic techniques of ergonomics on vehicle design.
CO4: Acquire knowledge on designing passenger compartment.
CO5: Enumerate the steps and methods of vehicle interior design.

Text Books

T1 Vivek D Bhise, “Ergonomics in the Automotive Design Process”, 2017, ISBN-10: 1439842108
T2 J. Brian Peacock, Waldemar Karwowski, “Automotive ergonomics”, Taylor & Francis ltd, 1993

References

R1 Tony Lewin, “How to Draw Cars like a Pro”, Motorbooks International, 2006.
R2 Fenton John, “Handbook of automotive body and system design”, Wiley-Blackwell, 2005.

19AU6304	TRACTOR AND FARM EQUIPMENT	L	T	P	C
		3	0	0	3

Course Objectives

1 To learn about tractor, its engine construction and classification.
2 To gain knowledge in the hydraulic systems used in earth movers and farm equipment.
3 To understand the testing methods of tractors along with power tillers and associated systems.
4 To impart knowledge in farm mechanization, methods involved and types.
5 To study about the primary and secondary tillage implementation with constructional details.

UNIT I TRACTORS (9)

Classification of tractors - Tractor engines – construction of engine blocks, cylinder head and crankcase - features of cylinder, piston, connecting rod and crankshaft – firing order combustion chambers.

UNIT II HYDRAULIC SYSTEMS (9)

Hydraulic system - working principles, three point linkage - draft control - weight transfer, theory of traction - tractive efficiency – tractor chassis mechanics - stability - longitudinal and lateral. Controls - visibility - operators seat.

UNIT III POWER TILLER AND TRACTOR TESTING (9)

Power tiller - special features - clutch - gear box - steering and brake. Makes of tractors and power tillers. Types of tests- test procedure - need for testing & evaluation of farm tractor -Test code for performance testing of tractors and power tillers.

UNIT IV FARM MECHANIZATION (9)

Farm mechanisation – objectives. Tillage - objectives - methods – primary tillage implements - secondary tillage implements - animal drawn ploughs - construction. Types of farm implements – trailed, mounted. Field capacity - forces acting on tillage tool.

UNIT V PRIMARY AND SECONDARY TILLAGE IMPLEMENTS (9)

Mould board plough- attachments – mould board shapes and types. Disc plough – force representation on disc – Types of disc ploughs – Subsoiler plough - Rotary plough. Cultivators - types - construction. Disc harrows - Bund former - ridger – leveller. Basin lister-Wetland preparation implements.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Understand the construction of tractor engines, constructional features and classification of tractors.
CO2: Comprehend the different control mechanisms and methods used in hydraulic systems in farm equipment.
CO3: Recognize power tillers, its parts along with testing methods of tractors.
CO4: Differentiate the farm mechanization methods, implementation procedure and types of implementations.
CO5: Impart knowledge in primary and secondary tillage implements and equipment involved in it.

Text Books

T1 Jain, S.C. and C.R. Rai. Farm tractor maintenance and repair. Standard publishers and distributors, New Delhi, 2012.
T2 Jagdishwar Sahay. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi 6.,2014.

References

R1 Kepner, R.A., et al. Principles of farm machinery. CBS Publishers and Distributers, Delhi. 99, 2005
R2 Srivastava, A.C. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi, 1991.

19AU6305	ROBOTICS	L	T	P	C
		3	0	0	3

Course Objectives

1 To understand the concept of automation and robotics with its components.
2 To gain the knowledge in various drive systems and end effectors.
3 To study the different sensors used in robot control.
4 To perform motion analysis and its kinematics along with robot programming.
5 To analyze the basics of the industrial applications of robots.

UNIT I FUNDAMENTALS OF ROBOT (8)

Robot – definition – robot anatomy – co-ordinate systems - work envelope - classification – specifications – pitch, yaw and roll - joint notations - speed of motion - pay load - robot parts and their functions - need for robots - different applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS (9)

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

UNIT III SENSORS AND MACHINE VISION (10)

Sensors - Force sensing - touch and tactile sensors - proximity sensors - non-contact sensors - safety considerations in robotic cell - fail safe hazard sensor systems and compliance mechanism - Machine vision system – camera - frame grabber - sensing and digitizing image data - signal conversion - image storage - lighting techniques - image processing and analysis - data reduction – segmentation - feature extraction - object recognition - other algorithms - applications – Inspection – identification - visual serving - navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING (9)

Forward and inverse kinematics – manipulators with two and three DOF (in 2D), four DOF (in 3D) – DH matrices - deviations and problems – Robot programming - teach pendant programming - lead through programming - robot programming languages – VALprogramming – motion commands - sensor commands - end effector commands and simple programs.

UNIT V APPLICATIONS OF ROBOTS (9)

RGV – AGV - Role of robots in inspection, assembly, material handling, underwater, space and medical fields - Steps involved - Safety Considerations for Robot Operations.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Comprehend the concept of automation and robotics with its components.
CO2: Analyze the various drive systems and end effectors with types of robot motions.
CO3: Differentiate the various sensors and their methods control the robots.
CO4: Demonstrate motion analysis and its kinematics of robots and its programming.
CO5: Extrapolate the applications of robots in industries and articulate the safety features.

Text Books

T1 M.P.Groover, ―Industrial Robotics – Technology, Programming and Applications, McGraw-Hill, 2017.
T2 Fu.K.S. Gonzalz.R.C., and Lee C.S.G., ―Robotics Control, Sensing, Vision and Intelligence, McGraw-Hill Book Co., 1987

References

R1 YoramKoren, ―Robotics for Engineers, McGraw-Hill Book Co., 1992

BoS Chairman
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Principal / Dean (Academics)

		L	T	P	C
19AU7301	**AUTOMOTIVE VEHICLE MAINTENANCE** (Courses offered in Collaborations with Hindusthan – Eicher Centre of Excellence Regional Competency Development Centre)	3	0	0	3

Course Objectives

1 To understand the concepts of maintenance records and schedules.
2 To comprehended the necessary details to understand the engine repair and over hauling.
3 To provide the necessary knowledge on chassis repair and over hauling.
4 To have the knowledge on vehicle body maintenance and repair.
5 To understand the electrical system servicing and repair procedure.

UNIT I MAINTENANCE TOOL, SHOP, SCHEDULE, RECORDS (8)

Standard tool set, torque wrenches, compression and vacuum gauges, engine analyzer and scanner, computerized wheel alignment and balancing, gauges for engine tune up and pollution measurement, spark plug cleaner, cylinder re boring machine, fuel injection calibration machine. Importance of maintenance. Schedule and unscheduled maintenance. Scope of maintenance. Equipment downtime. Vehicle inspection. Reports. Log books. Trip sheet. Lay out and requirements of maintenance shop.

UNIT II POWER PLANT REPAIR AND OVERHAULING (9)

Dismantling of power plant and its components. Cleaning methods. Inspection and checking. Repair and reconditioning methods for all engine components. Maintenance of ignition system, fuel injection system, cooling system, - lubrication system. Power plant trouble shooting chart

UNIT III MAINTENANCE, REPAIR AND OVERHAULING OF THE CHASSIS (10)

Maintenance, servicing and repair of clutch, fluid coupling, gearbox, torque converter, propeller shaft. Maintenance of front axle, rear axle, brakes, steering systems.

UNIT IV MAINTENANCE AND REPAIR OF VEHICLE BODY (9)

Body panel tools for repairing. Tinkering and painting. Use of soldering, metalloid paste. Tyre maintenance, metallic, plastics

UNIT V MAINTENANCE AND REPAIR OF ELECTRICAL SYSTEMS (9)

Care, maintenance, testing and troubleshooting of battery, starter motor, dynamo, alternator and regulator. Transistorized regulator problems.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Apply the knowledge on maintenance tools and records.
CO2: Analyze the various procedures avail to carry out engine repair and over hauling.
CO3: Dismantle, Study and assemble the various parts of chassis sub systems.
CO4: Attain the knowledge of maintenance and repair of vehicle body.
CO5: Describe the maintenance procedure of various electrical subsystems.

Text Books

T1 Ernest Venk and Edward spicer, “Automotive maintenance and troubleshooting”, D.B. Taraporevala Sons, 2008.
T2 Ed May, “Automotive Mechanics Volume One”, Mc Graw Hill Publications, 2006

References

R1 Bosch Automotive Handbook, Tenth Edition,2018
R2 Doshi.J.A, “Vehicle Maintenance and Garage Practice”, Prentice Hall India Learning Private Limited,2014.

BoS Chairman
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19AU7302	RAILWAY ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

1 To get knowledge in railway tracks, its alignment, gauges involved and procedure of alignment.
2 To impart knowledge in track rails, its types, functions and general requirements.
3 To acquire knowledge in rail joints, welding methods and procedures.
4 To know about the railway track maintenance activities, tools required and schedules.
5 To get aware of modernization, high speed rail transportation and its effects.

UNIT I RAILWAY TRACK AND ALIGNMET OF LINES (9)

Long-term Corporate Plan of Indian Railways, Classification of Railway Lines in India Gauges on World Railways Different Gauges on Indian Railways, Choice of Gauge, Problems Caused by Change of Gauge, Uni-gauge Policy of Indian Railways, Loading Gauge, Construction Gauge - Importance of Good Alignment, Basic Requirements of an Ideal Alignment, Selection of a Good Alignment, Mountain Railways, Rack Railways.

UNIT II TRACK STRESS AND RAILS (9)

Requirements of a Good Track, Maintenance of Permanent Way, Track as an Elastic Structure, Forces Acting on the Track, Coning of Wheels, Tilting of Rails - Function of Rails, Types of Rails, Requirements for an Ideal Rail Section, Rail Manufacture, Rail Wear, Other Defects in Rails, Rail Failure, Rail Flaw Detection.

UNIT III RAIL JOINTS AND WELDING OF RAILS (9)

Ill Effects of a Rail Joint, Requirements of an Ideal Rail Joint, Types of Rail Joints, Welding a Rail Joint, Gas Pressure Welding, Electric or Metal Arc Welding, Flash Butt Welding, Thermit Welding of Rails, Recent Developments in Welding Techniques.

UNIT IV TRACK MAINTENANCE (9)

Necessity and Advantages of Track Maintenance, Essentials of Track Maintenance, Measuring Equipment and Maintenance Tools for Tracks, Maintenance of Rail Surface, Deep Screening of Ballast, Track Drainage, Maintenance of Track in Track circuited Lengths, Organization Structure for Track Maintenance, Protection of Track for Engineering Work, Patrolling of Railway Tracks, Track Tolerances

UNIT V MODERNIZATION OF RAILWAYS AND HIGH-SPEED TRAINS (9)

Modernization of Railways, Effect of High-speed Track, Vehicle Performance on Track, High-speed Ground Transportation System, Ballast less Track.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Gather knowledge on various railway tracks, gauges and procedure of alignment and its importance.
CO2: Depict the requirements of rail tracks, tilting, forces involved, its manufacturing and arising defects.
CO3: Get to know about the welding methods, procedure and developments in joining railway tracks.
CO4: Comprehend about the track maintenance activities, procedures, methods and precautionary measures involved.
CO5: Get updated in modern railways, high speed technologies and performance on track.

Text Books

T1 Satish Chandra & M.M.Agarwal, “Railway Engineering”, Oxford University Press, 2007
T2 J. H. Armstrong, “The Railroad: What It Is, What It Does”, 5th Edition, Simmons-Boardman (2008)

References

R1 Amit Gupta & B.L. Gupta, “Railway Engineering”, Standard Publish Distributors (2005)

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		L	T	P	C
19AU7303	**ENGINE AUXILLARY SYSTEMS** (Courses offered in Collaborations with Hindusthan – Eicher Centre of Excellence Regional Competency Development Centre)	**3**	**0**	**0**	**3**

Course Objectives

1 To understand the Carburetion systems used in automobiles and their functions.
2 To understand the gasoline injection systems used in automobiles and their functions.
3 To understand the diesel injection systems used in automobiles and their functions.
4 To understand the manifolds and mixture distribution in automobiles and their functions.
5 To acquire knowledge in lubrication and cooling systems used in automobiles and their functions.

UNIT I CARBURETION (9)

Introduction- principle of working-factors affecting carburetion-Air fuel mixtures-mixture requirements at different loads and speeds- Carburetor-Essential Parts-different circuits-compensating devices-working -types- Chokes-Effects of altitude on carburetion.

UNIT II ELECTRONICS INJECTION SYSTEMS (9)

Introduction-Need of Gasoline injection-types-components-EFI-merits-Demerits-MPFI system- port injection- throttle body injection-Function of MPFI-Electronic control system - group gasoline injection system- electronic diesel injection system - EDI control-CRFI system.

UNIT III DIESEL FUEL INJECTION (9)

Factors influencing fuel spray atomization- penetration and dispersion of diesel and heavy oils and their properties-rate and duration of injection- fuel line hydraulics- fuel pump- injectors- CRDI systems and its merits and demerits.

UNIT IV INTAKE ANS EXHAUST MANIFOLDS (9)

Intake system components- Discharge coefficient- Pressure drop-Air filter-Intake manifold-Connecting pipe-Exhaust system components-Exhaust manifold and exhaust pipe- Spark arresters- Waste heat recovery-Exhaust mufflers-Type of mufflers- exhaust manifold expansion.

UNIT V LUBRICATION AND COOOLING SYSTEMS (9)

Lubricants-lubricating systems- Lubrication of piston rings- bearings-oil consumption-Oil cooling. Heat transfer coefficients-liquid and air-cooled engines-coolants-additives and lubricity improvers- concept of adiabatic engines.

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: At the end of the course, the student will be familiar with the functionality, construction, working principle of carburetion.
CO2: Illustrate the electronics injection systems in automotive engines.
CO3: Illustrate the diesel fuel injection systems in automotive engines.
CO4: Students can Improve the Manifolds and Mixture Distribution in IC engine.
CO5: Summarize the lubrication and cooling system in automotive engines.

Text Books

T1 Ramalingam. K.K., “Internal Combustion Engine”, scitech publications,2003
T2 Ganesan V. “Internal Combustion Engines”, Third Edition, Tata McGraw-Hill, 2007.

References

R1 Konrad Reif, "Fundamentals of Automotive and Engine Technology (Bosch Professional Automotive Information", Springer Nature,2014.
R2 M. L. Mathur, R. P. Sharma, "Internal combustion engines", Dhanpat Rai Publication, 2005.

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19AU7304	TRIBOLOGY AND TEROTECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives

1. To understand the concept of tribology with its mechanisms and measurement techniques.
2. To understand friction between surfaces and its behavior in different materials.
3. To learn concept of wear, types and its influence in various materials.
4. To understand the concepts lubrication along with its characteristics.
5. To understand the basic concepts of Terotechnology and scheduled maintenance.

UNIT I INTRODUCTION TO TRIBOLOGY (9)

Introduction to contact between solid surfaces - Analysis of the Contacts - Single Asperity Contact of Homogeneous and Frictionless Solids - Single Asperity Contact of Layered Solids in Frictionless and Frictional Contacts - Multiple Asperity Dry Contacts - Measurement of the Real Area of Contact - Measurement Techniques - Typical Measurements.

UNIT II FRICTION (9)

Introduction to Friction - Solid–Solid Contact - Rules of Sliding Friction - Basic Mechanisms of Sliding Friction - Other Mechanisms of Sliding Friction - Friction Transitions During Sliding - Static Friction - Stick-Slip - Rolling Friction - Liquid-Mediated Contact - Friction of Materials - Friction of Metals and Alloys - Friction of Ceramics - Friction of Polymers - Friction of Solid Lubricants

UNIT III WEAR (9)

Introduction to wear - types of Wear Mechanism - Adhesive Wear - Abrasive Wear (by Plastic Deformation and Fracture) - Fatigue Wear - Impact Wear - Chemical (Corrosive) Wear - Electrical-Arc-Induced Wear - Fretting and Fretting Corrosion - Types of Particles Present in Wear Debris - Plate-Shaped Particles - Ribbon-Shaped Particles - Spherical Particles - Irregularly Shaped Particles - Wear of Materials - Wear of Metals and Alloys - Wear of Ceramics - Wear of Polymers.

UNIT IV LUBRICATION (9)

Introduction to Fluid Film Lubrication - Regimes of Fluid Film Lubrication - Hydrostatic Lubrication - Hydrodynamic Lubrication - Electrohydrodynamic Lubrication - Mixed Lubrication - Boundary Lubrication - Viscous Flow and Reynolds Equation - Viscosity and Newtonian Fluids - Fluid Flow - Hydrostatic Lubrication - Hydrodynamic Lubrication - Thrust Bearings - Journal Bearings - Squeeze Film Bearings - Gas-Lubricated Bearings - Electrohydrodynamic Lubrication - Forms of Contacts - Line Contact - Point Contact - Thermal Correction - Lubricant Rheology

UNIT V TEROTECHNOLOGY (9)

Terotechnology and its influence on plant engineering and maintenance, specific application areas, Overall effectiveness of equipment (OEE) and its measurement RAM analysis: Reliability, Availability, Inherent & Operational and Maintainability. Maintenance Management Practice –Various types of maintenance, breakdown, preventive, periodic or predictive, condition-based maintenance as predictive preventive maintenance.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Understand the basics of Tribology and importance in engineering field.
CO2: Infer about the friction and its associated effects on surfaces.
CO3: Understand the wear, its mechanisms and debris analysis.
CO4: Explain the lubrication principles and methods in real time.
CO5: Comprehend the concepts of terotechnology and the importance of scheduled maintenance in industries.

BoS Chairman
(Dr Sabarinathan C)

Principal / Dean (Academics)

Text Books

T1 Bharat Bhusan, “Introduction to Tribology”, John Wiley & Sons Publication, 2nd Edition, 2013

T2 Gwidon W. Stachowiak, Andrew W. Batchelor “Engineerring Tribology”, Butterworth Heinemann – Elsevier Publications, 3rd Edition, 2005.

References

R1 Dr. Bo N. J. Persson, “Sliding Friction Physical Principles and Applications”, Springer Publications, 2nd Edition, Springer Publications, 2000.

R2 B Bhadury and S.K. Basu, “Terotechnology: Reliability Engineering and Maintenance Management”, Asian Books, New Delhi 2002.

19AU7305	ENTERPRENEURSHIP DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives

1. Explaining the types, characteristics of entrepreneurship and its role in economic development.
2. Applying the theories of achievement motivation and the principles of entrepreneurship development program to enterprise.
3. Selecting the appropriate form of business ownership in setting up an enterprise.
4. Applying the fundamental concepts of finance and accounting to enterprise.
5. To understand the government policy and start up procedure for small scale industries.

UNIT I ENTREPRENEURSHIP (9)

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth- Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION (9)

Major Motives Influencing an Entrepreneur – Achievement Motivation Training-Self Rating- Business Games-Thematic Apperception Test – Stress Management-Entrepreneurship Development Programs – Need- Course Objectives.

UNIT III BUSINESS (9)

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – 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.

UNIT IV FINANCING AND ACCOUNTING (9)

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.

UNIT V SUPPORT TO ENTREPRENEURS (9)

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.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

- CO1: Explain the types, characteristics of entrepreneurship and its role in economic development
- CO2: Apply the theories of achievement motivation and the principles of entrepreneurship development program
- CO3: Select the appropriate form of business ownership in setting up an enterprise.
- CO4: Apply the fundamental concepts of finance and accounting to enterprise.
- CO5: Identify sickness in industry, select the appropriate corrective measures, and identify the growth strategies in enterprise.

Text Books

- T1 Khanka. S.S, “Entrepreneurial Development” S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.
- T2 Donald F Kuratko, “Entrepreneurships – Theory, Process and Practice”, Cengage Learning, 2014.

References

- R1 Hisrich R D, Peters M P, “Entrepreneurship” 8th Edition, Tata McGraw-Hill, 2013.
- R2 Mathew J Manimala, “Entrepreneurship theory at cross roads: paradigms and praxis”, Dream tech, 2005.
- R3 Charantimath, P. M., “Entrepreneurship Development and Small Business Enterprises”, Pearson, 2006.

19AU8301	AUTOMOTIVE INFOTAINMENT (Courses offered with Ford EcoSport)	L	T	P	C
		3	0	0	3

Course Objectives

1. Understand the basics of Automotive Infotronics and infotainment system.
2. Know the telematics in automotive systems.
3. Understand the automotive safety and security systems.
4. Comprehend the trouble codes and faults in autotronics.
5. learnt communication protocols in the automotive networking.

UNIT I INTRODUCTION (9)

Infotainment electronics Dashboard instrument cluster, car audio, telematics systems, navigation systems, multimedia systems. In-Vehicle Networking based services Integrating GPS, WiFi and Bluetooth Technologies, Smart Helmet. Introduction, driver support systems, driver information, driver perception, driver convenience, driver monitoring. Vehicle support systems, general vehicle control, collision avoidance, vehicle status monitoring.

UNIT II TELEMATICS (9)

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition, driver assistance systems, Connected Vehicles, Autonomous Vehicles, Adaptive cruise control, adaptive noise control, active roll control system, cylinder cut- off technology. Active suspension systems, requirement and characteristics, power steering, collapsible and tilt able steering column, power windows.

UNIT III SAFETY SYSTEMS AND SECURITY SYSTEMS (9)

Airbags, seat belt tightening system, collision warning systems, child lock, anti - lock braking systems. anti - spin regulation, traction control systems. Anti-theft technologies, immobilizers, alarm system, stolen vehicle tracking system, remote keyless entry, smart card system, number plate coding, lane departure warning system.

UNIT IV DIAGNOSTICS (8)

Onboard diagnostics, fault code displays. Off board diagnostics, engine data display, expert system occupant protection system. Airbag deployment system security and warning systems. diagnostic trouble codes.

UNIT V COMMUNICATION PROTOCOLS (9)

Introduction to control networking, Communication protocols in embedded systems – SPI, I2C, USB. Vehicle communication protocols, In Vehicle Networking, Introduction to CAN, LIN, FLEXRAY, MOST, AUTO SAR.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: get knowledge of Automotive Infotronics and infotainment system.
CO2: identify and use the telematics in automotive systems.
CO3: know aware of automotive safety and security systems.
CO4: clear the trouble codes and faults using OBD.
CO5: know the in-vehicle networking systems in automobile.

Text Books

T1 Ljubo Vlacic, Michel Parent and Fumio Harashima, “Intelligent Vehicle Technologies”, Butterworth-Heinemann publications, Oxford, 2001.
T2 Robert Bosch, “Automotive Hand Book”, 5th Edition, SAE, 2000.

References

R1 Bechhold, “Understanding Automotive Electronics”, SAE, 1998.
R2 Ronald K Jurgen, “Navigation and Intelligent Transportation Systems – Progress in Technology”, Automotive Electronics Series, SAE, USA, 1998.
R3 William B Riddens, “Understanding Automotive Electronics”, 5th edition, Butter worth Heinemann Woburn,1998.

BoS Chairman
(Dr Sabarinathan C)

Principal / Dean (Academics)

		L	T	P	C
19AU8302	**COMPUTATIONAL FLUID DYNAMICS**	**3**	**0**	**0**	**3**

Course Objectives

1. To provide the students with sufficient background to understand the mathematical representation of the governing equations of fluid flow and heat transfer.
2. To teach students how to express derivatives and differential equations through discretization techniques.
3. To enable the students to solve one and two-dimensional ordinary and partial differential equations using traditional CFD tools.
4. To help the students to understand the general transformation equations for grid generation
5. To identify the case studies of fluid flow and heat transfer applications.

UNIT I INTRODUCTION (9)

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.

UNIT II DISCRETISATION (9)

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.

UNIT III CFD TECHNIQUES (9)

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.

UNIT IV TURBULENCE MODELING (9)

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

UNIT V CASE STUDIES (9)

Modeling and analysis of heat transfer- fluid flow and automobile components using CFD packages.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Summarize the discretization process of governing equation
CO2: Rephrase the grid generation and its application
CO3: Solve the different mathematical modules used in CFD
CO4: Determine the Turbulence Energy Equation in mathematical form
CO5: Utilize the model and analyze fluid flow and heat transfer problems using commercial CFD

Text Books

T1 Versteeg, H.K., and Malalasekera, "An Introduction to Computational Fluid Dynamics: The Finite Volume Method", Pearson Education, 2014.

T2 Muralidhar K and Sundararajan T, "Computational Fluid Flow and Heat Transfer", Narosa Publications, 2003.

References

R1 John. F. Wendt, "Computational Fluid Dynamics – An Introduction", Springer, 2013.

R2 Chung T.J, "Computational Fluid Dynamicsl", Cambridge University Press, 2002.

BoS Chairman
(Dr Sabarinathan C)

Principal / Dean (Academics)

19AU8303	AUTOMOTIVE PAINTING TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives

The objective of this course is to enable the students:

1. To understand the basic concepts about paints, their ingredients, functions of various ingredients and classification of paints.
2. To understand composition and properties of various ingredients.
3. To understand about surface preparation and application of paints on various surfaces.
4. To understand the Modern Automotive Coating Processes.
5. To understand the Automotive Coating Performance.

UNIT I Basics aspects and concepts (9)

Paint definition, paints and their general ingredients, functions of ingredients, classifications of paints, drying / curing mechanism of paints.

UNIT II Paints and coatings raw materials (9)

Drying oils, modified drying oils, natural resins, synthetic resins, extenders & prime pigments, inorganic & organic pigments, lakes & toners, dyes & pigments, true solvents, latent solvents & diluents, properties of solvents, drying catalysts (driers), plasticizers, additives for solvent-borne & water-borne paints.

UNIT III Surface preparation (9)

Different steps involved in preparation of painting process, paint removal – sand blasting, hot caustic solution, paint remover, power sanding equipment, spray gun, types, common paint defects and their prevention & cure.

UNIT IV Modern Automotive Coating Processes (9)

Pretreatment, electrodeposition (ED), underbody coating (UBC) and seam sealing PVC (Polyvinyl Chloride), primer, smoother, topcoats, basecoat, clearcoat, spray coating.

UNIT V Automotive Coating Performance (9)

Coating Quality, Gloss and Smoothness of Paint Material, Colour, Corrosion Protection, Trends in Automotive Coating Processes- Powder Coating, 3-Wet Paint.

TOTAL: 45 PERIODS

Course Outcomes

On the successful completion of the course, students will be able to:

CO1: Understand the basic concepts about paints, their ingredients, and functions of ingredients and classification of paints.
CO2: Understand the composition and properties of various raw materials for paints.
CO3: Prepare and paint various types of substrates.
CO4: Learn the Modern Automotive Coating Processes.
CO5: Test the automotive paints coating performance and their raw materials.

Text Books

T1 V.C. Malshe, “Basics of Paint Technology (Part I & II)”, Prakash C. Malshe,2008
T2 Nelson K. Akafuah and Sadegh Poozes “Evolution of the Automotive Body Coating Process,” 2016

References

R1 Hans-Joachim Streitberger and Karl-Friedrich Dossel, "Automotive Paints and Coatings” John Wiley & Sons, 2008.
R2 A Monozukuri-Hitozukuri Perspective, “Automotive Painting Technology”, Springer Dordrecht Heidelberg London New York.2013

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19AU8304	NON-DESTRUCTIVE TESTING AND MATERIALS	L	T	P	C
		3	0	0	3

Course Objectives

1. To study and understand the various Non-Destructive Evaluation and Testing methods, theoryand their industrial applications.
2. To provide a basic understanding on different surface NDE techniques and apply them for inspecting materials in accordance with industry specifications and standards
3. To understand principles and techniques of thermography and eddy current testing
4. To provide a sound theoretical knowledge and practical skill for Ultrasonic testing
5. To get familiarized with codes, standards and specifications for RT with respect to safety norms

UNIT I INTRODUCTION TO NDT (7)

NDT Versus Mechanical testing–Overview of NDT Methods for the detection of manufacturing defects as well as material characterisation–merits and limitations–Various physical characteristics of materials and their applications in NDT–Visual inspection – Unaided and aided

UNIT II SURFACE NDE METHODS (8)

Liquid Penetrant Test-Principles–Types and properties of liquid penetrants–developers, advantages and limitations of various methods–Testing Procedure–Interpretation of results Magnetic Particle Testing- Theory of magnetism–Inspection materials–Magnetisation methods–Interpretation and evaluation of test indications–Principles and methods of demagnetization, Residual magnetism.

UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING (ET) (10)

Thermography- Principles, Contact and non contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation - infrared radiation and infrared detectors, Instrumentations and methods, applications–Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements–Probes–Instrumentation–Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

UNIT IV ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE) (10)

Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A-Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction. Acoustic Emission Technique–Principle, AE parameters, Applications

UNIT V RADIOGRAPHY (RT) (10)

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films - graininess,density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographicequivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed Tomography

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

- CO1: To have a basic knowledge of surface NDE techniques which enables to carry out various inspection in accordance with the established procedures
- CO2: Differentiate various defect types and select the appropriate NDT methods for better evaluation.
- CO3: Identify equipment required for the testing process
- CO4: Ability to communicate their conclusions clearly to specialist and non-specialist audiences.
- CO5: Documentation of the testing and evaluation of the results for further analysis.

Text Books

- T1 Baldev Raj, T.Jayakumar and M.Thavasimuthu “Practical Non-Destructive Testing”, Narosa Publishing, 2009.
- T2 Ravi Prakash, “Non-Destructive Testing Techniques”, 1st revised edition, New Age Publishers, 2010

References

- R1 Paul E Mix, “Introduction to Non-destructive testing: a training guide”, Wiley New Jersey, 2005
- R2 Charles, J. Hellier, “Handbook of Nondestructive evaluation”, McGraw Hill, New York 2001

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19AU8305	MOTORSPORTS ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

The objective of this course is to enable the students:

1. To understand the aerodynamic performance of racing vehicles.
2. To remember the essential types of engines, components and energy recovery systems used in racing vehicles.
3. To understand the sports vehicle chassis construction and suspension systems.
4. To understand the constructional outline of sports vehicles.
5. To remember and recall the various terms used in motor sporting events.

UNIT I RACE VEHICLE AERODYNAMICS (9)

Introduction – Aerodynamic vehicle shape – Impact – down-force performance – creating and measuring aerodynamic forces – type of air foil shapes – tyre performance – race vehicle dynamics – Effect of Aerodynamics.

UNIT II RACE VEHICLE ENGINE TECHNOLOGY (9)

Introduction to modern engine technologies - Lean Burn Engines, Stratified Charged Engines, Low heat Rejection Engines, Homogeneously Charged Compression Ignition Engines – Engine Tuning – Kinetic Energy Recovery System (KERS) – Race vehicle gear box – gear shift array.

UNIT III SPORTS VEHICLE CHASSIS AND SUSPENSION (9)

Chassis – Purpose – history – types – Ladder frame – Multi tubular – space frames – unitary Construction – safety regulations - Suspension – Trailing link – Wishbones – Sturt type – Swing axle – Sliding Pillar – live axle – De Dion.

UNIT IV SPORTS VEHICLE LAYOUT (9)

Front – rear suspension – Mounting Brackets – Methods of mounting suspension – Engine and Transmission Mounting – Steering layout and mechanism–Body Mounting – Exhaust pipe mounting – Brakes – Radiators – Oil Coolers – Electrical Wiring – Seats.

UNIT V RACING TERMINOLOGY (9)

Circuit general rule – Case Study: Kari Motor, Buddha & Madras Motor Race Circuit Layout –Flag – types –description – Race officials designation and roles – Importance of driver safety gears - Racing ethics.

TOTAL: 45 PERIODS

Course Outcomes

On the successful completion of the course, students will be able to:

CO1: Understand the aerodynamic characteristics of the motor sporting vehicles.
CO2: Remember the working of various racing vehicle engines and performance tune ups.
CO3: Understand the chassis integration and suspension performance of racing vehicles.
CO4: Understand the components mounting methods in sports vehicles.
CO5: Remember the necessary terms frequently used in motor sporting along with case studies.

Text Books

T1 Derek Seward, “Race Car Design”, Red Globe Press, 2014.
T2 Andrew Livesey, “Basic Motorsport Engineering”, A Butterworth-Heinemann Title, 2011.
T3 Josh Smith “Smith’s Fundamentals of Motorsport Engineering” OUP Oxford, 2013.

References

R1 V.A.W.Hiller and Calex Ltd, “Hillier’s Fundamentals of Motor Vehicle Technology” OUP Oxford, 2012.

R2 Michael Costin and David Phipps, “Racing and Sports Car Chassis Design”, Robert Bentley,1975.

19AU8306	AUTOMOTIVE TESTING AND DIAGNOSIS (Courses offered with Ford EcoSport)	L	T	P	C
		3	0	0	3

Course Objectives

1. To understand the various diagnostic techniques and processes.
2. To use engine diagnostic tools and equipment safely and properly.
3. To acquire the knowledge of diagnosing subsystems of engines.
4. To diagnose and repair the brakes, steering and other chassis systems.
5. To solve and rectify the fault and errors in electronic and electrical systems.

UNIT I DIAGNOSTIC TECHNIQUES (9)

Diagnostic Process – Mechanical diagnostic techniques – Electrical diagnostic techniques – Fault codes – Systems – Data Sources.

UNIT II ENGINES (9)

Diagnosing Engine Problems – Engine Removal, Disassembly, Inspection, and In-Chassis Repairs – Types of Rebuilds - Cleaning the Engine – Fuel System diagnosis

UNIT III ENGINE SUB SYSTEMS (9)

Fuel Ignition systems and diagnosis – Diesel ignition diagnosis – Lubrication and Cooling system diagnosis – Exhaust system diagnosis – Diagnosis of Automatic and Manual Transmission.

UNIT IV CHASSIS SYSTEMS (9)

Brakes – Diagnosis of brakes and ABS - Traction Control diagnosis – Steering and Tyres alignments and repairs – Suspension and Active suspensions diagnosis.

UNIT V ELECTRICAL SYSTEMS (9)

Electronic components and circuits – Multiplexing – Lighting diagnostics – Body electricals and Heating, ventilation and air conditioning diagnosis.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Illustrate the general diagnostic procedure and techniques.
CO2: Apply the diagnostic procedure of engine systems.
CO3: Illustrate the repair and recondition techniques of Engine sub systems.
CO4: Describe the methods of diagnosing brakes and other chassis systems.
CO5: Illustrate the electrical and electronic circuits and repairs.

Text Books

T1 Tim Gillies, “Automotive Engines – Diagnosis, Repair and Rebuilding”, Delmer Cengage Learning, 2011.
T2 Tom Denton., "Automotive Technology: Vehicle Maintenance and Repair", Routledge, 2017.

References

R1 Doshi J.A., "Vehicle Maintenance and Garage Practice", PHI Learning Pvt. Ltd., 2016.

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19AU8307	INDUSTRY 4.0	L	T	P	C
		3	0	0	3

Course Objectives

1. To understand the developments and challenges of industry4.0
2. To understand the road map for the industry 4.0
3. To learn the various technologies transforming industrial production
4. To gain knowledge about industry 4.0 opportunities for sustainability.
5. To understand different models and frame works for Industry 4.0 through case studies.

UNIT I INTRODUCTION (9)

Various Industrial Revolutions-Digitalisation and the Networked Economy-Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0-The Journey so far: Developments in USA, Europe, China and other countries-Comparison of Industry 4.0 Factory and Today's Factory-Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation.

UNIT II ROAD TO INDUSTRY 4.0 (9)

Internet of Things (IoT) - Industrial Internet of Things (IIoT) - Internet of Services-Smart Manufacturing-Smart Devices and Products-Smart Logistics-Smart Cities-Predictive Analytics

UNIT III TECHNOLOGIES FOR ENABLING INDUSTRY 4.0 (9)

Big Data Analytics-Simulation -Robotic Automation and Collaborative Robots-Horizontal and Vertical System Integration- -Cloud Computing-Cyber Security-Augmented Reality-Implementation patterns in manufacturing companies

UNIT IV INDUSTRY 4.0 OPPORTUNITIES FOR SUSTAINABILITY (9)

Sustainable Industry 4.0 Framework-Current Trends and Future Perspectives-Contribution of Industry 4.0 Technologies for Industrial Performance-Smart manufacturing standardization- Architectures, reference models and standards framework-Barriers to the adoption of industry 4.0 technologies in the manufacturing sector

UNIT V INDUSTRY 4.0 -CASE STUDIES (9)

IOT-enabled smart appliances under industry 4.0-Smart factory performance and Industry 4.0-Leveraging industry 4.0 – A business model pattern framework-Current research and future perspectives on human factors and ergonomics in Industry 4.0-Cybersecurity in the context of industry 4.0: A structured classification of critical assets and business impacts.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Implement the big data and digitization concepts in the development of industrial economy
CO2: Describe the development in improvising the societal needs through internet and logistics
CO3: Generate low cost products by implementing various technologies.
CO4: Create opportunities in the manufacturing sector with innovative ideas.
CO5: Provide solutions for the problems that are raised through industry 4.0.

Text Books

T1 Ustundag, Alp, Cevikcan, Emre,Industry 4.0: Managing The Digital Transformation,2018
T2 Popkova, Elena G., Ragulina, Julia V., Bogoviz, Aleksei V,Industry 4.0: Industrial Revolution of the 21st Century,2019
T3 Bartodziej, Christoph Jan,The Concept Industry 4.0,2017

References

R1 Knapcikova, Lucia, Balog, Michal,Industry 4.0: Trends in Management of Intelligent Manufacturing Systems,2019
R2 Richard Brunet-Thornton and Felipe Martinez ,Analyzing the Impacts of Industry 4.0 in Modern Business Environments,2018

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19AU8308 **AUTONOMOUS VEHICLE TECHNOLOGY**

L	T	P	C
3	0	0	3

Course Objectives

1. To get good exposure an autonomous vehicle technology
2. To understand the autonomous vehicle concepts.
3. To acquire knowledge in advance systems.
4. To familiarize the concept of automated mechanism.
5. To recognize the various adjustment systems for comfort and convenience drive.

UNIT I INTRODUCTION (9)

Autonomous driving-man and machine-automated driving in its social, historical and cultural contexts-autonomous driving technologies.

UNIT II PREPARATION IN AUTONOMOUS DRIVING (9)

Introduction-data sets-object detection- segmentation-stereo, optical flow, scene flow, tracking- convolution neural networks-semantic segmentation.

UNIT III DECISION,PLANNING AND CONTROL (9)

Vehicle model, road model and SL coordinate system, motion planning path planning ,speed planning, longitudinal planning-legal planning-control- bicycle control-PID control.

UNIT IV MOBILITY (9)

Autonomous driving from an innovation policy perspective - visions of autonomous driving in europe- competitiveness and innovation- efficiency and sustainability- harmonization and coordination.

UNIT V SAFETY AND SECURITY (9)

Predicting of machine perception for automated driving- predicting of machine perception for automated driving- the release of autonomous vehicles- safety concept for autonomous vehicles- collecting and making usable additional data- product liability issues in the risk management.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Acquire knowledge in autonomous vehicle importance.
CO2: Able to analyze the autonomous concepts.
CO3: Illustrate the various autonomous vehicle equipments functions and importance.
CO4: Acquire knowledge on various autonomous vehicle test.
CO5: Able to know the function of safety and security systems.

Text Books

T1 Ronald.K.Jurgen, “Autonomous Handbook”, Second Edition, McGraw-Hill Inc., 1999.
T2 Creating Autonomous Vehicle Systems (Kindle Edition)by Shaoshan Liu, Liyun Li.

References

R1 Ronald.K.Jurgen, “Autonomous systems”, Second Edition, McGraw-Hill Inc., 1999.
R2 George A. Peters, Barbara J. Peters, - Vehicle technology – 2002.

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19AU8309	OFF ROAD VEHICLES	L	T	P	C
		3	0	0	3

Course Objectives

1. Students will be able to understand the various off road vehicle, earth moving machine, construction machine and equipments
2. To impart knowledge in off road vehicle special equipments
3. Able to understand the design concepts of off road vehicle special equipments
4. To impart the knowledge of handling off road vehicles and equipments
5. To learn about off road vehicle systems and features

UNIT I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES (9)

Off road vehicles-Construction layout-capacity-applications-Power Plants-Chassis and Transmission-Multi axle vehicles.

UNIT II EARTH MOVING MACHINES (9)

Earthmovers-dumpers-loaders-single bucket-Multi bucket-rotary types-bulldozers-excavators-backhoe loaders-scrappers-drag and self powered types-Bush cutters-stumpers-tree dozer-rippers etc-crawler tracks mounted / wheeled-bull dozers-tilt dozers and angle dozers-front end loaders- factors affecting efficiency output of tractors-and demerits.

UNIT III SCRAPPERS ,GRADERS, SHOVELS AND DITCHERS (9)

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

UNIT IV FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES (9)

Earth moving machines-Power and capacity-General description-specification-functions-light- medium and heavy wheeled tractors-Power take off-special implements-Special features and constructional details of tankers-gun-carriers and transport vehicles.

UNIT V VEHICLE SYSTEMS ,FEATURES (9)

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-dumper-Safety features-safe warning system-Design aspects-loader bucket-dumper and water tank of sprinkler.

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: At the end of the course, the students will understand the off road vehicles based on the need and purpose.
CO2: Learnt about off road vehicle special equipments.
CO3: To develop the design concepts of off road vehicle special equipments.
CO4: Learners able to handle the off road vehicle and its special equipments.
CO5: Learners will be familiar in off road vehicle system and features.

Text Books

T1 Robert L Peurifoy, “Construction, planning, equipment and methods” Tata McGraw Hill, 2009.
T2 Nakra C.P., “Farm machines and equipments” Dhanparai Publishing company Pvt. Ltd.
T3 Abrosimov.K. Bran berg.A and Katayer.K., "Road making machinery", MIR Publishers, Moscow, 1971.
T4 SAE Handbook Vol. III., Society of Automotive Engineers, 1997
T5 Wong.J.T., "Theory of Ground Vehicles”, John Wiley & Sons, New York, 1987.

References

R1 Ia. S. Ageikin, “Off the Road Wheeled and Combined Traction Devices: Theory and Calculation”, Ashgate Publishing Co. Ltd. 1988.

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19AU8310	UNCONVENTIONAL MACHINING PROCESSES	L	T	P	C
		3	0	0	3

Course Objectives

1 To learn about various unconventional machining processes
2 To learn machining processes that use different energies
3 To understand the principle, mechanism of metal removal of various unconventional machining processes.
4 To study the various process parameters and their effect on the component machined on various unconventional machining processes.
5 To understand the applications of different processes

UNIT I INTRODUCTION (5)

Unconventional machining Process – Need – classification – Brief overview.

UNIT II MECHANICAL ENERGY BASED PROCESSES (10)

Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining – Ultrasonic Machining. (AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR–Variation in techniques used – Applications

UNIT III ELECTRICAL ENERGY BASED PROCESSES (10)

Electric Discharge Machining (EDM)–working Principle–Equipment's–Process Parameters–Surface Finish and MRR–Electrode / Tool – Power and control Circuits–Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.

UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES (10)

Chemical machining and Electro–Chemical machining–Etchants–maskant techniques of applying, maskants–Process Parameters–Surface finish and MRR–Applications–Principles of ECM–equipments–Surface Roughness and MRR–Electrical circuit–Process Parameters–ECG and ECH –Applications.

UNIT V THERMAL ENERGY BASED PROCESSES (10)

Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Able to differentiate the machining processes that use different energies
CO2: Able to identify the process parameters, their effect and applications of different processes.
CO3: Select the best machining process for different materials to be processed
CO4: Apply and analyze the manufacturing processes to reduce the cost of the product
CO5: Solve problems related to tools, equipment and processes used in the industry

Text Books

T1 Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., New Delhi, 2007
T2 Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, New Delhi,2007

References

R1 Benedict. G.F. "Nontraditional Manufacturing Processes", Marcel Dekker Inc., New York,1987.
R2 McGeough, "Advanced Methods of Machining", Chapman and Hall, London, 1998.

		L	T	P	C
19AU6401	**BASICS OF AUTOMOBILE ENGINEERING** (Courses offered in Collaborations with Hindusthan – Eicher Centre of Excellence Regional Competency Development Centre)	**3**	**0**	**0**	**3**

Course Objectives

1. To understand the basic fundamentals of automobile engineering
2. To acquire knowledge of automotive engines
3. To impart knowledge of various power transmission unit
4. To understand the principles of steering and brake systems
5. To know about automotive electrical systems and its functions

UNIT I INTRODUCTION (8)

Automobile - Components of an automobile - Classification of automobiles - Layout of chassis - Types of drives front wheel - rear wheel - four wheel.

UNIT II IC ENGINES (9)

Classification - ignition system - firing order - Otto/ Diesel cycles - Two stroke and four stroke engines – scavenging - Cooling and Lubrication systems - Fuel Supply system – air fuel ratio - Carburetor – types.

UNIT III TRANSMISSION SYSTEM (10)

Clutch - Function - single plate - multi plate - friction clutches - Centrifugal and semi centrifugal clutch - Gear Box -slide mesh - constant mesh and synchromesh gear box - Torque convertor – overdrive - Propeller shaft and rear axle- Universal joint – Differential - Rear axle drives - Wheels and Tyres.

UNIT IV STEERING AND BRAKE (9)

Steering system - function and principle - Ackerman and Davis steering principles - wheel alignment –steering gear boxes. Brakes - Mechanical - hydraulic and vacuum brake - master cylinder - wheel cylinder -Bleeding of brakes.

UNIT V ELECTRICAL SYSTEMS (9)

Battery – types - Dynamo and Alternator – Cutout relay - Diagram of Wiring system - Lighting System and Accessories - Headlight - switches - Windscreen Wipers – Horn – Speedometer – Heater and Air conditioning.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Provides basic platform knowledge of automobile engineering
CO2: Acquired the knowledge the working principal of petrol and diesel engines
CO3: Interpret the method of power transmission unit
CO4: Built knowledge of steering and brake
CO5: Acquired the knowledge of automotive electrical systems and functioning

Text Books

T1 Kirpal Singh, Automotive Engineering, Vol. I & II, Standard Publishers, New Delhi,2010.
T2 Gupta,S K“A Textbook of Automobile Engineering”, Chand Publishing,2013

References

R1 Rajput, R K, “A Textbook of Automobile Engineering”, Firewall Media, 2007.
R2 Butterworth-Heinemann, “ Automobile and Mechanical Electrical Systems”, Tom Denton Publisher,2011.

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19AU7402	AUTOMOTIVE SAFETY (Courses offered with Ford EcoSport)	L	T	P	C
		3	0	0	3

Course Objectives

1. To get good exposure an automotive safety.
2. To understand the safety concepts.
3. To acquire knowledge in safety equipments.
4. To familiarize the concept of crash mechanism.
5. To recognize the various adjustment systems for comfort and convenience drive.

UNIT I INTRODUCTION (9)

Evolution of automotive safety - Active safety: driving safety, conditional safety, perceptibility safety, operating safety- passive safety: exterior safety, interior safety, safety sandwich construction – NCAP.

UNIT II SAFETY CONCEPTS (9)

Design of the body for safety -Energy equation - engine location - deceleration of vehicle inside passenger compartment - deceleration on impact with stationary and movable obstacle.

UNIT III SAFETY EQUIPMENTS (9)

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 system - Central Locking system - Child safety.

UNIT IV CRASH AND IMPACT MECHANICS (8)

Design of crash crumple zones - Behavior of specific body structures in crash testing - Roll over crash tests - Regulatory requirements for crash testing & testing procedure - vehicle impacts- Side and Frontal Pole Impact.

UNIT V COMFORT AND CONVENIENCE SYSTEM (9)

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

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Acquired the knowledge in automotive safety and importance.
CO2: Able to analyze the safety concepts.
CO3: Illustrate the various safety equipments functions and importance.
CO4: Acquire knowledge on various crash test and impact test.
CO5: Able to know the function of warning and avoidance systems.

Text Books

T1 Ljubo Vlacic, Michel Parent, Fumio Harashima – “Intelligent Vehicle Technologies Theory and Applications” -Butterworth-Heinemann, 2001.
T2 Robert Bosch GmbH - “Safety, Comfort and Convenience Systems”- Wiley; 3rd edition, 2007

References

R1 ARAI Safety standards
R2 Bosch, “Automotive HandBook”, 6th edition, SAE, 2004.
R3 J. Marek, H.-P. Trah, Y. Suzuki, I. Yokomori - “Sensors for Automotive Applications” -WILEY-VCH Verlag GmbH & Co. 2003

BoS Chairman
(Dr Sabarinathan C)

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There are no changes made in the Curriculum and Syllabus of R2019A (Amended Regulations)

BoS Chairman
(Dr.C.Sabarinathan)

Dean (Academics)
(Dr.P.N.Magudeswaran)