

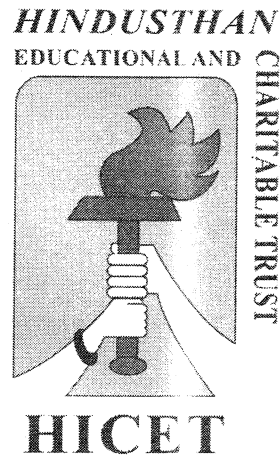
HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai)

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

Coimbatore - 641 032.

B.E. AUTOMOBILE ENGINEERING

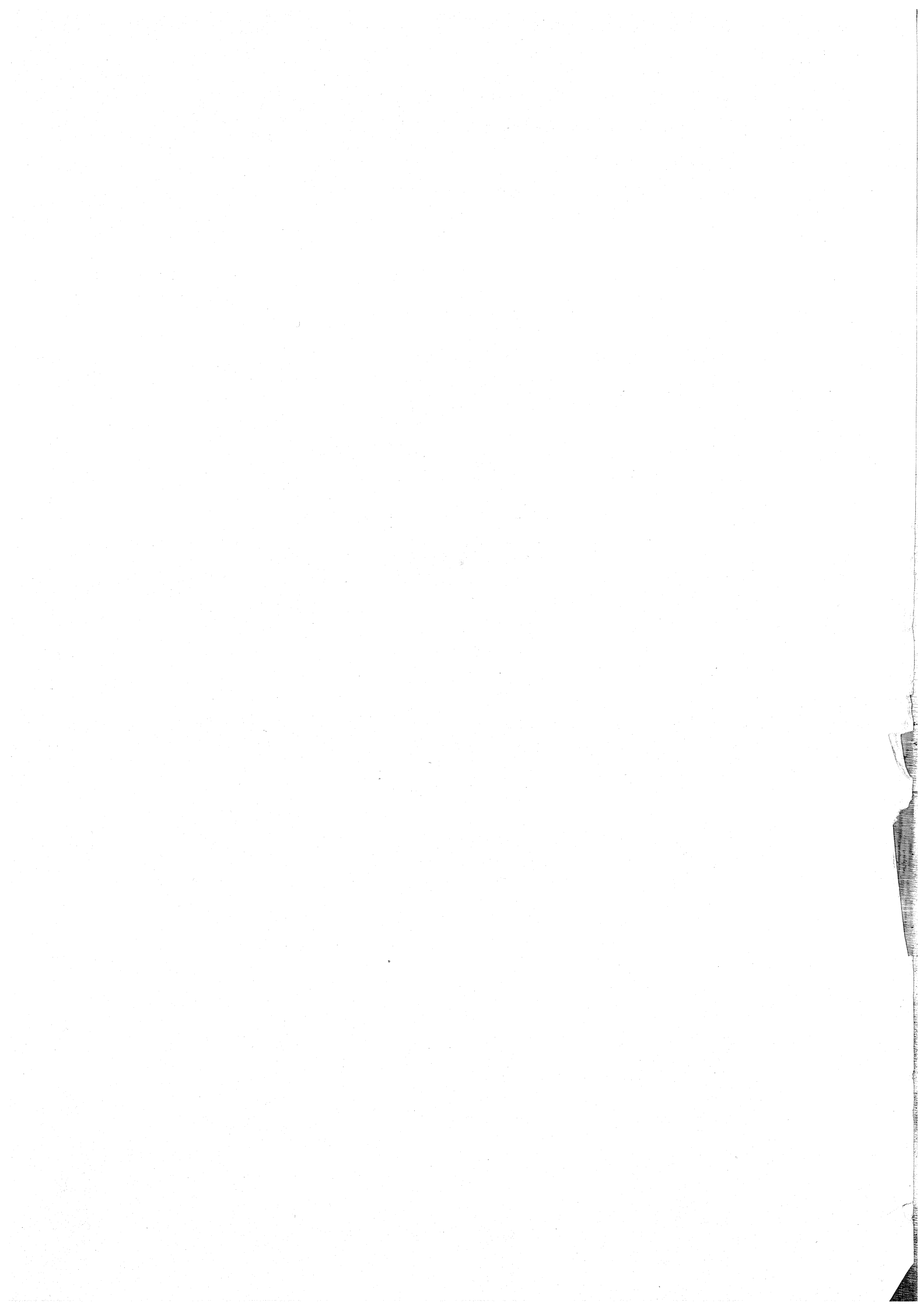


CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the Odd Semester

Academic year 2023-24

(Academic Council Meeting Held on 19.06.2023)



CURRICULUM

R2022





DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. AUTOMOBILE ENGINEERING (UG)

REGULATION-2022

For the students admitted during the academic year 2023-2024 and onwards

SEMESTER I

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22MA1101	Matrices and Calculus	BSC	3	1	0	4	4	40	60	100
2	22ME1201	Engineering Drawing	ESC	1	4	0	3	5	40	60	100
THEORY WITH LAB COMPONENT											
3	22HE1151	English for Engineers	HSC	2	0	2	3	4	40	60	100
4	22PH1151	Physics for Non-Circuit Engineering	BSC	2	0	2	3	4	50	50	100
5	22IT1151	Python Programming and practices	ESC	2	0	2	3	4	50	50	100
EEC COURSES (SE/AE)											
6	22HE1072	ENTREPRENEURSHIP & INNOVATION (Common to all branches)	AEC	1	0	0	1	1	100	0	100
7	22HE1073	Introduction to Soft Skills	SEC	1	0	0	0	1	100	0	100
MANDATORY COURSE											
8.	22MC1093/ 22MC1094	தமிழர் மரபு / Heritage of Tamils	MC	2	0	0	1	2	0	0	0
9.	22MC1095	Universal Human Values	MC	2	0	0	0	2	0	0	0
TOTAL				15	5	6	18	27	770	330	700

SEMESTER II

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22MA2101	Differential equations and complex analysis	BSC	3	1	0	4	4	40	60	100
2	22PH2101	Basics of material science	BSC	2	0	0	2	3	40	60	100
3	22CY2101	Environmental science	ESC	2	0	0	2	3	40	60	100
	22ME2101	Engineering Mechanics	ESC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
4	22HE2151	Effective Technical Communication	HSC	2	0	2	3	4	50	50	100

5	22CY2152	Applied Chemistry	BSC	2	0	2	3	4	50	50	100
PRACTICAL COURSES											
7	22ME2001	Engineering Practices	ESC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8	22HE2071	Design Thinking	AEC	1	0	2	2	2	100	0	100
9	22HE2073	Soft Skills and Aptitude -I	SEC	1	0	0	1	1	100	0	100
MANDATORY COURSE											
10.	22MC2094/ 22MC2095	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology	MC	2	0	0	1	2	0	0	0
11.	22MC2093	NCC */NSS / YRC / Sports / Clubs / Society Service - Enrollment (Common)	MC	All students shall enroll, on admission, in anyone of the personality and character development programmes and undergo training for about 80 hours							
TOTAL				18	1	10	23	26	520	380	900

SEMESTER III

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22MA3104	Fourier analysis and numerical techniques	BSC	3	1	0	4	4	40	60	100
2.	22AU3201	Fundamentals of Automotive Engines	PCC	3	0	0	3	3	40	60	100
3.	22AU3202	Fundamentals of Thermodynamics	PCC	3	1	0	4	3	40	60	100
4.	22AU3203	Mechanics of Materials	PCC	3	1	0	4	4	40	60	100
THEORY WITH LAB COMPONENT											
5.	22AU3251	Manufacturing Technology	PCC	2	0	2	3	4	50	50	100
PRACTICAL											
6.	22AU3001	Automotive Components Lab	ESC	0	0	4	2	4	60	40	100
7.	22AU3002	Mechanics of Materials Lab	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8.	22HE3071	Soft Skills -2	SEC	1	0	0	1	1	100	0	100
9.	22AU3072	Machine Drawing	AEC	0	0	4	2	2	60	40	100
10.	22MC3092	Essence of Indian Traditional Knowledge	AEC	2	0	0	0	0	-	-	-
TOTAL				19	3	10	25	29	470	430	900

SEMESTER IV

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22HE4101	IPR and Start-ups	HSC	2	0	0	2	2	40	60	100
2.	22AU4201	Automotive Chassis components Design	BSC	3	0	0	3	3	40	60	100

3.	22AU4202	Automotive Electricals and Electronics systems	PCC	3	1	0	4	3	40	60	100
4.	22AU4203	Mechanics of Machines	PCC	3	1	0	4	4	40	60	100
5.	22AU4204	Fluid and Pneumatic systems	PCC	3	0	0	3	4	40	60	100
THEORY WITH LAB COMPONENT											
6.	22AU4251	Fundamentals of Heat Transfer	PCC	3	0	0	3	4	40	60	100
PRACTICAL											
7.	22AU4001	Automotive Electricals and Electronics Laboratory	PCC	0	0	4	2	4	60	40	100
8.	22AU4002	Computer Aided Engine components design Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9.	22HE4071	Soft Skills -III	SEC	1	0	0	1	1	100	0	100
TOTAL				18	2	8	24	29	460	440	900
* Two weeks internship carries 1 credit and it will be done during Semester III summer vacation and same will be evaluated in Semester IV. If students unable to undergo in semester III, then the Internship I offered in the semester IV can be clubbed with Internship II (Total: 4 weeks-2 credits)											

SEMESTER V

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22AU5201	Vehicle design and data characteristics	PCC	3	0	0	3	4	40	60	100
2.	22AU5202	Automotive Fuels and Lubricants	PCC	3	0	0	3	3	40	60	100
3.	22AU53XX	Professional Elective-1	PEC	3	0	0	3	3	40	60	100
4.	22AU53XX	Professional Elective-2	PEC	3	0	0	3	3	40	60	100
5.	22AU53XX	Professional Elective-3	PEC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
6.	22AU5251	Two and Three-wheeler technology	PCC	2	0	2	3	4	50	50	100
PRACTICAL											
7.	22AU5001	Automotive Fuels and Lubricants Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8.	22HE5071	Soft Skills -4/Foreign languages	SEC	1	0	0	1	1	100	0	100
TOTAL				18	0	6	21	25	410	390	800

SEMESTER VI

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22AU6201	Vehicle Dynamics	PCC	3	0	0	3	3	40	60	100
2.	22HE6101	Professional Ethics (Common)	HSC	3	0	0	3	3	40	60	100

3.	22AU63XX	Professional Elective-4	PEC	3	0	0	3	3	40	60	100
4.	22AU63XX	Professional Elective-5	PEC	3	0	0	3	3	40	60	100
5.	22XX64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
6.	22XX64XX	Open Elective – 2*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
7.	22AU6001	Computer Aided Engineering Laboratory	PCC	0	0	4	2	4	60	40	100
8.	22AU6002	Engine Performance and Emission testing laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9.	22HE6071	Soft Skills – 5	SEC	2	0	0	2	2	100	0	100
TOTAL				20	0	8	24	28	460	440	900

SEMESTER VII

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22AU7201	Design of Automotive Transmission systems	PCC	3	0	0	3	3	40	60	100
2.	22AU7202	Engine and Vehicle Management systems	PCC	3	1	0	4	4	40	60	100
3.	22AU73XX	Professional Elective-6	PEC	3	0	0	3	3	40	60	100
4.	22XX7401	Open Elective – 3*	OEC	3	0	0	3	3	40	60	100
5.	22LS74XX	Open Elective – 4*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
6.	22AU7001	Vehicle Maintenance Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
7.	22AU7701	Internship - II*	SEC	-	-	-	2	1	100	0	100
TOTAL				15	1	4	20	21	360	340	700
* - Two weeks internship carries 1 credit and it will be done during Semester VI summer vacation/placement training and same will be evaluated in Semester VII.											

SEMESTER VIII

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
EEC COURSES (SE/AE)											
1.	22AU8901	Project Work/Granted Patent	SEC9	0	0	20	10	20	100	100	200
TOTAL				0	0	20	10	20	100	100	200

Note:

- *As per the AICTE guideline, in Semesters I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Further, the students who enrolled his/her name in HICET NCC and Air Wing are eligible to undergo this subject. The earned extra credits printed in the Consolidated Mark sheet as per the regulation.

- NCC course level 1 & Level 2 will be added in the list of open elective subjects in the appropriate semester. Further, the students who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.
- The above-mentioned NCC Courses will be offered to the students who are going to be admitted in the Academic Year 2021 – 22.

SEMESTER-WISE CREDIT DISTRIBUTION

B.E. / B.TECH. PROGRAMMES										
S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSC	3	3	-	2	-	3	-	-	11
2	BSC	7	9	4	-	-	-	-	-	20
3	ESC	6	5	2	-	-	-	-	-	15
4	PCC	-	-	16	20	12	7	9	-	64
5	PEC	-	-	-	-	9	6	3	-	18
6	OEC	-	-	-	-	-	6	6	-	12
7	EEC	2	3	3	1	1	2	2	10	25
8	MCC	✓	✓	-	-	-	-	-	-	-
Total		18	22	25	24	21	24	20	10	165

OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES)

To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AI6451	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2	22CS6451	Blockchain Technology	OEC	2	0	2	4	3
3	22EC6451	Cyber security	OEC	2	0	2	4	3
4	22EC6452	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6451	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6451	Augmented and Virtual Reality	OEC	2	0	2	4	3

OPEN ELECTIVE I AND II

To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3

Details of Vertical II: PRODUCT AND PROCESS DEVELOPMENT

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COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
			L	T	P		
2AU5304	Value Engineering	PEC	3	0	0	3	3
2AU5305	Additive Manufacturing	PEC	3	0	0	3	3
2AU5306	CAD/CAM	PEC	3	0	0	3	3
2AU6303	Ergonomics in Design	PEC	3	0	0	3	3
2AU6304	New Product Development	PEC	3	0	0	3	3
2AU7302	Product Life Cycle Management	PEC	3	0	0	3	3

Details of Vertical III: ROBOTICS AND AUTOMATION

COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
			L	T	P		
2AU5307	Value Engineering	PEC	3	0	0	3	3
2AU5308	Additive Manufacturing	PEC	3	0	0	3	3
2AU5309	CAD/CAM	PEC	3	0	0	3	3
2AU6305	Ergonomics in Design	PEC	3	0	0	3	3
2AU6306	New Product Development	PEC	3	0	0	3	3
2AU7303	Product Life Cycle Management	PEC	3	0	0	3	3

Details of Vertical IV: DIGITAL AND GREEN MANUFACTURING

COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
			L	T	P		
2AU5310	Digital Manufacturing and IoT	PEC	3	0	0	3	3
2AU5311	Lean Manufacturing	PEC	3	0	0	3	3
2AU5312	Modern Robotics	PEC	3	0	0	3	3
2AU6307	Green Manufacturing Design and Practices	PEC	3	0	0	3	3
2AU6308	Environment Sustainability and Impact Assessment	PEC	3	0	0	3	3
2AU7304	Green Supply Chain Management	PEC	3	0	0	3	3

Details of Vertical V: CLEAN AND GREEN ENERGY TECHNOLOGIES

COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
			L	T	P		
2AU5313	Bioenergy Conversion Technologies	PEC	3	0	0	3	3

2	22AU5314	Carbon Footprint estimation and reduction techniques	PEC	3	0	0	3	3
3	22AU5315	Energy Conservation in Industries	PEC	3	0	0	3	3
4	22AU6309	Energy Efficient Buildings	PEC	3	0	0	3	3
5	22AU6310	Renewable Energy Technologies	PEC	3	0	0	3	3
6	22AU7305	Equipment for Pollution Control	PEC	3	0	0	3	3

Details of Vertical VI: LOGISTICS AND SUPPLY CHAIN MANAGEMENT

S. NO.	COURSE CODE	COURSE TITLE	CATEG ORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AU5316	Automation in Manufacturing	PEC	3	0	0	3	3
2	22AU5317	Material Handling Equipment, Repair and Maintenance	PEC	3	0	0	3	3
3	22AU5318	Robotics	PEC	3	0	0	3	3
4	22AU6311	Container Logistics	PEC	3	0	0	3	3
5	22AU6312	Logistics in Manufacturing, Supply Chain and Distribution	PEC	3	0	0	3	3
6	22AU7306	Data Science	PEC	3	0	0	3	3

Enrollment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree. For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

VERTICALS FOR MINOR DEGREE

- Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

Note: Each programme should provide verticals for minor degree

Minor Degree - Automotive Vehicle Technology (Offered by Automobile Engineering)									
S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	22AU5601	Automotive Engines	3	0	0	3	40	60	100
2	22AU6601	Automotive Chassis	3	0	0	3	40	60	100
3	22AU6602	Automotive Transmission	3	0	0	3	40	60	100
4	22AU7601	Automotive Electronics	3	0	0	3	40	60	100

5	22AU7602	Intelligent vehicular systems	3	0	0	3	40	60	100
6	22AU8601	Electric and Hybrid vehicles	3	0	0	3	40	60	100

Minor Degree - Fintech and Block Chain (common to all departments)

S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	22CS5601	Financial Management	3	0	0	3	40	60	100
2	22CS5602	Fundamentals of Investment	3	0	0	3	40	60	100
3	22CS5603	Banking, Financial Services and Insurance	3	0	0	3	40	60	100
4	22CS5604	Introduction to Blockchain and its Applications	3	0	0	3	40	60	100
5	22CS5605	Fintech Personal Finance and Payments	3	0	0	3	40	60	100
6	22CS5606	Introduction to Fintech	3	0	0	3	40	60	100

Minor Degree - Entrepreneurship (common to all departments)

S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	22BA5601	Foundation of Entrepreneurship	3	0	0	3	40	60	100
2	22BA6601	Introduction to Business Venture	3	0	0	3	40	60	100
3	22BA6602	Team Building & Leadership Management for Business	3	0	0	3	40	60	100
4	22BA7601	Creativity & Innovation in Entrepreneurship	3	0	0	3	40	60	100
5	22BA7602	Principles of Marketing Management for Business	3	0	0	3	40	60	100
6	22BA8601	Human Resource Management for Entrepreneurs	3	0	0	3	40	60	100

Minor Degree - Environment and Sustainability (common to all departments)

S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	22CEXXXX	Sustainable infrastructure Development	3	0	0	3	40	60	100
2	22CEXXXX	Sustainable Agriculture and Environmental Management	3	0	0	3	40	60	100
3	22CEXXXX	Sustainable Bio Materials	3	0	0	3	40	60	100
4	22CEXXXX	Materials for Energy Sustainability	3	0	0	3	40	60	100
5	22CEXXXX	Green Technology	3	0	0	3	40	60	100
6	22CEXXXX	Environmental Quality Monitoring and Analysis	3	0	0	3	40	60	100

Honors Degree - Electric and hybrid vehicle development									
S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	22AU52XX	Fundamentals of Electric and Hybrid Vehicles	3	0	0	3	40	60	100
2	22AU62XX	Battery Technology	3	0	0	3	40	60	100
3	22AU62XX	Automotive Embedded Systems	3	0	0	3	40	60	100
4	22AU72XX	Advanced Automotive Safety Systems	3	0	0	3	40	60	100
5	22AU72XX	Special Purpose Electric Vehicle	3	0	0	3	40	60	100
6	22AU82XX	Electric Vehicles and its Sustainable Development	3	0	0	3	40	60	100
Honors Degree - Motorsport Engineering									
S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	22AU52XX	Composite Structure	3	0	0	3	40	60	100
2	22AU62XX	High performance engine design	3	0	0	3	40	60	100
3	22AU62XX	Motorsports Electric Vehicle	3	0	0	3	40	60	100
4	22AU72XX	Motorsports Vehicle Body Engineering	3	0	0	3	40	60	100
5	22AU72XX	Motorsports Race Electronics and Control Systems	3	0	0	3	40	60	100
6	22AU82XX	Motorsports racing circuits and Design	3	0	0	3	40	60	100
Honors Degree - Vehicle Development and Validation									
S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	22AU52XX	Automotive Product Design and Development	3	0	0	3	40	60	100
2	22AU62XX	Noise, Vibration and Harshness	3	0	0	3	40	60	100
3	22AU62XX	Automotive Instrumentation	3	0	0	3	40	60	100
4	22AU72XX	Testing and Measurement Systems	3	0	0	3	40	60	100
5	22AU72XX	Homologation	3	0	0	3	40	60	100
6	22AU82XX	Automotive Prototyping	3	0	0	3	40	60	100

CREDIT DISTRIBUTION

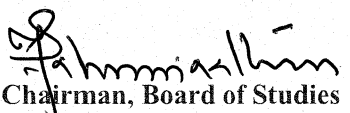
Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	18	23	25	24	21	24	20	10	165

* Student can earn extra credit 35 over and above the total credits


ADDITIONAL CREDIT COURSE FOR NCC CADETS										
S.No	Course code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1	21HE1074	NCC General and National Integration	VA	1	0	0	1	100	0	100
2	21HE2074	Social Services and Community Development	VA	1	0	0	1	100	0	100
3	21HE3074	Leadership Qualities and Camp Activities	VA	1	0	0	1	100	0	100
4	21HE4074	General awareness, communication and Aero engines	VA	1	0	0	1	100	0	100

ADDITIONAL CREDIT COURSE FOR AUTOMOBILE ENGINEERING						
S.No	Course Code	Course Title	Category	Duration	Assessment	Credit
1	21VAAU01	Foundry Technology	VA	30 hrs	Internal	1
2	21VAAU02	Forming and Shaping of Plastics	VA	30 hrs	Internal	1
3	21VAAU03	Microcontroller Programming in Automotive applications	VA	30 hrs	Internal	1
4	21VAAU04	Vehicle development and testing regulations (ARAI)	VA	30 hrs	Internal	1
5	21VAAU05	Bigdata Analysis	VA	30 hrs	Internal	1
6	21VAAU06	Data mining	VA	30 hrs	Internal	1
7	21VAAU07	Fire and safety Engineering	VA	30 hrs	Internal	1
8	21VAAU08	Introduction to MS office	VA	30 hrs	Internal	1
9	21VAAU09	Advanced Automotive Electrical and Electronics	VA	30 hrs	Internal	1
10	21VAAU10	Autodesk Fusion 360	VA	30 hrs	Internal	1

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


Chairman, Board of Studies
Chairman - BoS
AUTO - HiCET


Dean (Academics)
HiCET


Principal
PRINCIPAL
Hindusthan College Of Engineering & Technology
COIMBATORE - 641 032.

SYLLABUS



Course Code	Name of the Course	L	T	P	C
B.E./B.Tech 22MA1101	MATRICES AND CALCULUS (Common to all Branches)	3	1	0	4

The learner should be able to

- Course Objective
1. Construct the characteristic polynomial of a matrix and use it to identify eigenvalues and Eigenvectors
 2. Impart the knowledge of sequences and series.
 3. Analyse and discuss the maxima and minima of the functions of several variables.
 4. Evaluate the multiple integrals and apply in solving problems.
 5. Apply vector differential operator for vector function and theorems to solve engineering problems.

Unit	Description	Instructional Hours
I	Matrices 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.	12
II	Single Variate Calculus Rolle's Theorem–Lagrange's Mean Value Theorem–Maxima and Minima–Taylor's and Maclaurin's Series.	12
III	Functions of Several Variables Partial derivatives–Total derivative, Jacobian, Maxima, minima and saddle points; Method of Lagrange multipliers	12
IV	Integral Calculus Double integrals in Cartesian coordinates–Area enclosed by plane curves (excluding surface area)– Triple integrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates.	12
V	Vector Calculus Gradient, divergence and curl; Green's theorem, Stoke's and Gauss divergence theorem (statement only) for cubes only.	12
Total Instructional Hours		60

At the end of the course, the learner will be able to

- Course Outcome
- CO1: Compute Eigen values and Eigen vectors of the given matrix and transform given quadratic form into canonical form.
- CO2: Apply the concept of differentiation to identify the maximum and minimum values of curve.
- CO3: Compute partial derivatives of function of several variables and write Taylor's series for functions with two variables.
- CO4: Evaluate multiple integral and its applications in finding area, volume.
- CO5: Apply the concept of vector calculus in two and three dimensional spaces.

TEXTBOOKS:

T1: G.B. Thomas and R.L. Finney, "Calculus and Analytical Geometry", 9th Edition Addison Wesley Publishing Company, 2016.

T2: Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2019.

T3: K.P. Uma and S. Padma, "Engineering Mathematics I (Matrices and Calculus)", Pearson Ltd, 2022.

REFERENCE BOOKS:


R1- Jerrold E. Marsden, Anthony Tromba, "Vector Calculus", W.H. Freeman, 2003

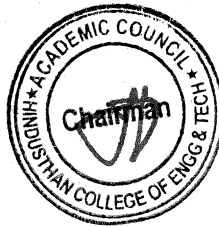
R2- Strauss M.J, G.L. Bradley and K.J. Smith, "Multivariable Calculus", Prentice Hall, 2002.

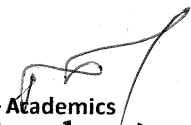
R3- Veerarajan T, "Engineering Mathematics", McGraw Hill Education (India) Pvt Ltd, New Delhi, 2016.

CO PO MAPPING

PO&	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9		PO11			
CO1	3	3	3	3	3	-	-	-	-	-	-	2	2	1
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO5	3	3	3	3	3	-	-	-	-	-	-	2	1	2
AVG	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2


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Programme	Course Code	Name of the Course	L	T	P	C
BE/B.Tech	22PH1151	PHYSICS FOR NON- CIRCUIT ENGINEERING I – SEM (AERO,AUTO,AGRI,CHEM,CIVIL,MECH,MCT &FT)	2	0	2	3

The student should be able to

1. Gain knowledge about laser, their applications, become conversant with principles of optical fiber, types and applications of optical fiber
2. Enhance his fundamental knowledge about properties of matter
3. Understand the concept of Wave optics
4. Gain knowledge about Quantum Physics.
5. Acquire fundamental knowledge of thermal physics which is related to the engineering program

Unit	Description	Instructional Hours
I	LASER AND FIBRE OPTICS Spontaneous emission and stimulated emission – Type of lasers – Nd:YAG laser - Laser Applications – Holography – Construction and reconstruction of images. Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index and modes) – Fiber optical communication link. Determination of Wavelength and particle size using Laser	6
II	PROPERTIES OF MATTER Elasticity – Hooke's law – Poisson's ratio – Bending moment – Depression of a cantilever – Determination of Young's modulus of the material of the beam by Uniform bending theory and experiment. Twisting couple - torsion pendulum: theory and experiment Determination of Young's modulus by uniform bending method Determination of Rigidity modulus – Torsion pendulum	6
III	WAVE OPTICS Interference of light – air wedge – Thickness of thin paper - Testing of thickness of surface- Michelson interferometer. Diffraction of light – 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	6
IV	QUANTUM PHYSICS Black body radiation – Compton effect: theory and experimental verification – wave particle duality – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box .	6
V	THERMAL PHYSICS Transfer of heat energy – thermal conduction, convection and radiation – thermal conductivity - Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – applications: solar water heaters.	6
Total Instructional Hours		30

After completion of the course the learner will be able to

- CO1: Understand the advanced technology of LASER and optical communication in the field of Engineering
- CO2: Illustrate the fundamental properties of matter
- CO3: Discuss the Oscillatory motions of particles
- CO4: Understand the advanced technology of Quantum Physics in the field of Engineering
- CO5: Develop the technology of thermal physics in engineering field

TEXT BOOKS:

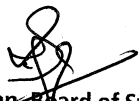
- T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
 T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

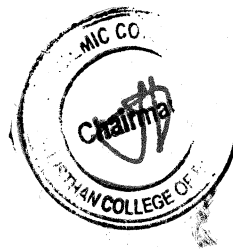
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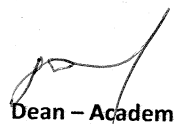
- R1 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company Ltd., New Delhi 2016
 R2 -Dr. G. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2021

CO PO MAPPING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	1	1	-	1	-	2	3	3	2
CO2	3	3	2	2	1	1	1	-	1	-	2	2	3	1
CO3	3	3	2	2	2	1	1	-	1	-	1	2	2	2
CO4	3	2	3	1	3	1	1	-	1	-	1	2	2	1
CO5	3	2	3	1	2	1	1	-	1	-	2	2	2	1
Avg	3	2.6	2.6	1.6	2.2	1	1	-	1	-	1.6	2.2	2.4	1.4


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B.E./ B.Tech/ I	22HE115 1	ENGLISH FOR ENGINEERS (Common to all Branches)	L 2	T 0	P 2	C 3
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The student should be able

- Course Objective
1. To improve the communicative proficiency of learners.
 2. To help learners use language effectively in professional writing.
 3. To advance the skills of maintaining the suitable one of communication.
 4. To introduce the professional life skills.
 5. To impart official communication etiquette.

Unit	Description	Instructional Hours
I	Language Proficiency: Types of Sentences, Functional Units, Framing question. Writing: process description, Writing Checklist. Vocabulary – words on environment. Practical Component: Listening- Watching short videos and answer the questions, Speaking- Self introduction ,formal & semi-formal, Reading- Purpose of Reading - Churning & Assimilation, Interpreting Ideas - Interpreting Graphs in Technical Writing.	7+2
II	Language Proficiency: Tenses, Adjectives and adverbs. Writing: Formal letters (letters conveying positive and negative news), Formal and informal email writing (using emoticons, abbreviations& acronyms), reading comprehension. Vocabulary- words on entertainment. Practical Component: Listening- Comprehensions based on TED talks Speaking- Narrating a short story or an event happened in their life Reading - Skimming – Scanning – Reading: Scientific Texts – Literary Texts .	7+2
II	Language Proficiency: Prepositions, phrasal verbs. Writing: Formal thanks giving, Congratulating, warning and apologizing letters, cloze test. Vocabulary – words on tools. Practical Component: Listening- Listen to songs and answer the questions Speaking- Just a minute Reading- Reading feature articles (from newspapers and magazines) - Reading to identify point of view and perspective (opinion pieces, editorials etc.)	5+4
I	Language Proficiency: Subject verb concord, Prefixes & suffixes. Writing: Preparing agenda & minutes, writing an event report. Vocabulary – words on engineering process. Practical Component: Listening- Comprehensions based on Talk of orators or interview shows Speaking- Presentation on a general topic with ppt. Reading- Reading Comprehension - Techniques for Good Comprehension - - Sequencing of Sentences.	5+4
V	Language Proficiency: Modal Auxiliaries, Active & passive, voice, Writing: Project report (proposal & progress), sequencing of sentences Vocabulary – words on engineering material Practical Component: Listening- Listening- Comprehensions based on Nat Geo/Discovery channel videos Speaking- Preparing posters and presenting as a team. Reading- Biographies, travelogues, technical blogs.	6+3
Total Instructional Hours		45

- After completion of the course the learner will be able
- Course Outcome
- CO1: To communicate in a professional forum
 - CO2: To speak or write a content in the proficient language
 - CO3: To maintain and use appropriate one of the communication.
 - CO4: To read, write and present in a professional way.
 - CO5: To follow the etiquettes in formal communication.

TEXTBOOKS:

T1- Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press, 2016. T2-

Raymond Murphy, "Essential English Grammar", Cambridge University Press, 2019.

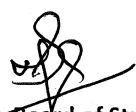
REFERENCE BOOKS:

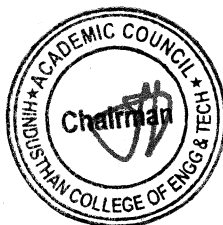
R1- Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice", Oxford University Press, 2009.

R2- Raymond Murphy, "English Grammar in Use"-4th edition Cambridge University Press, 2004.

R3-KamaleshSadanana“AFoundationCoursefortheSpeakersofTamil-Part-I&II”,Orient Blackswan,2010.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2					1	2	2	2	3	1	1	1	2
CO2	2	1			1	1	1	2	2	3		2		2
CO3	2	1			1	1	2	3	3	3		1	1	2
CO4	2	1				1	2	2	2	3	1	1		
CO5	2					1	1	2	3	3		1	1	2
Avg	2	1	-	-	1	1	1.6	2.2	2.4	3	1	1.2	1	2


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Programme	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech	22ME1201	ENGINEERING DRAWING (AGRI, BME, (CHEM,,AERO, AUTO, CIVIL,MECH, MECT,FT,EEE)	1	4	0	3

The learner should be able

Course
Objective

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	Description	Instructional Hours
	PLANE CURVES 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.	12
I	PROJECTIONS OF POINTS, LINES AND PLANE SURFACES 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).	12
II	PROJECTIONS OF SOLIDS Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane by rotating object method.	12
III	SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 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.	12
IV	ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS 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.	12
V		
Total Instructional Hours		60

Course
Outcome

- At the end of the course, the learner 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 BOOK:

T1. K.Venugopal, V.Prabu Raja, "Engineering Drawing, AutoCAD, Building Drawings", 5th edition New Age International Publishers, New Delhi 2016.


T2. K.V.Natarajan, "A textbook of Engineering Graphics", Dhanlaxmi Publishers, Chennai 2016.

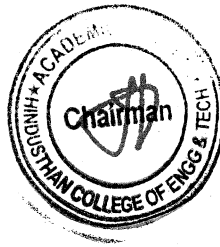
REFERENCES:


R1. BasantAgrawal and C.M.Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing company Limited, New Delhi, 2013.

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	1	1	1	1	1	3	1	1	1	1
CO 2	3	2	2	1	1	1	1	1	1	2	1	1	1	1
CO 3	3	2	3	1	2	1	1	1	1	2	1	1	1	2
CO 4	3	2	3	1	2	1	1	1	1	2	1	1	2	2
CO 5	3	2	3	1	2	1	1	1	1	2	1	1	2	2
AVG	3	2	2.6	1	1.6	1	1	1	1	2.2	1	1	1.4	1.6


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Programme	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech	22IT1151	PYTHON PROGRAMMING AND PRACTICES AGRI, CHEM, FT, AERO, AUTO, CIVIL, MECH, MECT, ECE, BME)	2	0	2	3

The learner should be able

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	Description	Instructional Hours
I	ALGORITHMIC PROBLEM SOLVING 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: To find the Greatest Common Divisor (GCD) of two numbers, Fahrenheit to Celsius, Perform Matrix addition.	5+4
II	DATA, STATEMENTS, CONTROL FLOW Data Types, Operators and precedence of operators, expressions, statements, comments; Conditionals: Boolean values and operators, conditional (if), alternative (if -else), chained conditional (if -elif-else); Iteration: state, while, for, break, continue, pass; Simple algorithms and programs: Area of the circle, check the given year is Leap year or not, Factorial of a Number.	5+4
III	FUNCTIONS, STRINGS Functions, parameters and arguments; Fruitful functions: return values, local and global scope, function composition, recursive functions. Strings: string slices, immutability, string functions and methods, string module. Illustrative programs: Perform Linear Search, Selection sort, Sum of all elements in a List, Pattern Programs	5+4
IV	LISTS, TUPLES, DICTIONARIES 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: List Manipulation, Finding Maximum in a List, String processing.	5+4
V	FILES, MODULES, PACKAGES Files and exception: text files, reading and writing files, errors and exceptions, handling exceptions, modules, packages Illustrative programs: Reading writing in a file, word count, Handling Exceptions	9
Total Instructional Hours		45

- At the end of the course, the learner will be able to
- Course Outcome
- 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 3.6.2, Shroff Publishers, First edition (2017).
- T2: S. Annadurai, S. Shankar, I. Jasmine, M. Revathi, Fundamentals of Python Programming, Mc-Graw Hill Education (India) Private Ltd, 2019.

REFERENCE BOOKS:

- R1: Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem- Solving

Focus, Wiley India Edition, 2013.


R2: Timothy A. Budd, —Exploring Python1, 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

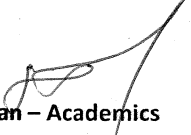
India Education Services Pvt. Ltd., 2016

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	1	1	1	1	1	1	1	2	2	3	3
CO 2	3	3	2	1	1	1	1	1	1	1	1	2	2	3
CO 3	3	3	2	1	1	1	1	1	1	1	1	2	2	3
CO 4	3	3	1	1	1	1	1	1	1	1	1	2	2	3
CO 5	3	1	1	1	1	1	1	1	1	1	1	1	2	1
AVG	3	2.6	1.4	1	1	1	1	1	1	1	1	1.8	2.2	2.6


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Programme	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/	22HE1095	UNIVERSAL HUMAN VALUES (COMMON TO ALL BRANCHES)	2	0	0	0

The student should be made

Course Objectives

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding Interms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Unit

	Description	Instructional Hours
	Introduction to Value Education	
I	Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)-Understanding Value Education - Self-exploration as the Process for Value Education - Continuous Happiness and Prosperity – the Basic Human Aspirations - Happiness and Prosperity – Current Scenario - Method to Fulfill the Basic Human Aspirations	6
	Harmony in the Human Being and Harmony in the Family	
II	Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body - The Body as an Instrument of the Self - Understanding Harmony in the Self- Harmony of the Self with the Body - Programme to ensure self-regulation and Health	6
	Harmony in the Family and Society	
III	Harmony in the Family – the Basic Unit of Human Interaction.Values in Human to Human Relationship'Trust' – the Foundational Value in Relationship Values in Human to Human Relationship'Respect' – as the RightEvaluation Understanding Harmony in the Society	6
	Harmony in the Nature / Existence	
IV	Understanding Harmony in the Nature.Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature- Understanding Existence as Co-existence of mutually interacting units in all pervasivespace Realizing Existence as Co-existence at All Levels The Holistic Perception of Harmony in Existence. Vision for the Universal Human Order	6
	Implications of the Holistic Understanding – a Look at Professional Ethics	
V	Natural Acceptance of Human Values Definitiveness of (Ethical) Human Conduct A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical CaseStudiesStrategies for Transition towards Value-based Life and Profession	6

Total Instructional Hours 30

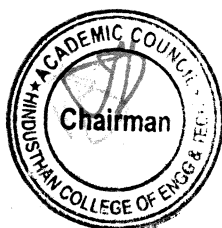
Course Outcome

- CO1: To become more aware of holistic vision of life - themselves and their surroundings.
 CO2: To become more responsible in life, in the Society and in handling problems with sustainable Solutions.
 CO3: To sensitive towards their commitment towards what they understood towards environment and Socially responsible behavior.
 CO4: To able to apply what have learnt to their own self in different day-to-day settings in real life and In handling problems with sustainable solutions.
 CO5: To develop competence and capabilities for maintaining Health and Hygiene.

Reference Books:

- R1.A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
 R2.Teachers'ManualforAFoundationCourseinHumanValuesandProfessionalEthics,RRGaur,


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Programme	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech	22HE1072	ENTREPRENEURSHIP & INNOVATION (Common for all Branches)	1	0	0	1

The student should be made

Course Objectives

1. To acquire the knowledge and skills needed to manage the development of innovation.
2. To recognize and evaluate potential opportunities to monetize these innovations.
3. To plan specific and detailed method to exploit these opportunities.
4. To acquire the resources necessary to implement these plans.
5. To make students understand organizational performance and its importance.

Module

Description

- 1 Entrepreneurial Thinking
- 2 Innovation Management
- 3 Design Thinking
- 4 Opportunity Spotting / Opportunity Evaluation
- 5 Industry and Market Research
- 6 Innovation Strategy and Business Models
- 7 Financial Forecasting
- 8 Business Plans/ Business Model Canvas
- 9 Entrepreneurial Finance
- 10 Pitching to Resources Providers / Pitch Deck
- 11 Negotiating Deals
- 12 New Venture Creation
- 13 Lean Start-ups
- 14 Entrepreneurial Ecosystem
- 15 Velocity Venture

TOTAL INSTRUCTIONAL HOURS 15

At the end of the course, the learner will be able to

Course Outcome

- CO1: Understand the nature of business opportunities, resources, and industries in critical and creative aspects.
- CO2: Understand the processes by which innovation is fostered, managed, and commercialized.
- CO3: Remember effectively and efficiently the potential of new business opportunities.
- CO4: Assess the market potential for a new venture, including customer need, competitors, and industry attractiveness..
- CO5: Develop a business model for a new venture, including revenue. Margins, operations, Working capital, and investment

TEXTBOOKS

- T1: Arya Kumar "Entrepreneurship—Creating and Leading an Entrepreneurial Organization", Pearson, Second Edition (2012).
- T2: Emrah Yayici "Design Thinking Methodology", Artbiztech, First Edition (2016).

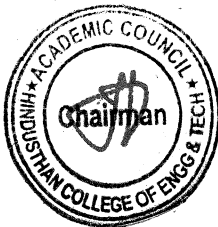
REFERENCEBOOKS

- R1: Christopher Golis "Enterprise & Venture Capital", Allen & Unwin Publication, Fourth Edition (2007).
- R2: Thomas Lockwood & Edger Papke "Innovation by Design", Career Press.com, Second Edition (2017).
- R3: Jonathan Wilson "Essentials of Business Research", Sage Publication, First Edition (2010).

WEBRESOURCES

- W1: <https://blof.forgeforward.in/tagged/startup-lessons>
- W2: <https://blof.forgeforward.in/tagged/entrepreneurship>
- W3: <https://blof.forgeforward.in/tagged/minimum-viable-product>
- W4: <https://blof.forgeforward.in/tagged/minimum-viable-product>
- W5: <https://blof.forgeforward.in/tagged/innovation>

Chairman, Board of Studies
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AUTO - HICET



Dean - Academics
Dean (Academics)
HICET

Programme	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech	22MC1094	HERITAGE OF TAMIL	2	0	0	0

The learner should be able to

- Course Objective
1. Introduce students to the great History of Tamil literature.
 2. Establish the heritage of various forms of Rock art and Sculpture art.
 3. To study and understand the various folk and Martial arts of Tamil culture
 4. Introduce students to Ancient Tamil concepts to understand the richness of Tamil literature.
 5. To learn about the various influences or impacts of Tamil language in Indian culture.

Unit	Description	Instructional Hours
I	Language and Literature Language families in India – Dravidian Languages – Tamil as a classical language – Classical Literature in Tamil- Secular nature of Sangam Literature – Distributive justice in Sangam Literature – Management principles in Thirukural – Tamil epics and impacts of Buddhism & Jainism in Tamil and Bakthi literature of Azhwars and Nayanmars – Forms of minor poetry – Development of Modern literature in Tamil – Contribution of Bharathiyar and Bharathidasan.	6
II	Heritage – Rock Art Paintings to Modern Art – Sculpture Hero Stone to Modern Sculpture – Bronze icons – Tribes and their handicrafts - Art of temple car making – Massive Terracotta sculptures, Village deities, Thiruvalluvar statue at Kanyakumari, Making of musical instruments – Mridangam, Parai, Yazh and Nadhaswaram - Role of Temples in social and economic life of Tamils.	6
III	Folk and Martial Arts Therukoothu, Karagattam, Villupattu, Kaniyan koothu, Oyilattam, Leather puppetry, Silambattam., Valari Tiger dance – Sports and Games of Tamils. Thinai Concept of Tamils	6
IV	Flora and Fauna of Tamils – Aham and Puram Concept from Tholkappiyam and Sangam Literature – Aram concept of Tamils – Education and Literacy during Sangam Age - Ancient cities and ports of Sangam age – Export and Import during Sangam age – Overseas conquest of Cholas. Contribution of Tamils to Indian National Movement and Indian Culture	6
V	Contribution of Tamils to Indian freedom struggle – The cultural influence of Tamils over the other parts of India – Self respect movement – Role of Siddha Medicine in indigenous systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil books.	6
Total Instructional Hours		30

At the end of the course, the learner will be able to

- Course Outcome
- CO1: Learn about the works pertaining to Sangam age
CO2: Aware of our Heritage in art from Stone sculpture to Modern Sculpture.
CO3: Appreciate the role of Folk arts in preserving, sustaining and evolution of Tamil culture.
CO4: Appreciate the intricacies of Tamil literature that had existed in the past.
CO5: Understand the contribution of Tamil Literature to Indian Culture

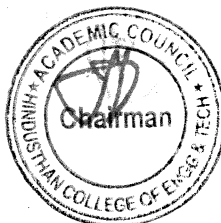
TEXTBOOKS:


- T1: Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
T2: Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
T3: Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)(Published by: International Institute of Tamil Studies).

REFERENCEBOOKS:

- R1-The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)
R2- Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu TextBook and Educational Services Corporation, Tamil Nadu)
R3-Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – ReferenceBook.

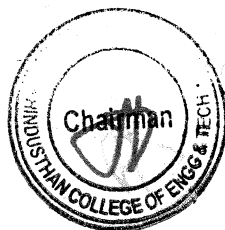

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Dean (Academics)
HiCET

Programme	Course Code	Course Title	L	T	P	C
BE/BTECH	22HE1073	INTRODUCTION TO SOFT SKILLS	0	0	0	1
Course Objectives:	1. To develop and nurture the soft skills of the students through instruction, knowledge acquisition, demonstration and practice. 2. To enhance the students ability to deal with numerical and quantitative skills. 3. To identify the core skills associated with critical thinking. 4. To develop and integrate the use of English language skills.					
Unit	Description	Instructional Hours				
I	Lessons on excellence Skill introspection, Skill acquisition, consistent practice	2				
II	Logical Reasoning Problem Solving - Critical Thinking- Lateral Thinking - Coding and Decoding – Series – Analogy - Odd Man Out - Visual Reasoning - Sudoku puzzles - Attention to detail	11				
III	Quantitative Aptitude Addition and Subtraction of bigger numbers - Square and square roots - Cubes and cube roots - Vedic maths techniques - Multiplication Shortcuts - Multiplication of 3 and higher digit numbers – Simplifications - Comparing fractions - Shortcuts to find HCF and LCM - Divisibility tests shortcuts - Algebra and functions	11				
IV	Recruitment Essentials Resume Building - Impression Management	2				
V	Verbal Ability Nouns and Pronouns – Verbs - Subject-Verb Agreement - Pronoun-Antecedent – Agreement - Punctuations	4				
		Total Instructional Hours	30			
Course Outcome:	CO1:	Students will analyze interpersonal communication skills. public speaking skills.				
	CO2:	Students will exemplify tautology, contradiction and contingency by logical thinking.				
	CO3:	Students will be able to develop an appropriate integral form to solve all sorts of quantitative problems.				
	CO4:	Students can produce a resume that describes their education, skills, experiences and measurable achievements with proper grammar, format and brevity.				
	CO5:	Students will be developed to acquire the ability to use English language with an error while making optimum use of grammar.				


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HICET

SUBJECT CODE – 22MC1093

GE3152

தமிழர் மரபு

LTPC
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அலகு I மொழி மற்றும் இலக்கியம்: 3
இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி

இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை: 3
நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளூர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.


அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: 3
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புனியாட்டம், தமிழர்களின்

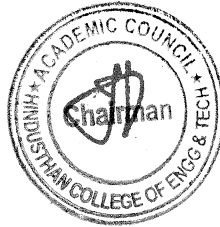
விளையாட்டுகள்.

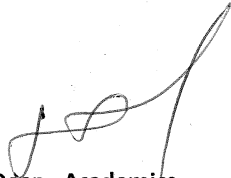
அலகு IV தமிழர்களின் இணைக் கோட்பாடுகள்: 3
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: 3
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிக்கள் - தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருறை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
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8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

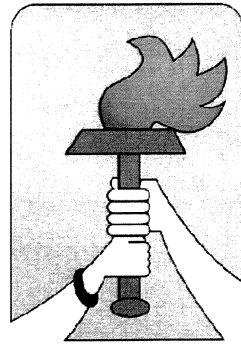

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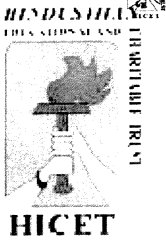
HINDUSTHAN
COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution)

Coimbatore – 641032

DEPARTMENT OF AUTOMOBILE ENGINEERING
Revised Curriculum and Syllabus for the Batch 2022-2026
(Academic Council Meeting Held on 19.06.2023)

2022 REGULATIONS



Hindusthan College of Engineering and Technology

(An Autonomous Institution, Affiliated to Anna University, Chennai
Approved by AICTE, New Delhi & Accredited by NAAC with 'A' Grade)
Valley Campus, Pollachi Highways, Coimbatore, Tamilnadu.



DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. AUTOMOBILE ENGINEERING (UG)

REGULATION-2022

(For the students admitted during the academic year 2022-2026)

SEMESTER I

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22MA1101	Matrices and Calculus	BSC	3	1	0	4	4	40	60	100
2.	22ME1201	Engineering Drawing	ESC	1	4	0	3	5	40	60	100
THEORY WITH LAB COMPONENT											
3.	22PH1151	Physics for Non-Circuit Engineering	BSC	2	0	2	3	4	50	50	100
4.	22HE1151	English for Engineers	HSC	2	0	2	3	4	50	50	100
5.	22IT1151	Python Programming and practices	ESC	2	0	2	3	4	50	50	100
EEC COURSES (SE/AE)											
6.	22HE1071	UHV	AEC	2	0	0	2	3	40	60	100
7.	22HE1072	Entrepreneurship & Innovation	AEC	1	0	0	1	1	100	0	100
MANDATORY COURSE											
8.	22MC1091/ 22MC1092	தமிழரும் தொழில்நுட்பமும் / Indian Constitution	MC	2	0	0	0	2	0	0	0
TOTAL				15	5	6	19	23	470	330	400



SEMESTER II

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22MA2101	Differential equations and complex analysis	BSC	3	1	0	4	4	40	60	100
2.	22CY2101	Environmental Studies	ESC	2	0	0	2	3	40	60	100
3.	22PH2101	Basics of Material Science	BSC	2	0	0	2	3	40	60	100
4.	22ME2101	Engineering Mechanics	ESC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
5.	22CY2152	Applied Chemistry	BSC	2	0	2	3	4	50	50	100
6.	22HE2151	Effective Technical Communication	HSC	2	0	2	3	4	50	50	100
PRACTICAL											
7.	22ME2001	Engineering Practices	ESC	0	0	4	2	2	50	50	100
EEC COURSES (SE/AE)											
8.	22HE2071	Design Thinking	AEC	2	0	0	2	2	100	0	100
9.	22HE2072	Soft Skills -1	AEC	1	0	0	1	1	100	0	100
MANDATORY COURSE											
10.	22MC2091/ 22MC2092	தமிழர்மரபு / Heritage of Tamils	MC	2	0	0	0	2	100	0	100
11.	22MC2093	NCC */NSS / YRC / Sports / Clubs / Society Service - Enrollment (Common)	MC	All students shall enroll, on admission, in anyone of the personality and character development programmes and undergo training for about 80 hours							
TOTAL				19	2	12	22	28	610	390	1000

SEMESTER III

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22MA3104	Fourier analysis and numerical techniques	BSC	3	1	0	4	4	40	60	100
2.	22AU3201	Fundamentals of Automotive Engines	PCC	3	0	0	3	3	40	60	100
3.	22AU3202	Fundamentals of Thermodynamics	PCC	3	1	0	4	3	40	60	100
4.	22AU3203	Mechanics of Materials	PCC	3	1	0	4	4	40	60	100
THEORY WITH LAB COMPONENT											
5.	22AU3251	Manufacturing Technology	PCC	2	0	2	3	4	50	50	100
PRACTICAL											
6.	22AU3001	Automotive Components Lab	ESC	0	0	4	2	4	60	40	100
7.	22AU3002	Mechanics of Materials Lab	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											



8.	22HE3071	Soft Skills -2	SEC	1	0	0	1	1	100	0	100
9.	22AU3072	Machine Drawing	AEC	0	0	4	2	2	60	40	100
10.	22MC3092	Essence of Indian Traditional Knowledge	AEC	2	0	0	0	0	-	-	-
TOTAL				19	3	10	25	29	470	430	900

SEMESTER IV

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22HE4101	IPR and Start-ups	HSC	2	0	0	2	2	40	60	100
2.	22AU4201	Automotive Chassis components Design	BSC	3	0	0	3	3	40	60	100
3.	22AU4202	Automotive Electricals and Electronics systems	PCC	3	1	0	4	3	40	60	100
4.	22AU4203	Mechanics of Machines	PCC	3	1	0	4	4	40	60	100
5.	22AU4204	Fluid and Pneumatic systems	PCC	3	0	0	3	4	40	60	100
THEORY WITH LAB COMPONENT											
6.	22AU4251	Fundamentals of Heat Transfer	PCC	3	0	0	3	4	40	60	100
PRACTICAL											
7.	22AU4001	Automotive Electricals and Electronics Laboratory	PCC	0	0	4	2	4	60	40	100
8.	22AU4002	Computer Aided Engine components design Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9.	22HE4071	Soft Skills -III	SEC	1	0	0	1	1	100	0	100
TOTAL				18	2	8	24	29	460	440	900
* Two weeks internship carries 1 credit and it will be done during Semester III summer vacation and same will be evaluated in Semester IV. If students unable to undergo in semester III, then the Internship I offered in the semester IV can be clubbed with Internship II (Total: 4 weeks-2 credits)											

SEMESTER V

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22AU5201	Vehicle design and data characteristics	PCC	3	0	0	3	4	40	60	100
2.	22AU5202	Automotive Fuels and Lubricants	PCC	3	0	0	3	3	40	60	100
3.	22AU53XX	Professional Elective-1	PEC	3	0	0	3	3	40	60	100
4.	22AU53XX	Professional Elective-2	PEC	3	0	0	3	3	40	60	100
5.	22AU53XX	Professional Elective-3	PEC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											



6.	22AU5251	Two and Three-wheeler technology	PCC	2	0	2	3	4	50	50	100
PRACTICAL											
7.	22AU5001	Automotive Fuels and Lubricants Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8.	22HE5071	Soft Skills -4/Foreign languages	SEC	1	0	0	1	1	100	0	100
TOTAL				18	0	6	21	25	410	390	800

SEMESTER VI

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22AU6201	Vehicle Dynamics	PCC	3	0	0	3	3	40	60	100
2.	22HE6101	Professional Ethics (Common)	HSC	3	0	0	3	3	40	60	100
3.	22AU63XX	Professional Elective-4	PEC	3	0	0	3	3	40	60	100
4.	22AU63XX	Professional Elective-5	PEC	3	0	0	3	3	40	60	100
5.	22XX64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
6.	22XX64XX	Open Elective – 2*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
7.	22AU6001	Computer Aided Engineering Laboratory	PCC	0	0	4	2	4	60	40	100
8.	22AU6002	Engine Performance and Emission testing laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9.	22HE6071	Soft Skills – 5	SEC	2	0	0	2	2	100	0	100
TOTAL				20	0	8	24	28	460	440	900

SEMESTER VII

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22AU7201	Design of Automotive Transmission systems	PCC	3	0	0	3	3	40	60	100
2.	22AU7202	Engine and Vehicle Management systems	PCC	3	1	0	4	4	40	60	100
3.	22AU73XX	Professional Elective-6	PEC	3	0	0	3	3	40	60	100
4.	22XX7401	Open Elective – 3*	OEC	3	0	0	3	3	40	60	100
5.	22LS74XX	Open Elective – 4*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
6.	22AU7001	Vehicle Maintenance Laboratory	PCC	0	0	4	2	4	60	40	100



EEC COURSES (SE/AE)											
7.	22AU7701	Internship - II*	SEC	-	-	-	2	1	100	0	100
TOTAL				15	1	4	20	21	360	340	700

* - Two weeks internship carries 1 credit and it will be done during Semester VI summer vacation/placement training and same will be evaluated in Semester VII.

SEMESTER VIII

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
EEC COURSES (SE/AE)											
1.	22AU8901	Project Work/Granted Patent	SEC9	0	0	20	10	20	100	100	200
TOTAL				0	0	20	10	20	100	100	200

Note:

- *As per the AICTE guideline, in Semesters I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Further, the students who enrolled his/her name in HICET NCC and Air Wing are eligible to undergo this subject. The earned extra credits printed in the Consolidated Mark sheet as per the regulation.
- NCC course level 1 & Level 2 will be added in the list of open elective subjects in the appropriate semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.
- The above-mentioned NCC Courses will be offered to the students who are going to be admitted in the Academic Year 2021 – 22.

SEMESTER-WISE CREDIT DISTRIBUTION

B.E. / B.TECH. PROGRAMMES										
S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSC	3	3	-	2	-	3	-	-	11
2	BSC	7	9	4	-	-	-	-	-	20
3	ESC	6	5	2	-	-	-	-	-	15
4	PCC	-	-	16	20	12	7	9	-	64
5	PEC	-	-	-	-	9	6	3	-	18
6	OEC	-	-	-	-	-	6	6	-	12
7	EEC	3	3	3	1	1	2	2	10	25
8	MCC	✓	✓	-	-	-	-	-	-	-
Total		19	22	25	23	22	24	20	10	165

**OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES)**

To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AI6451	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2	22CS6451	Blockchain Technology	OEC	2	0	2	4	3
3	22EC6451	Cyber security	OEC	2	0	2	4	3
4	22EC6452	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6451	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6451	Augmented and Virtual Reality	OEC	2	0	2	4	3

OPEN ELECTIVE I AND II

To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3
6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
9	22EI6402	Graphical Programming using Virtual Instrumentation	OEC	3	0	0	3	3
10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	0	0	3	3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3	3
12	22EE6401	Digital Marketing	OEC	3	0	0	3	3
13	22EE6402	Research Methodology	OEC	3	0	0	3	3
14	22FT6401	Traditional Foods	OEC	3	0	0	3	3
15	22AG6401	Urban Agriculture and Organic Farming	OEC	3	0	0	3	3
16	22CH6401	Biomass and Biorefinery	OEC	3	0	0	3	3

Note: Non-Circuit Departments can add one Open Elective course in the above list to offer for the circuit branches

OPEN ELECTIVE III

Students shall choose any one of the open elective courses such that the course content or title not belong to their own programme.

(Note: Each programme in our institution is expected to provide one course only)



S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AU7401	Automotive Fault diagnosis systems	OEC	3	0	0	3	3

OPEN ELECTIVE IV

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22LS7401	General studies for competitive examinations	OEC	3	0	0	3	3
2	22LS7402	Human Rights, Women Rights and Gender equity	OEC	3	0	0	3	3
3	22LS7403	Indian ethos and Human values	OEC	3	0	0	3	3
4	22LS7404	Financial independence and management	OEC	3	0	0	3	3
5	22LS7405	Yoga for Human Excellence	OEC	3	0	0	3	3
6	22LS7406	Democracy and Good Governance	OEC	3	0	0	3	3
7	22LS7407	NCC Level - II	OEC	3	0	0	3	3

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical 1 Modern Mobility Systems	Vertical 2 Product and Process Development	Vertical 3 Robotics and Automation	Vertical 4 Digital and Green Manufacturing	Vertical 5 Clean and Green Energy Technologies	Vertical 6 Logistics and Supply Chain Management
22AU5301 Automotive Materials, Components, Design & Testing	22AU5304 Value Engineering	22AU5307 Sensors and Instrumentation	22AU5310 Digital Manufacturing and IoT	22AU5313 Bioenergy Conversion Technologies	22AU5316 Automation in Manufacturing
22AU5302 Conventional and Futuristic Vehicle Technology	22AU5305 Additive Manufacturing	22AU5308 Electrical Drives and Actuators	22AU5311 Lean Manufacturing	22AU5314 Carbon Footprint estimation and reduction techniques	22AU5317 Material Handling Equipment, Repair and Maintenance
22AU5303 Renewable Powered Off Highway Vehicles and Emission Control Technology	22AU5306 CAD/CAM	22AU5309 Embedded Systems and Programming	22AU5312 Modern Robotics	22AU5315 Energy Conservation in Industries	22AU5318 Robotics
22AU6301 Vehicle Health Monitoring, Maintenance and Safety	22AU6303 Ergonomics in Design	22AU6305 Robotics	22AU6307 Green Manufacturing Design and Practices	22AU6309 Energy Efficient Buildings	22AU6311 Container Logistics



22AU6302 Hybrid and Electric Vehicle Technology	22AU6304 New Product Development	22AU6306 Smart Mobility and Intelligent Vehicles	22AU6308 Environment Sustainability and Impact Assessment	22AU6310 Renewable Energy Technologies	22AU6312 Logistics in Manufacturing, Supply Chain and Distribution
22AU7301 Thermal Management of Batteries and Fuel Cells	22AU7302 Product Life Cycle Management	22AU7303 Haptics and Immersive Technologies	22AU7304 Green Supply Chain Management	22AU7305 Equipment for Pollution Control	22AU7306 Data Science

Students are permitted to choose all Professional Electives from a particular vertical or from different verticals.

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Details of Vertical I: MODERN MOBILITY SYSTEMS

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AU5301	Automotive Materials, Components, Design & Testing	PEC	3	0	0	3	3
2	22AU5302	Conventional and Futuristic Vehicle Technology	PEC	3	0	0	3	3
3	22AU5303	Renewable Powered Off Highway Vehicles and Emission Control Technology	PEC	3	0	0	3	3
4	22AU6301	Vehicle Health Monitoring, Maintenance and Safety	PEC	3	0	0	3	3
5	22AU6302	Hybrid and Electric Vehicle Technology	PEC	3	0	0	3	3
6	22AU7301	Thermal Management of Batteries and Fuel Cells	PEC	3	0	0	3	3

Details of Vertical II: PRODUCT AND PROCESS DEVELOPMENT

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AU5304	Value Engineering	PEC	3	0	0	3	3
2	22AU5305	Additive Manufacturing	PEC	3	0	0	3	3
3	22AU5306	CAD/CAM	PEC	3	0	0	3	3
4	22AU6303	Ergonomics in Design	PEC	3	0	0	3	3
5	22AU6304	New Product Development	PEC	3	0	0	3	3
6	22AU7302	Product Life Cycle Management	PEC	3	0	0	3	3

Details of Vertical III: ROBOTICS AND AUTOMATION

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AU5307	Value Engineering	PEC	3	0	0	3	3
2	22AU5308	Additive Manufacturing	PEC	3	0	0	3	3
3	22AU5309	CAD/CAM	PEC	3	0	0	3	3
4	22AU6305	Ergonomics in Design	PEC	3	0	0	3	3
5	22AU6306	New Product Development	PEC	3	0	0	3	3
6	22AU7303	Product Life Cycle Management	PEC	3	0	0	3	3

Details of Vertical IV: DIGITAL AND GREEN MANUFACTURING

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AU5310	Digital Manufacturing and IoT	PEC	3	0	0	3	3
2	22AU5311	Lean Manufacturing	PEC	3	0	0	3	3
3	22AU5312	Modern Robotics	PEC	3	0	0	3	3
4	22AU6307	Green Manufacturing Design and Practices	PEC	3	0	0	3	3
5	22AU6308	Environment Sustainability and Impact Assessment	PEC	3	0	0	3	3
6	22AU7304	Green Supply Chain Management	PEC	3	0	0	3	3

Details of Vertical V: CLEAN AND GREEN ENERGY TECHNOLOGIES

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AU5313	Bioenergy Conversion Technologies	PEC	3	0	0	3	3
2	22AU5314	Carbon Footprint estimation and reduction techniques	PEC	3	0	0	3	3
3	22AU5315	Energy Conservation in Industries	PEC	3	0	0	3	3
4	22AU6309	Energy Efficient Buildings	PEC	3	0	0	3	3
5	22AU6310	Renewable Energy Technologies	PEC	3	0	0	3	3
6	22AU7305	Equipment for Pollution Control	PEC	3	0	0	3	3

**Details of Vertical VI: LOGISTICS AND SUPPLY CHAIN MANAGEMENT**

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AU5316	Automation in Manufacturing	PEC	3	0	0	3	3
2	22AU5317	Material Handling Equipment, Repair and Maintenance	PEC	3	0	0	3	3
3	22AU5318	Robotics	PEC	3	0	0	3	3
4	22AU6311	Container Logistics	PEC	3	0	0	3	3
5	22AU6312	Logistics in Manufacturing, Supply Chain and Distribution	PEC	3	0	0	3	3
6	22AU7306	Data Science	PEC	3	0	0	3	3

Enrollment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree. For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

VERTICALS FOR MINOR DEGREE

- Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

Note: Each programme should provide verticals for minor degree

Minor Degree - Automotive Vehicle Technology (Offered by Automobile Engineering)									
S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	22AU5601	Automotive Engines	3	0	0	3	40	60	100
2	22AU6601	Automotive Chassis	3	0	0	3	40	60	100
3	22AU6602	Automotive Transmission	3	0	0	3	40	60	100
4	22AU7601	Automotive Electronics	3	0	0	3	40	60	100
5	22AU7602	Intelligent vehicular systems	3	0	0	3	40	60	100
6	22AU8601	Electric and Hybrid vehicles	3	0	0	3	40	60	100

**Minor Degree - Fintech and Block Chain (common to all departments)**

S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	22CS5601	Financial Management	3	0	0	3	40	60	100
2	22CS5602	Fundamentals of Investment	3	0	0	3	40	60	100
3	22CS5603	Banking, Financial Services and Insurance	3	0	0	3	40	60	100
4	22CS5604	Introduction to Blockchain and its Applications	3	0	0	3	40	60	100
5	22CS5605	Fintech Personal Finance and Payments	3	0	0	3	40	60	100
6	22CS5606	Introduction to Fintech	3	0	0	3	40	60	100

Minor Degree - Entrepreneurship (common to all departments)

S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	22BA5601	Foundation of Entrepreneurship	3	0	0	3	40	60	100
2	22BA6601	Introduction to Business Venture	3	0	0	3	40	60	100
3	22BA6602	Team Building & Leadership Management for Business	3	0	0	3	40	60	100
4	22BA7601	Creativity & Innovation in Entrepreneurship	3	0	0	3	40	60	100
5	22BA7602	Principles of Marketing Management for Business	3	0	0	3	40	60	100
6	22BA8601	Human Resource Management for Entrepreneurs	3	0	0	3	40	60	100

Minor Degree - Environment and Sustainability (common to all departments)

S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	22CEXXXX	Sustainable infrastructure Development	3	0	0	3	40	60	100
2	22CEXXXX	Sustainable Agriculture and Environmental Management	3	0	0	3	40	60	100
3	22CEXXXX	Sustainable Bio Materials	3	0	0	3	40	60	100
4	22CEXXXX	Materials for Energy Sustainability	3	0	0	3	40	60	100
5	22CEXXXX	Green Technology	3	0	0	3	40	60	100
6	22CEXXXX	Environmental Quality Monitoring and Analysis	3	0	0	3	40	60	100



Honors Degree - Electric and hybrid vehicle development									
S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	22AU52XX	Fundamentals of Electric and Hybrid Vehicles	3	0	0	3	40	60	100
2	22AU62XX	Battery Technology	3	0	0	3	40	60	100
3	22AU62XX	Automotive Embedded Systems	3	0	0	3	40	60	100
4	22AU72XX	Advanced Automotive Safety Systems	3	0	0	3	40	60	100
5	22AU72XX	Special Purpose Electric Vehicle	3	0	0	3	40	60	100
6	22AU82XX	Electric Vehicles and its Sustainable Development	3	0	0	3	40	60	100
Honors Degree - Motorsport Engineering									
S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	22AU52XX	Composite Structure	3	0	0	3	40	60	100
2	22AU62XX	High performance engine design	3	0	0	3	40	60	100
3	22AU62XX	Motorsports Electric Vehicle	3	0	0	3	40	60	100
4	22AU72XX	Motorsports Vehicle Body Engineering	3	0	0	3	40	60	100
5	22AU72XX	Motorsports Race Electronics and Control Systems	3	0	0	3	40	60	100
6	22AU82XX	Motorsports racing circuits and Design	3	0	0	3	40	60	100
Honors Degree - Vehicle Development and Validation									
S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	22AU52XX	Automotive Product Design and Development	3	0	0	3	40	60	100
2	22AU62XX	Noise, Vibration and Harshness	3	0	0	3	40	60	100
3	22AU62XX	Automotive Instrumentation	3	0	0	3	40	60	100
4	22AU72XX	Testing and Measurement Systems	3	0	0	3	40	60	100
5	22AU72XX	Homologation	3	0	0	3	40	60	100
6	22AU82XX	Automotive Prototyping	3	0	0	3	40	60	100

CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	26	24	18	14	165

* Student can earn extra credit 35 over and above the total credits




ADDITIONAL CREDIT COURSE FOR NCC CADETS										
S.No	Course code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1	21HE1074	NCC General and National Integration	VA	1	0	0	1	100	0	100
2	21HE2074	Social Services and Community Development	VA	1	0	0	1	100	0	100
3	21HE3074	Leadership Qualities and Camp Activities	VA	1	0	0	1	100	0	100
4	21HE4074	General awareness, communication and Aero engines	VA	1	0	0	1	100	0	100

ADDITIONAL CREDIT COURSE FOR AUTOMOBILE ENGINEERING						
S.No	Course Code	Course Title	Category	Duration	Assessment	Credit
1	21VAAU01	Foundry Technology	VA	30 hrs	Internal	1
2	21VAAU02	Forming and Shaping of Plastics	VA	30 hrs	Internal	1
3	21VAAU03	Microcontroller Programming in Automotive applications	VA	30 hrs	Internal	1
4	21VAAU04	Vehicle development and testing regulations (ARAI)	VA	30 hrs	Internal	1
5	21VAAU05	Bigdata Analysis	VA	30 hrs	Internal	1
6	21VAAU06	Data mining	VA	30 hrs	Internal	1
7	21VAAU07	Fire and safety Engineering	VA	30 hrs	Internal	1
8	21VAAU08	Introduction to MS office	VA	30 hrs	Internal	1
9	21VAAU09	Advanced Automotive Electrical and Electronics	VA	30 hrs	Internal	1
10	21VAAU10	Autodesk Fusion 360	VA	30 hrs	Internal	1

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


Chairman, Board of Studies

**Chairman - BoS
AUTO - HiCET**


Dean - Academics
Dean (Academics)

HiCET
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Principal

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COIMBATORE - 641 032.



PRINCIPAL
Khalifa Bin Zayed School of Engineering & Technology
COMMERCIAL - 641 152

Dean Faculty of Engineering
Khalifa Bin Zayed School of Engineering & Technology

Chairman
Khalifa Bin Zayed School of Engineering & Technology



Programme	Course Code	Name of the Course	L	T	P	C
B.E	22MA3104	FOURIER ANALYSIS AND NUMERICAL TECHNIQUES (AUTO , AERO)	3	1	0	4

The learner should be able to

- Course Objective**
- Analyze Fourier series which is central to many applications in engineering.
 - Apply the effective tools for the solutions of one and two dimensional boundary value problems.
 - Apply Fourier transform techniques in various situations.
 - Explain single and multi step methods to solve Ordinary differential equations
 - Describe various methods to solve ordinary differential equations and partial differential equations

Unit	Description	Instructional Hours
I	FOURIER SERIES Dirichlet's conditions- General Fourier Series – Odd and Even Functions – Half rangesine and cosine series – Change of Interval - Parseval's Identity - Harmonic analysis.	12
II	BOUNDARY VALUE PROBLEMS Classification of PDE - Solutions of one dimensional wave equation - Onedimensional equation of heat conduction (excluding insulated edges).Two dimensional heat equations-Steady state solution of two dimensional equation of heatconduction in infinite plate	12
III	FOURIER TRANSFORMS Fourier Transform Pairs - Fourier sine and cosine transforms – Properties - Transforms of Simple functions – Convolution Theorem (Statement only) – Parseval's identity (Statement only).	12
IV	INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS Single step methods for solving first order equations: Taylor's series method – Eulerand Modified Euler methods – Fourth order Runge-kutta method -Multi step method: Milne's predictor and corrector method.	12
V	BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 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– Laplace Equations and Poisson Equations.	12
Total Instructional Hours		60

At the end of the course, the learner will be able to

- Course Outcome**
- CO1: Understand the principles of Fourier series which helps them to solve physical problems of engineering.
 CO2: Employ Fourier series in solving the boundary value problems.
 CO3: Apply Fourier transform techniques which extend its applications.
 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 differentialequations.

TEXT BOOKS:

- T1 - Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018
 T2 - Bali. N.P and Manish Goyal & Watkins, "Advanced Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007


REFERENCE BOOKS:

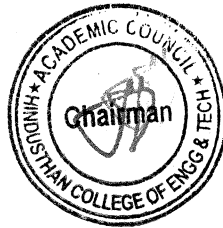
- R1 - Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012.
 R2 - Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2018.
 R3 - Grewal B.S. and Grewal J.S. "Numerical Methods in Engineering and Science", 6th Edition, Khannapublishers, New Delhi 2015.




CO PO MAPPING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	2	2	-	-	-	-	-	-	2	1	-
CO2	3	3	3	2	3	-	-	-	-	-	-	2	1	-
CO3	3	3	3	3	3	-	-	-	-	-	-	2	1	-
CO4	3	3	3	3	3	-	-	-	-	-	-	2	1	-
CO5	3	3	3	3	3	-	-	-	-	-	-	2	1	-
Avg	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1	-


Chairman, Board of Studies
Chairman - BOS
AUTO - HICET




Dean - Academics
Dean (Academics)
HICET



22AU3201

FUNDAMENTALS OF AUTOMOTIVE ENGINES

L	T	P	C
3	0	0	3

Course Objectives

1. To develop a comprehensive understanding of IC engines, explore the thermodynamic cycles involved, and introduce the concept of hydrogen engines
2. To get comprehensive knowledge of various fuel injection and ignition systems used in IC engine
3. To understand the combustion phenomena and design considerations in SI engines.
4. To comprehend the combustion processes and design considerations in CI engines.
5. To identify the nature of pollutant formation and explore techniques for controlling emissions.

UNIT I INTERNAL COMBUSTION ENGINES (9)

Introduction: Construction and Working of Two-Stroke and Four-Stroke SI and CI Engines, Comparison of SI and CI Engines, Engine Classification and Firing Order, Otto Cycle, Diesel Cycle, and Dual Cycles, hydrogen engines.

UNIT II INJECTION AND IGNITION SYSTEMS (9)

Diesel Fuel Injection Systems: Types, Functions, Fuel Injection Pump, Jerk Distributor, Mechanical and Pneumatic Speed Governor, Fuel Injector: Types of Nozzle, Common Rail Direct Injection (CRDI), Air-Fuel Ratio: Carburetion, Types of Carburetor, Spark Plug: Ignition Systems, Battery Coil, Magneto Coil, Electronic Type, Petrol Injection System: Multi-Point Fuel Injection (MPFI), Gasoline Direct Injection (GDi).

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 and Knocking, Comparison of Knock in CI and SI Engines, Types of Injection in CI Engines, Types of Combustion Chambers.

UNIT V ENGINE PERFORMANCE AND EMISSION STANDARDS (9)

Indicated Power, Brake Power, Engine Torque, Mechanical Efficiency, Air Standard Efficiency, Emissions: Types (CO, HC, NO_x, SO₂), Emission Control Measures for IC Engines, Bharat Stage (BS) Standards and Norms, Effect of Emissions on the Environment and Human Beings.

TOTAL: 45 PERIODS

Course Outcomes

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

- CO1: Gain comprehensive understanding of IC engines, thermodynamic cycles, and hydrogen engines.
- CO2: Identify and categorize different types of injection and ignition systems.
- CO3: Attain in-depth knowledge of combustion phenomena in spark ignition (SI) engines.
- CO4: study of combustion in CI engines aimed to acquire an extensive understanding of the process.
- CO5: Utilize acquired knowledge to assess and manage pollution levels effectively.

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

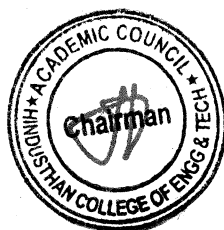
- R1 K. K. Ramalingm, internal Combustion Engines, Scitech publications, Chennai, 2018.
- R2 Heldt, P.M., High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta




CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	2	3	3	3	3	-	-	2	-	3	2	3
CO2	3	3	2	2	2	2	2	-	-	2	-	2	3	3
CO3	2	2	-	3	3	3	3	-	-	2	-	3	2	3
CO4	2	2	2	2	2	2	2	-	-	2	-	2	2	3
CO5	3	3	2	2	3	2	2	-	-	2	-	2	2	2
AVG	2.6	2.4	2	2.4	2.6	2.4	2.4	-	-	2	-	2.4	2.2	2.8


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22AU3202

FUNDAMENTALS OF THERMODYNAMICS

L	T	P	C
3	1	0	4

Course Objectives

- 1 To understand 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.

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

UNIT I BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS

(9+3)

Basic concepts - concept of continuum, microscopic and macroscopic approach, path and point functions. Intensive and extensive properties, 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— steady and unsteady flow processes.

UNIT II SECOND LAW OF THERMODYNAMICS

(9+3)

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

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE

(9+3)

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. Steam power cycle. Ideal and actual Rankine cycles, Cycle Improvement Methods-Reheat and Regenerative cycles.

UNIT IV IDEAL AND REAL GASES, GAS MIXTURES AND THERMODYNAMIC RELATIONS

(9+3)

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, Daltons law, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function. Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule-Thomson Coefficient, Clausius Clapeyron equation.

UNIT V PSYCHROMETRY

(9+3)

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: 60 PERIODS

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

- CO1: Understand 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 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, 2008.
- T2 Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", Anuragam Publications, 2012.

References

- R1 Holman.J.P., "Thermodynamics", 3rd Edition, McGraw-Hill, 1995.
- R2 Rathakrishnan.E., "Fundamentals of Engineering Thermodynamics", Prentice-Hall of India Pvt.Ltd, 2006
- R3 Chattopadhyay,P, "Engineering Thermodynamics", Oxford University Press, 2010.
- R4 Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.

Web Resources


- W1 web.iitd.ac.in/~pmvs/courses/mcl141/mcl141-36.ppt
- W2 https://en.wikibooks.org/wiki/Engineering_Thermodynamics

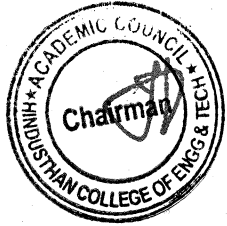
CO PO MAPPING

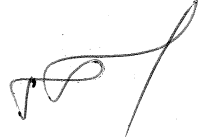
PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
3	3	3	1	-	-	-	-	-	1	-	2	2	3
3	3	2	1	-	-	-	-	-	1	-	2	2	2
2	3	3	3	-	-	-	-	-	2	-	2	2	3
3	3	2	3	-	-	-	-	-	1	-	2	2	3
3	3	2	1	-	-	-	-	-	2	-	2	2	2
2.8	3	2.4	1.8	-	-	-	-	-	1.4	-	2	2	2.6

PSO-2
3
3
3
2
2
2.6

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22AU3251

MANUFACTURING TECHNOLOGY

L	T	P	C
2	0	2	3

Course Objectives

1. To understand the manufacturing concepts of metal casting processes
2. To develop the knowledge in metal joining process
3. To acquire knowledge about various machining processes
4. To interpret the students about forming of plastics and metals
5. To get knowledge of powder metallurgy used in automobile applications

UNIT I METAL CASTING PROCESSES (9)

Sand Casting – Sand Moulds - Type of Patterns – Pattern Materials – Pattern Allowances – Types of Moulding Sand – Properties – Core Making – Methods of Sand Testing – Working Principle of Special Casting Processes – Shell-Pressure Die Casting – Centrifugal Casting – CO2 Process – Sand Casting Defects – Inspection Methods

Preparation of Sand Mould With Solid & Split Pattern.

UNIT II JOINING PROCESSES (9)

Fusion Welding Processes – Types of Gas Welding – Equipments Used – Flame Characteristics – Filler and Flux Materials - Arc Welding Equipments - Gas Metal Arc Welding – Flux Cored – Submerged Arc Welding – Electro Slag Welding – TIG and MIG Welding Process. Principles Of Resistance Welding – Spot/Butt, Seam Welding – Percussion Welding- Weld Defects.

Experimental procedure of Butt joint, T joint, L joint using Arc Welding Equipments

UNIT III MACHINING PROCESSES (9)

Construction, Working Principles And Commonly Performed Operations In The Following Machines: Lathe-Shaper-Mechanisms-Planer-Types-Milling Machine-Types-Drilling Machine-Types-Grinding Machine-Types-Basics Of CNC Machines.

Experimental Procedure of Facing, Plain Turning and Step Turning

UNIT IV MANUFACTURING OF PLASTIC COMPONENTS (9)

Types of Plastics - Characteristics of the Forming and Shaping Processes – Moulding of Thermoplastics – Working Principles and Typical Applications - Injection Moulding – Blow Moulding – Rotational Moulding – Film Blowing – Extrusion – Thermoforming.

Industrial / Field visit to Plastic Components Manufacturing Industries

UNIT V METAL DEFORMATION AND POWDER METALLURGY (9)

Principles of Extrusion – Types of Extrusion – Hot and Cold Extrusion. Sheet Metal Characteristics - Typical Shearing Operations, Bending and Drawing Operations – Stretch Forming Operations - Metal Spinning. Powder Metallurgy Process – Sintering Process Variables, Manufacture of Friction Lining Materials for Clutches and Brakes – Plastics - Raw Material – Automobile Components

Experimental Procedure of Cylindrical Grinding, Surface Grinding

TOTAL: 45 PERIODS

Course Outcomes

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

- CO1: Students will be able to get in-depth knowledge of various manufacturing processes
- CO2: Students will get in depth knowledge about metal joining and metal removing process
- CO3: Students can have capable to select appropriate manufacturing process for a particular Engineering application and their projects.
- CO4: Capable of students to do basic manufacturing process
- CO5: learnt about advance powder metallurgy and manufacturing process

Text Books

- T1 Hajra Choudhury, “Elements of Workshop Technology”, Vol-I and Vol-II Asia Publishing House, 1996.
- T2 R.K.Jain and S.C.Gupta, “Production Technology”, Hanna Publishers, 1997.
- T3 P.C. Sharma, “A text book of production technology”, S. Chand and Company, IV Edition, 2003.
- T4 Serope Kalpak jian, and Steven R. Schmid,” Manufacturing Engineering and Technology”, Pearson Education.


References

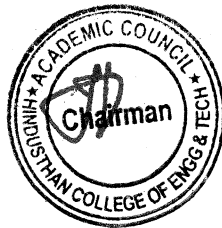
- R1 Ghosh, A., and Malik, A. K., “Manufacturing Science”, Affiliated East west Press Pvt. Ltd., 2008.
- R2 Rao PN, “Manufacturing Technology”, 3/e, TMH, New Delhi, 2010.
- R3 H.M.T. "Production Technology-Hand Book, Tata McGraw Hill, 1990.




CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	3	1	-	-	-	-	-	1	-	2	2	3
CO2	3	3	2	1	-	-	-	-	-	1	-	2	2	2
CO3	2	3	3	3	-	-	-	-	-	2	-	2	2	3
CO4	3	3	2	3	-	-	-	-	-	1	-	2	2	3
CO5	3	3	2	1	-	-	-	-	-	2	-	2	2	2
AVG	2.8	3	2.4	1.8	-	-	-	-	-	1.4	-	2	2	2.6


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22AU3001

AUTOMOTIVE COMPONENTS LABORATORY

L	T	P	C
0	0	4	2

Course Objectives

1. Gain knowledge of the operational principles of petrol and diesel engines.
2. To acquire knowledge about fuel supply system and vehicles frames.
3. To examine and analyze the construction and operation of vehicle axles and differentials.
4. To comprehend the operation and purpose of the clutch and gearbox.
5. To comprehend the operation of the steering system as well as the cooling and lubrication system.

LIST OF EXPERIMENTS

1. Dismantle and assemble a multi-cylinder petrol engine to identify its nomenclature.
2. Disassemble, examine the nomenclature, and reassemble a multi-cylinder diesel engine.
3. Examine the fuel systems of petrol and diesel engines.
4. Analyze and measure the frames of light and heavy commercial vehicles.
5. Axle Dismantling and Assembly: Front and Rear Axles
6. Disassemble and assemble of differentials and to identify the load distribution.
7. Dismantling and Assembly of a Clutch.
8. Analysis of Gearbox Functioning and Components to Compute Gear Ratios.
9. Investigate the functioning of steering systems.
10. Explore the cooling and lubrication systems.

TOTAL: 45 PERIODS

Course Outcomes

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

- CO1: Acquire knowledge about the functioning principles of petrol and diesel engines.
- CO2: Obtain a comprehensive understanding of the fuel supply system and vehicle frames.
- CO3: Evaluate and analyze the design and functionality of vehicle axles and differentials
- CO4: Gain knowledge about the working mechanisms and functions of the clutch and gearbox.
- CO5: Gain an understanding of the purpose and operation of the steering system and the cooling and lubrication system.


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

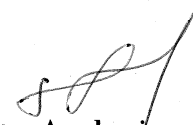


CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	1	1	2	-	2	3	-	-	3	-	3	2	2
CO2	2	2	2	2	-	-	3	-	-	3	-	3	3	2
CO3	2	2	2	2	-	-	2	-	-	2	-	2	3	3
CO4	2	2	1	2	2	-	2	-	-	1	-	2	3	3
CO5	2	2	2	1	2	-	2	-	-	2	-	2	2	2
AVG	2.2	1.8	1.6	1.8	2	2	2.4	-	-	2.2	-	2.4	2.6	2.4


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22AU3002

MECHANICS OF MATERIALS LAB

L T P C
0 0 4 2

Course Objectives

- 1 To learn about different testing methods of materials
- 2 To understand the methods to determine various mechanical properties
- 3 To develop knowledge on the effect of heat treatment process on different materials
- 4 To understand the effect of stresses for different type of loading
- 5 To examine the microstructure of different materials

S.No LIST OF EXPERIMENTS

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen- Charpy and Izod
5. Deflection test on beams
6. Hardness test on metals - Brinnell and Rockwell Hardness Number
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Tempering- Improvement Mechanical properties Comparison
(i)Unhardened specimen
(ii) Quenched Specimen and
(iii) Quenched and tempered specimen.
10. Microscopic Examination of
(i) Hardened samples and
(ii)Hardened and tempered samples.

TOTAL:45 PERIODS

Course Outcomes

- At the end of this course students will be able to:
- CO1: Ability to perform different destructive testing
 - CO2: Ability to characteristic materials
 - CO3: Able to choose materials based upon loading and properties
 - CO4: Analyze the behaviour of material for various loading
 - CO5: Classify the material based upon microstructure


LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

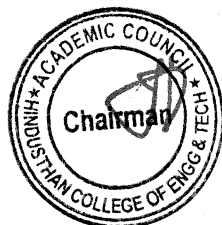
S.No	NAME OF THE EQUIPMENT	QTY.
1	Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity	1
2	Torsion Testing Machine (60 NM Capacity)	1
3	Impact Testing Machine (300 J Capacity)	1
4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7	Metallurgical Microscopes	1
8	Muffle Furnace (800 C)	1




CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	1	1	2	-	2	3	-	-	3	-	3	2	2
CO2	2	2	2	2	-	-	3	-	-	3	-	3	3	2
CO3	2	2	2	2	-	-	2	-	-	2	-	2	3	3
CO4	2	2	1	2	2	-	2	-	-	1	-	2	3	3
CO5	2	2	2	1	2	-	2	-	-	2	-	2	2	2
AVG	2.2	1.8	1.6	1.8	2	2	2.4	-	-	2.2	-	2.4	2.6	2.4


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Programme	Course Code	Course Title	L	T	P	C
BE/BTECH	22HE3071	Soft Skills and Aptitude - II	0	0	0	1

- Course Objectives:**
1. Solve Logical Reasoning questions of easy to intermediate level
 2. Solve Quantitative Aptitude questions of easy to intermediate level
 3. Solve Verbal Ability questions of easy to intermediate level
 4. Display good writing skills while dealing with essays

Unit	Description	Instructional Hours
I	Logical Reasoning Clocks - Calendars - Direction Sense - Cubes - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency	9
II	Quantitative Aptitude Time and work: Work with different efficiencies, Pipes and cisterns, Work equivalence, Division of wages - Time, Speed and Distance: Basics of time, speed and distance, Relative speed, Problems based on trains, Problems based on boats and streams, - Profit and loss, Basic terminologies in profit and loss - Averages - Weighted average	12
III	Verbal Ability Sentence Correction: Subject-Verb Agreement, Modifiers, Parallelism, Pronoun-Antecedent Agreement, Verb Time Sequences, Comparisons, Prepositions, Determiners - Sentence Completion and Para-jumbles: Pro-active thinking, Reactive thinking (signpost words, root words, prefix suffix, sentence structure clues), Fixed jumbles, Anchored jumbles.	7
IV	Writing skills for placements Essay writing: Idea generation for topics, Best practices, Practice and feedback	2
Total Instructional Hours		30

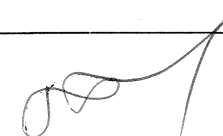
Course Outcome	Description
CO1	Students will avoid the various fallacies that can arise through the misuse of logic.
CO2	Students would opt for alternate methods to solve the problems rather than conventional methods.
CO3	Students will heighten their awareness of correct usage of English grammar in writing and speaking
CO4	Students will be concise and clear, using professional language for placements.

REFERENCE BOOKS:

R1:	A New Approach To Reasoning Verbal & Non-Verbal By B.S. Sijwali
R2:	How to prepare for data interpretation for CAT by Arun Sharma.
R3:	How to Crack TEST OF REASONING in all competitive examinations by Jaikishan and Premkishan.
R4:	Quantitative Aptitude for Competitive Examinations - Dr. R.S. Aggarwal, S. Chand
R5:	Word Power Made Easy by Norman Lewis
R:6	Six weeks to words of power by Wilfred Funk


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HiCET page | 15



22AU3072

MACHINE DRAWING

L	T	P	C
2	0	0	2

Course Objectives

- 1 To understand need for the rivet and welded joints
- 2 To recognize various threaded bolt and fasteners
- 3 To develop knowledge in select various types of fits, tolerance, hole and shaft basis systems
- 4 To familiarize students with reading of blue print and production drawing
- 5 To develop knowledge in machine elements part diagram and assembly

UNIT I RIVET AND WELDED JOINTS

(6)

Introduction – Rivet, Riveting, Caulking and Fullering – types heads – chain – Zig Zag rivet – Classification – Welded joints and symbols – Dimensioning method – Edge preparation method – Surface finish - Rules for applying symbol – welding process abbreviations

UNIT II SCREWED FASTENERS AND BOLTED JOINTS

(7)

Screw thread nomenclature – Forms of threads – types of thread profile – Designation – Multi-start – Right and Left hand threads – Representation – Bolted joints – Drawing of Square, Hexagonal and both head bolts – Types of Nuts, Bolts, cap, machine and set screws – Locking nuts – Foundation bolts

UNIT III LIMITS, TOLERANCES AND FITS

(6)

Limit systems – Deviations – Allowance – Size – Fundamental tolerances – hole and shaft deviations – Placing method - simple problems – Fits – Types of fits – Tolerance representation in drawing – Industry Standards

UNIT IV BLUE PRINT READING AND PRODUCTION DRAWING

(6)

Introduction – Blue print reading and practice – Rear tool post – Pump housing – Gear Box cover – Production drawing – Part – Work assembly drawing – Simple examples

UNIT V MANUAL DRAWING PRACTICE

(20)

Detailed drawings of following machine parts are given and draw the Elevations / Sectional elevations / Plan / and Side views with dimensioning and bill of materials – Sleeve & Cotter joint – Knuckle joint – Flanged coupling – Universal Coupling – Pulleys – Engine parts – Stuffing Box – Piston - Single plate clutch

TOTAL: 45 PERIODS

Course Outcomes

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

- CO1: Ability to understand the various types of joining process
- CO2: Able to know the various types of screws and bolts
- CO3: Apply the knowledge of fits and tolerance to various applications
- CO4: Acquire the knowledge of study of blue print and production drawing
- CO5: Construct an assembly drawing with various part drawings of machine components

Text Books


- T1 Narayana, K L, Kannaiah, P, Venkata Reddy, K., “Machine Drawing”, New age International Pvt Ltd., 2006.
- T2 Gopalakrishna K R, "Machine Drawing", Seventeenth Edition, Subhas Stores, Bangalore, 2007.

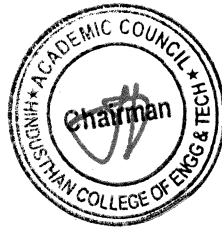
References

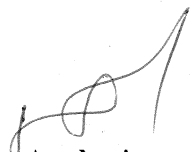
- R1 Bhatt N. D, “Machine Drawing”, Charotar Publishing House, Anand, 1999.
- R2 Gill, P S, “A Text book of Machine Drawing”, Kataria & Sons, Delhi, 2017

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	1	1	1	1	1	3	1	1	1	1
CO 2	3	2	2	1	1	1	1	1	1	2	1	1	1	1
CO 3	3	2	3	1	2	1	1	1	1	2	1	1	1	2
CO 4	3	2	3	1	2	1	1	1	1	2	1	1	2	2
CO 5	3	2	3	1	2	1	1	1	1	2	1	1	2	2
AVG	3	2	2.6	1	1.6	1	1	1	1	2.2	1	1	1.4	1.6


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B.E/ II 22MC2092 ESSENCE OF INDIAN TRADITIONAL 2 0 0 0
KNOWLEDGE
The learner should be able to

- Course Objective**
1. Comprehend the basic principles of Indian Tradition.
 2. Understand that Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
 3. Realize the Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature is also important in modern society with rapid technological advancements and societal disruptions.
 4. Apprehend the Indian linguistic tradition and Indian artistic tradition.

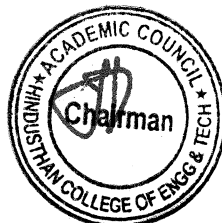
Unit	Description	Instructional Hours
I	Basic Structure of Indian Knowledge System	3
II	Modern Science and Indian Knowledge System	3
III	Yoga and Holistic Health care	3
IV	Philosophical tradition	3
V	Indian linguistic tradition (Phonology, Morphology, Syntax and semantics), Indian artistic tradition and Case Studies.	3
Total Instructional Hours		15

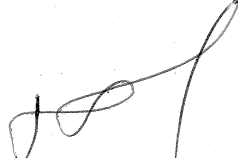
- Course Outcome**
- At the end of the course, the learner will be able to**
- Ability to understand the structure of Indian system of life.
 - Connect up and explain basics of Indian Traditional knowledge in modern scientific perspective.

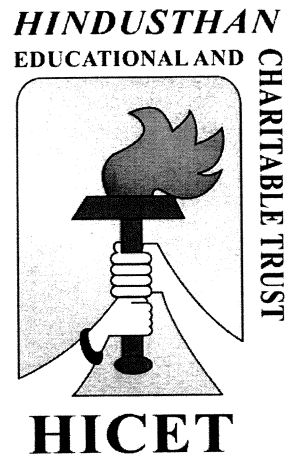
REFERENCE BOOKS:

- R1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
- R2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
- R3. Fritzo Capra, Tao of Physics
- R4. Fritzo Capra, The wave of Life.
- R5. V N Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Amakum
- R6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta.
- R7. GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi, 2016.
- R8. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016.
- R9. P R Sharma (English translation), Shodashang Hridayam.


 Chairman, Board of Studies
Chairman - B.E.
AUTO - HICET



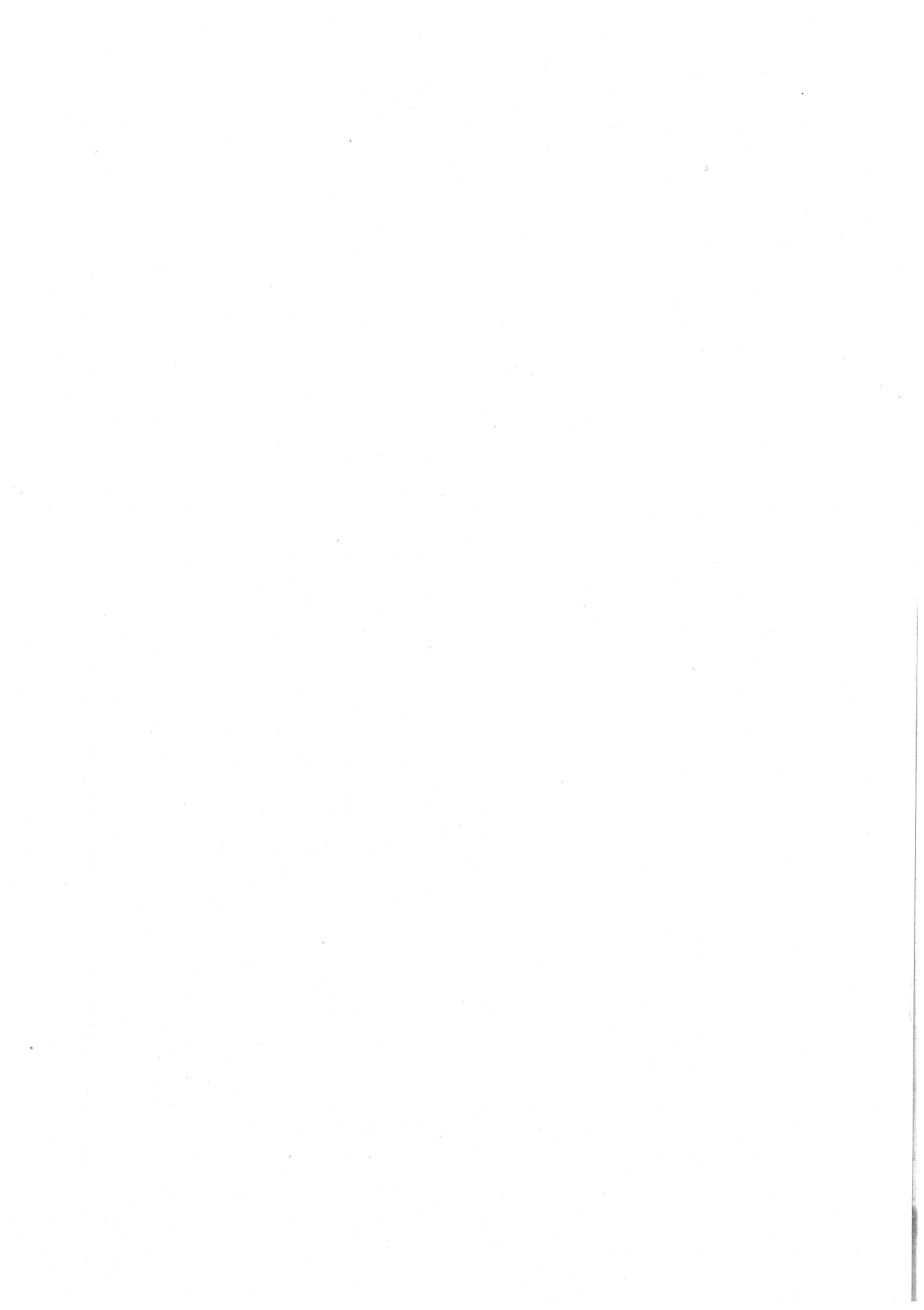

 Dean - Academics
Dean (Academics)
HICET



HINDUSTHAN
COLLEGE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution)
Coimbatore – 641032

DEPARTMENT OF AUTOMOBILE ENGINEERING
Revised Curriculum and Syllabus for the Batch 2021-2025
(Academic Council Meeting Held on 19.06.2023)

2019 REGULATIONS



**Hindusthan College of Engineering and Technology**

(An Autonomous Institution, Affiliated to Anna University, Chennai
Approved by AICTE, New Delhi & Accredited by NAAC with 'A' Grade)
Valley Campus, Pollachi Highways, Coimbatore, Tamilnadu.

**DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS****CBCS PATTERN****UNDERGRADUATE PROGRAMMES****B.E. AUTOMOBILE ENGINEERING (UG)****REGULATION-2019 (Revised on July 2021)**

(For the students admitted during the academic year 2021-2025 and onwards)

SEMESTER I

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE1101	Technical English	HS	2	1	0	3	40	60	100
2	21MA1102	Calculus and Linear Algebra	BS	3	1	0	4	40	60	100
THEORY WITH LAB COMPONENT										
3	21PH1151	Applied Physics	BS	2	0	2	3	50	50	100
4	21CY1151	Engineering Chemistry	BS	2	0	2	3	50	50	100
5	21CS1151	Python Programming and practices	ES	2	0	2	3	50	50	100
6	21ME1152	Engineering Drawing	ES	1	0	4	3	50	50	100
PRACTICAL										
7	21HE1071	Language Competency Enhancement Course - I	HS	0	0	2	1	0	100	100
NON-CREDIT MANDATORY COURSE										
8	21HE1072	Career Guidance Level - I Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
9	21HE1073	Entrepreneurship and Innovation	EEC	1	0	0	0	100	0	100
Total				13	2	12	20	580	320	900
As Per AICTE Norms 3 Weeks Induction Programme is Added in The First Semester as an Audit Course										

**SEMESTER II**

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE2101	Business English for Engineers	HS	2	1	0	3	40	60	100
2	21MA2101	Differential Equations and Complex Variables	BS	3	1	0	4	40	60	100
3	21ME2101	Engineering Mechanics	ES	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
4	21PH2151	Material Science	BS	2	0	2	3	50	50	100
5	21CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
6	21IT2151	Programming in C	ES	2	0	2	3	50	50	100
PRACTICAL										
7	21ME2001	Engineering Practices	ES	0	0	4	2	50	50	100
8	21HE2071	Language Competency Enhancement Course - II	HS	0	0	2	1	0	100	100
NON-CREDIT MANDATORY COURSE										
9	21HE2072	Career Guidance Level – II Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
Total				17	2	12	22	520	380	900

SEMESTER III

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21MA3101	Fourier Series and Statistics	BS	3	1	0	4	40	60	100
2	21AU3201	Fluid and Pneumatic Systems	PC	3	1	0	4	40	60	100
3	21AU3202	Engineering Thermodynamics	PC	3	0	0	3	40	60	100
4	21AU3203	Theory of Automotive Engines**	PC	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
5	21AU3251	Automotive Structures and Design	PC	2	0	2	3	50	50	100
PRACTICAL										
6	21AU3001	Automotive Components Lab**	PC	0	0	3	1.5	50	50	100
7	21AU3002	Computer Aided Drawing Lab**	PC	0	0	3	1.5	50	50	100
NON CREDIT MANDATORY COURSE										
8	21MC3191	Indian Constitution	MC	2	0	0	0	100	-	100
9	21HE3072	Career Guidance – Level III Personality, Aptitude and Career Development	EEC	2	0	0	0	100	-	100
10	21HE3073	Leadership Management Skills	EEC	1	0	0	0	100	-	100
Total				20	2	8	20	610	390	1000

**SEMESTER IV**

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21MA4101	Numerical Methods	BS	3	1	0	4	40	60	100
2	21AU4201	Mechanism and Machine Theory	PC	3	1	0	4	40	60	100
3	21AU4202	Automotive Engine Components Design**	PC	3	1	0	4	40	60	100
4	21AU4203	Two and Three Wheelers Technology#	PC	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
5	21AU4251	Fundamentals of Heat Transfer	PC	2	0	2	3	50	50	100
PRACTICAL										
6	21AU4001	Computer Aided Automotive Engine Components Lab##	PC	0	0	3	1.5	50	50	100
7	21AU4002	Two and Three Wheelers Technology Lab#	PC	0	0	3	1.5	50	50	100
NON CREDIT MANDATORY COURSE										
8	21MC4191	Essence of Indian Traditional Knowledge	MC	2	0	0	0	100	-	100
9	21HE4072	Career Guidance – Level IV Personality, Aptitude and Career Development	EEC	2	0	0	0	100	-	100
Total				18	3	8	21	510	390	900

SEMESTER V

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21AU5201	Automotive Emission and Pollution Control**s	PC	3	0	0	3	40	60	100
2	21AU5202	Vehicle Design and Data Characteristics**	PC	3	1	0	4	40	60	100
3	21AU5203	Automotive Fuels and Lubricants	PC	3	0	0	3	40	60	100
4	21AU53XX	Professional Elective – 1	PE	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
5	21AU5251	Automotive Transmission*	PC	2	0	2	3	50	50	100
6	21AU5252	Automotive Chassis Components Design##	PC	2	0	2	3	50	50	100
PRACTICAL										
7	21AU5001	Engine Performance and Emission Testing Lab*	PC	0	0	3	1.5	50	50	100
8	21AU5002	Automotive Fuels and Lubricants Lab	PC	0	0	3	1.5	50	50	100
ONE CREDIT MANDATORY COURSE										
9	21HE5071	Soft Skill I	EEC	1	0	0	1	100	-	100
10	21HE5072	Design Thinking	EEC	1	0	0	1	100	-	100
Total :				18	1	10	24	560	440	1000

**SEMESTER VI**

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21AU6201	Total Quality Management ^s	HS	3	0	0	3	40	60	100
2	21AU6202	Vehicle Dynamics and Control Systems* ^{#s}	PC	3	0	0	3	40	60	100
3	21AU6203	Finite Element Analysis	PC	3	1	0	4	40	60	100
4	21AU63XX	Professional Elective – 2	PE	3	0	0	3	40	60	100
5	21XX64XX	Open Elective - 1	OE	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
6	21AU6251	Automotive Vehicle Body and Aerodynamics*	PC	2	0	3	3.5	50	50	100
PRACTICAL										
7	21AU6001	Finite Element Analysis Lab ^{##}	PC	0	0	3	1.5	50	50	100
ONE CREDIT MANDATORY COURSE										
8	21AU6701	Internship Training / In plant Training	EEC	0	0	0	1	100		100
9	21HE6071	Soft Skill-II	EEC	1	0	0	1	100	-	100
10	21HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	100	-	100
Total :				19	1	6	24	600	400	1000

SEMESTER VII

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21AU7201	Advanced Electrical and Electronics* ^{#s}	PC	3	f	0	3	40	60	100
2	21AU7202	Engine and Vehicle Management Systems* ^{#s}	PC	3	0	0	3	40	60	100
3	21AU73XX	Professional Elective – 3	PE	3	0	0	3	40	60	100
4	21XX74XX	Open Elective – 2	OE	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
5	21AU7251	Electric and Hybrid Vehicle ^{ss}	PC	2	0	2	3	50	50	100
PRACTICAL										
6	21AU7001	Advanced Electrical and Electronics Lab* ^{#s}	PC	0	0	3	1.5	50	50	100
7	21AU7002	Vehicle Maintenance Laboratory* [#]	PC	0	0	3	1.5	50	50	100
PROJECT										
8	21AU7901	Project Work – Phase I	EEC	0	0	4	2	50	50	100
Total				14	0	12	20	360	440	800

**SEMESTER VIII**

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21AU83XX	Professional Elective – 4	PE	3	0	0	3	40	60	100
2	21AU83XX	Professional Elective – 5	PE	3	0	0	3	40	60	100
PROJECT										
3	21AU8901	Project Work – Phase II	EEC	0	0	16	08	100	100	200
Total :				6	0	16	14	190	210	400

Credit Distribution - Semester Wise

Sem	I	II	III	IV	V	VI	VII	VII	Total
Credits	20	22	20	21	24	24	20	14	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

**LIST OF PROFESSIONAL ELECTIVES**

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I									
1	21AU5301	Alternative Fuels and Energy Systems	3	0	0	3	40	60	100
2	21AU5302	Tyre Technology*	3	0	0	3	40	60	100
3	21AU5303	Automotive Materials and Manufacturing Technology	3	0	0	3	40	60	100
4	21AU5304	Battery Technology	3	0	0	3	40	60	100
5	21AU5305	Plastic Parts Manufacturing Technology	3	0	0	3	40	60	100
6	21AU5306	Composite Materials	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE II									
1	21AU6301	Automotive Airconditioning	3	0	0	3	40	60	100
2	21AU6302	Fuel Cell Technology	3	0	0	3	40	60	100
3	21AU6303	Ergonomics in Automotive Design	3	0	0	3	40	60	100
4	21AU6304	Additive Manufacturing	3	0	0	3	40	60	100
5	21AU6305	Robotics	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE III									
1	21AU7301	Automotive Vehicle Maintenance*#	3	0	0	3	40	60	100
2	21AU7302	Digital Supply Chain Management	3	0	0	3	40	60	100
3	21AU7303	Engine Auxiliary Systems*#	3	0	0	3	40	60	100
4	21AU7304	Tribology and Terotechnology	3	0	0	3	40	60	100
5	21AU7305	Entrepreneurship Development	3	0	0	3	40	60	100
6	21AU7306	Automotive Embedded Systems	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE IV									
1	21AU8301	Digital Vehicle Monitoring	3	0	0	3	40	60	100
2	21AU8302	Computational Fluid Dynamics	3	0	0	3	40	60	100
3	21AU8303	Automotive Painting Technology	3	0	0	3	40	60	100
4	21AU8304	Non-Destructive Testing and Materials	3	0	0	3	40	60	100
5	21AU8305	Motorsports Engineering	3	0	0	3	40	60	100



PROFESSIONAL ELECTIVE V									
S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	21AU8306	Automotive Cyber Security	3	0	0	3	40	60	100
2	21AU8307	Industry 4.0	3	0	0	3	40	60	100
3	21AU8308	Autonomous Vehicle Technology	3	0	0	3	40	60	100
4	21AU8309	Off Road Vehicles	3	0	0	3	40	60	100
5	21AU8310	Unconventional Machining Processes	3	0	0	3	40	60	100
6	21AU8311	Vehicle Transport Management	3	0	0	3	40	60	100
OPEN ELECTIVE (OE)									
1	21AU6401	Basics of Automobile Engineering*	3	0	0	3	40	60	100
2	21AU7402	Automotive Safety*#s	3	0	0	3	40	60	100
LIFE SKILL OPEN ELECTIVES COURSES									
1	21LSX401	General Studies for Competitive Examinations	3	0	0	3	40	60	100
2	21LSX402	Human Rights, Women's Rights and Gender Equality	3	0	0	3	40	60	100
3	21LSX403	Indian Ethos and Human Values	3	0	0	3	40	60	100
4	21LSX404	Indian Constitution and Political System	3	0	0	3	40	60	100
5	21LSX405	Yoga for Human Excellence	3	0	0	3	40	60	100
NCC OPEN ELECTIVE COURSES									
(Only for the students' who have opted NCC subjects in Semester I, II, III & IV are eligible)									
1	21HEZ401	NCC course level 1	3	0	0	3	40	60	100
2	21HEZ402	NCC course level 2	3	0	0	3	40	60	100

Minor Degree - Automotive Vehicle Technology (Offered by Automobile Engineering)									
S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	21AU5601	Automotive Engines	3	0	0	3	40	60	100
2	21AU6601	Automotive Chassis	3	0	0	3	40	60	100
3	21AU6602	Automotive Transmission	3	0	0	3	40	60	100
4	21AU7601	Automotive Electronics	3	0	0	3	40	60	100
5	21AU7602	Intelligent vehicular systems	3	0	0	3	40	60	100
6	21AU8601	Electric and Hybrid vehicles	3	0	0	3	40	60	100



Minor Degree - Fintech and Block Chain (common to all departments)									
S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	21CS5601	Financial Management	3	0	0	3	40	60	100
2	21CS5602	Fundamentals of Investment	3	0	0	3	40	60	100
3	21CS5603	Banking, Financial Services and Insurance	3	0	0	3	40	60	100
4	21CS5604	Introduction to Blockchain and its Applications	3	0	0	3	40	60	100
5	21CS5605	Fintech Personal Finance and Payments	3	0	0	3	40	60	100
6	21CS5606	Introduction to Fintech	3	0	0	3	40	60	100

Minor Degree - Entrepreneurship (common to all departments)									
S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	21BA5601	Foundation of Entrepreneurship	3	0	0	3	40	60	100
2	21BA6601	Introduction to Business Venture	3	0	0	3	40	60	100
3	21BA6602	Team Building & Leadership Management for Business	3	0	0	3	40	60	100
4	21BA7601	Creativity & Innovation in Entrepreneurship	3	0	0	3	40	60	100
5	21BA7602	Principles of Marketing Management for Business	3	0	0	3	40	60	100
6	21BA8601	Human Resource Management for Entrepreneurs	3	0	0	3	40	60	100

Minor Degree - Environment and Sustainability (common to all departments)									
S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	21CEXXXX	Sustainable infrastructure Development	3	0	0	3	40	60	100
2	21CEXXXX	Sustainable Agriculture and Environmental Management	3	0	0	3	40	60	100
3	21CEXXXX	Sustainable Bio Materials	3	0	0	3	40	60	100
4	21CEXXXX	Materials for Energy Sustainability	3	0	0	3	40	60	100
5	21CEXXXX	Green Technology	3	0	0	3	40	60	100
6	21CEXXXX	Environmental Quality Monitoring and Analysis	3	0	0	3	40	60	100



Honors Degree - Electric and hybrid vehicle development									
S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	21AU52XX	Fundamentals of Electric and Hybrid Vehicles	3	0	0	3	40	60	100
2	21AU62XX	Battery Technology	3	0	0	3	40	60	100
3	21AU62XX	Automotive Embedded Systems	3	0	0	3	40	60	100
4	21AU72XX	Advanced Automotive Safety Systems	3	0	0	3	40	60	100
5	21AU72XX	Special Purpose Electric Vehicle	3	0	0	3	40	60	100
6	21AU82XX	Electric Vehicles and its Sustainable Development	3	0	0	3	40	60	100
Honors Degree - Motorsport Engineering									
S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	21AU52XX	Composite Structure	3	0	0	3	40	60	100
2	21AU62XX	High performance engine design	3	0	0	3	40	60	100
3	21AU62XX	Motorsports Electric Vehicle	3	0	0	3	40	60	100
4	21AU72XX	Motorsports Vehicle Body Engineering	3	0	0	3	40	60	100
5	21AU72XX	Motorsports Race Electronics and Control Systems	3	0	0	3	40	60	100
6	21AU82XX	Motorsports racing circuits and Design	3	0	0	3	40	60	100
Honors Degree - Vehicle Development and Validation									
S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	21AU52XX	Automotive Product Design and Development	3	0	0	3	40	60	100
2	21AU62XX	Noise, Vibration and Harshness	3	0	0	3	40	60	100
3	21AU62XX	Automotive Instrumentation	3	0	0	3	40	60	100
4	21AU72XX	Testing and Measurement Systems	3	0	0	3	40	60	100
5	21AU72XX	Homologation	3	0	0	3	40	60	100
6	21AU82XX	Automotive Prototyping	3	0	0	3	40	60	100

CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	26	24	18	14	165

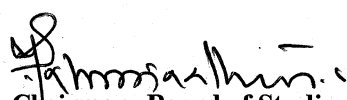
* Student can earn extra credit 35 over and above the total credits

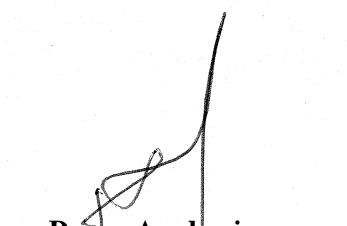



ADDITIONAL CREDIT COURSE FOR NCC CADETS										
S.No	Course code	Course Title	Type	L	T	P	C	CIA	ESE	TOTAL
1	21HE1074	NCC General and National Integration	VA	1	0	0	1	100	0	100
2	21HE2074	Social Services and Community Development	VA	1	0	0	1	100	0	100
3	21HE3074	Leadership Qualities and Camp Activities	VA	1	0	0	1	100	0	100
4	21HE4074	General awareness, communication and Aero engines	VA	1	0	0	1	100	0	100

ADDITIONAL CREDIT COURSE FOR AUTOMOBILE ENGINEERING						
S.No	Course Code	Course Title	Category	Duration	Assessment	Credit
1	21VAAU01	Foundry Technology	VA	30 hrs	Internal	1
2	21VAAU02	Forming and Shaping of Plastics	VA	30 hrs	Internal	1
3	21VAAU03	Microcontroller Programming in Automotive applications	VA	30 hrs	Internal	1
4	21VAAU04	Vehicle development and testing regulations (ARAI)	VA	30 hrs	Internal	1
5	21VAAU05	Bigdata Analysis	VA	30 hrs	Internal	1
6	21VAAU06	Data mining	VA	30 hrs	Internal	1
7	21VAAU07	Fire and safety Engineering	VA	30 hrs	Internal	1
8	21VAAU08	Introduction to MS office	VA	30 hrs	Internal	1
9.	21VAAU09	Autodesk Fusion 360	VA	30 hrs	Internal	1

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


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COIMBATORE - 641032.11



21AU5201	AUTOMOTIVE EMISSION AND POLLUTION CONTROL	L	T	P	C
	(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, NO_x, 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, NO_x, 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.




CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	1	1	-	2	-	-	2	-	2	-	3	1	1
CO2	1	2	2	2	2	-	-	-	-	2	-	2	2	1
CO3	2	2	3	2	2	-	-	-	-	2	-	2	1	1
CO4	3	1	1	2	2	-	-	2	-	2	-	2	1	1
CO5	2	2	3	2	1	-	-	-	-	2	-	2	2	1
AVG	2	1.6	2	2	1.8	-	-	2	-	2	-	2.2	1.4	1


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21AU5202	VEHICLE DESIGN AND DATA CHARACTERISTICS	L	T	P	C
		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.

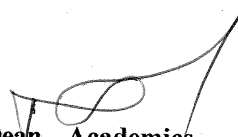


CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	3	1	1	-	-	-	-	1	-	1	2	3
CO2	3	3	2	1	1	1	-	-	-	1	-	1	2	2
CO3	2	3	3	3	1	-	-	-	-	1	-	1	2	2
CO4	3	3	2	3	2	2	-	-	-	1	-	1	2	3
CO5	3	3	2	1	1	1	-	-	-	1	-	1	2	2
AVG	2.8	3	2.4	1.8	1.2	1.333	-	-	-	1	-	1	2	2.4


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21AU5203

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

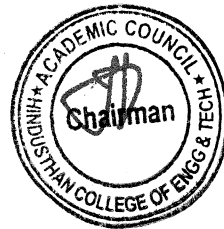
- R1 Paul Richards "Automotive fuels reference book" SAE International, Third edition 2014
- R2 Roger Frederick Haycock, John Hillier, Arthur J. Caines "Automotive lubricants Reference book", SAE International, Second edition 2004




CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	2	3	2	-	3	2	-	3	-	2	2	2
CO2	2	3	2	2	2	-	2	-	-	2	-	1	3	2
CO3	3	3	2	2	2	2	2	2	-	2	-	2	3	2
CO4	2	2	1	2	-	-	2	-	-	2	-	2	2	2
CO5	2	2	2	2	2	-	2	-	-	2	-	2	2	2
AVG	2.2	2.4	1.8	2.2	2	2	2.2	2	-	2.2	-	1.8	2.4	2


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AUTOMOTIVE TRANSMISSION

L T P C

21AU5251

(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 Converter.
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 converter 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



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

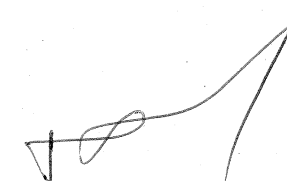
Sl.No.	Name of the Equipment	Quantity
1.	Two wheeler gearbox	01
2.	Three Wheeler gearbox	01
3.	Differential Unit	01
4.	CVT of a two wheeler	01

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	3	2	3	2	3	-	-	3	-	2	2	3
CO2	3	2	3	2	3	2	2	-	-	3	-	2	2	3
CO3	3	3	2	-	3	3	3	-	-	2	-	2	2	3
CO4	3	3	2	-	2	2	2	-	-	2	-	1	2	3
CO5	3	3	2	-	3	2	2	-	-	2	-	1	2	3
AVG	3	2.6	2.4	2	2.8	2.2	2.4	-	-	2.4	-	1.6	2	3


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21AU5252	AUTOMOTIVE CHASSIS COMPONENTS DESIGN (Courses offered in Collaborations with Hindusthan – Eicher Centre of Excellence Regional Competency Development Centre)	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.



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

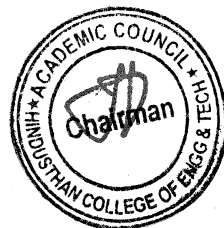
LIST OF EQUIPMENTS


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.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	3	1	-	3	3	-	-	2	-	2	2	3
CO2	3	2	3	1	-	1	1	-	-	2	-	1	2	3
CO3	3	3	2	1	-	3	3	-	-	2	-	1	2	2
CO4	3	3	2	1	-	2	2	-	-	2	-	2	3	2
CO5	3	3	2	1	-	2	2	-	-	2	-	2	2	2
AVG	3	2.8	2.4	1	-	2.2	2.2	-	-	2	-	1.6	2.2	2.4


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21AU5001 ENGINE PERFORMANCE AND EMISSION TESTING LABORATORY **L** **T** **P** **C**
0 **0** **4** **2**

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.

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

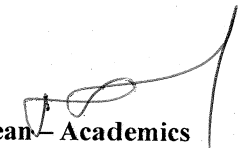


CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	3	3	2	3	3		-	1		3	3	2
CO2	3	2	3	3	2	3	3		-	1		2	2	3
CO3	3	2	3	3	2	3	2		-	1		3	3	3
CO4	3	2	3	2	2	2	2		-	1		2	2	2
CO5	3	2	3	2	1	2	2		-	1		2	3	3
AVG	3	2	3	2.6	1.8	2.6	2.4	-	-	1	-	2.4	2.6	2.6


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21AU5002

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

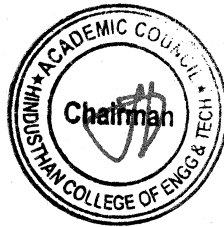
Sl.No.	Name of the equipment	Quantity
1.	Flash and fire point apparatus (for Petrol)	1
2.	Aniline point Apparatus	1
3.	Reid vapor pressure test Apparatus	1
4.	Bomb and Gas Calorimeters	1
5.	Carbon Residue Test Apparatus	1
6.	Copper Strip Corrosion Test Apparatus	1
7.	Cloud and Pour point Apparatus	1
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

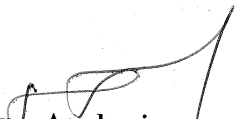


CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	2	3	3	3	3	-	-	3	-	3	3	2
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CO3	3	2	2	3	3	2	2	-	-	3	-	2	3	2
CO4	2	3	2	3	3	3	2	-	-	2	-	2	2	2
CO5	1	3	1	3	2	3	2	-	-	2	-	2	2	2
AVG	2.2	2.6	1.8	2.8	2.8	2.6	2.2	-	-	2.6	-	2.4	2.6	2


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21HE5071

SOFT SKILLS - I

L	T	P	C
1	0	0	1

Course Objectives

1. To employ soft skills to enhance employability and ensure workplace and career success.
2. To enrich students' numerical ability of an individual and is available in technical flavor.
3. To interpret things objectively, to be able to perceive and interpret trends to make generalizations and be able to analyze assumptions behind an argument/statement.

UNIT I INTRODUCTION TO SOFT SKILLS (3)

Introduction- Objective -Hard vs Soft Skills - Measuring Soft Skills- Structure of the Soft Skills -Self Management- Critical Thinking-Reflective thinking and writing- p2p Interaction

UNIT II ART OF COMMUNICATION (4)

Verbal Communication - Effective Communication - Active listening -Paraphrasing - Feedback - Non-Verbal Communication - Roles-Types- How nonverbal communication can go wrong- How to Improve nonverbal Communication - Importance of feelings in communication - dealing with feelings in communication.

UNIT III WORLD OF TEAMS (3)

Self Enhancement - importance of developing assertive skills- developing self-confidence - developing emotional intelligence - Importance of Team work - Team vs. Group - Attributes of a successful team - Barriers involved - Working with Groups - Dealing with People- Group Decision Making.

UNIT IV QUANTITATIVE APTITUDE (3)

Averages - Profit and loss - Partnerships - Time and work - Time, Speed and Distance - Problems based on trains - Problems based on boats and streams

UNIT V LOGICAL REASONING (4)

Clocks - Calendars - Direction Sense - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency

TOTAL: 20 PERIODS

Course Outcomes

- CO1: Students will have clarity on their career exploration process and to match their skills and interests with a chosen career path.
- CO2: Students will develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others
- CO3: Students will understand how teamwork can support leadership skills
- CO4: Students will be able to make sense of problems, develop strategies to find solutions, and persevere in solving them.
- CO5: Students will demonstrate an enhanced ability to draw logical conclusions and implications to solve logical problems.


References

- R1 Frederick H. Wentz , Soft Skills Training: A Workbook to Develop Skills for Employment
- R2 Arun Sharma, How to prepare for data interpretation for CAT.
- R3 Jaikishan and Premkishan, How to Crack TEST OF REASONING in all competitive examinations.
- R4 B.S. Sijwali, A New Approach To Reasoning Verbal & Non-Verbal
- R5 Dr. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations - S. Chand

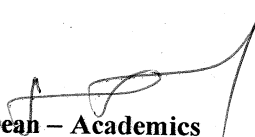


CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					-	2	3	2	-	3	-	3
CO2					-	-	3	2	-	3	-	3
CO3					-	2	2	2	-	2	-	2
CO4					2	-	2	2	-	1	-	2
CO5					2	2	2	2	-	2	-	2
AVG					2	2	2.4	2	-	2.2	-	2.4


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21HE5072

DESIGN THINKING

L	T	P	C
1	0	0	1

Course Objectives

1. To expose students to the design process
2. To develop and test innovative ideas through a rapid iteration cycle.
3. To provide an authentic opportunity for students to develop teamwork and leadership skills

UNIT I DESIGN ABILITY (4)

Asking Designers about what they Do – Deconstructing what Designers Do – Watching what Designers Do – Thinking about what Designers Do – The Natural Intelligence of Design Sources

UNIT II DESIGNING TO WIN (4)

Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods

UNIT III DESIGN TO PLEASE AND DESIGNING TOGETHER (4)

Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.

UNIT IV DESIGN EXPERTISE (3)

Design Process – Creative Design - Design Intelligence – Development of Expertise – Novice to Expert

TOTAL: 15 PERIODS

Course Outcomes

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

- CO1: Develop a strong understanding of the Design Process
- CO2: Learn to develop and test innovative ideas through a rapid iteration cycle.
- CO3: Develop teamwork and leadership skills

Text Books

- T1 Nigel Cross, “Design Thinking”, Kindle Edition

References

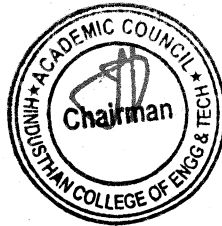
- R1 Tom Kelley, “Creative Confidence”, 2013
- R2 Tim Brown, “Change by Design”, 2009.

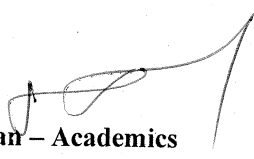


CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					-	2	3	2	-	3	-	3
CO2					-	-	3	2	-	3	-	3
CO3					-	2	2	2	-	2	-	2
CO4					2	-	2	2	-	1	-	2
CO5					2	2	2	2	-	2	-	2
AVG					2	2	2.4	2	-	2.2	-	2.4


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21AU5301

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

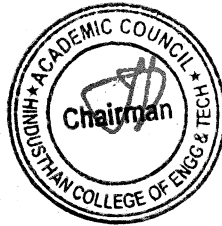
- R1 Gerhard Knothe, Jon Van Gerpen, Jargon Krahl, The Biodiesel Handbook, AOCS PressChampaign, Illinois 2005.
- R2 Transactions of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc.).

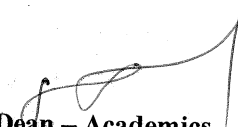


CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	1	1	2	3	3	-	-	3	-	3	3	2
CO2	1	2	-	2	2	3	3	-	-	3	-	2	2	3
CO3	1	2	2	3	2	3	3	-	-	2	-	2	3	2
CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4


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21AU5302

TYRE 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 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

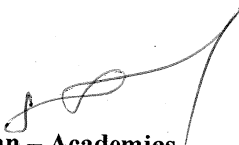


CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	1	1	2	3	3	-	-	3	-	3	3	2
CO2	1	2	-	2	2	3	3	-	-	3	-	2	2	3
CO3	1	2	2	3	2	3	3	-	-	2	-	2	3	2
CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4


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21AU5303	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

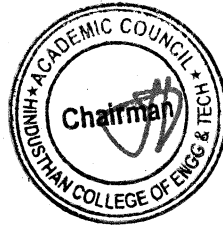
- R1 Kenneth Budinski, "Surface Engineering for wear resistance", Prentice Hall, 1988
- R2 Hiroshi Yamagata," The Science and Technology of Materials in Automotive Engines", Woodhead Publishing,2005
- R3 Flinn R. A. and Trojan P. K., "Engineering Materials and their Applications", Jaico, 1999.
- R4 Sabroff.A.M. & Others, " Forging Materials & Processes ", Reinhold Book Corporation, New York,1988.
- R5 Gladius Lewis, "Selection of Engineering Materials", Prentice Hall Inc. New Jersey USA, 1995.




CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	1	1	-	-	-	-	-	-	2	-	-	2	2
CO2	3	1	1	-	-	-	-	-	-	2	-	1	2	2
CO3	3	1	1	1	1	-	-	-	-	2	-	2	2	2
CO4	3	1	1	-	2	-	-	-	-	2	-	2	2	2
CO5	2	2	2	-	-	1	1	-	-	2	2	-	3	2
AVG	2.8	1.2	1.2	1	1.5	1	1	-	-	2	2	1.667	2.2	2


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21AU5304

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 – Aluminium 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 design Performance 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 Dincer, Halil S. Hamut and Nader Javani, "Thermal Management of Electric Vehicle Battery Systems", John Wiley & Sons Ltd., 2016.
- T2 Guangjin Zhao, "Reuse and Recycling of Lithium-Ion Power Batteries", John Wiley & Sons. 2017. (ISBN: 978-1-1193-2185-9)

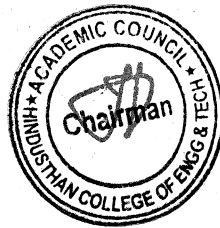
References


- 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)"

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	1	1	-	-	-	-	-	-	2	-	-	2	2
CO2	3	1	1	-	-	-	-	-	-	2	-	1	2	2
CO3	3	1	1	1	1	-	-	-	-	2	-	2	2	2
CO4	3	1	1	-	2	-	-	-	-	2	-	2	2	2
CO5	2	2	2	-	-	1	1	-	-	2	2	-	3	2
AVG	2.8	1.2	1.2	1	1.5	1	1	-	-	2	2	1.667	2.2	2


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21AU5305

PLASTIC PARTS MANUFACTURING TECHNOLOGY

L	T	P	C
3	0	0	3

Course Objectives

- 1 To gain knowledge in selection, processing and thermoforming of polymers
- 2 To acquire the knowledge in Injection moulding processes and its implications.
- 3 To learn the various compression moulding techniques.
- 4 To understand the procedures involved in polymer extrusion.
- 5 To get exposure in rapid tooling techniques and applications.

UNIT I SELECTION, PROCESSING AND THERMOFORMING OF POLYMERS (9)

Types of processing techniques – selection criteria for processing methods - Definition - Effect of polymer properties on processing behavior - Melting & Solidification behavior. Thermoforming-pressure forming-vacuum forming- drape forming, plug assisted forming, snap-back vacuum forming. - Pressure forming –heating systems. Matched die forming-continuous forming methods–applications

UNIT II INJECTION MOULDING (9)

Injection Moulding: Principle-Definition of Terms – Shot capacity, clamping force, injection pressure, speed etc- Technical specifications selection criteria for types of machineries. Cycle time process variables & its effects on moulding quality-Cavity-pressure profile-factors influencing moulding shrinkage- Types of clamping systems-start up and shut down procedures - Common moulding defects, causes and remedies. Thermoset Injection Moulding - Process-Machine description, parts and their functions - process parameters-merits and de-merits.

UNIT III COMPRESSION MOULDING (9)

Introduction-principles-definition of terms - Compression moulding process specifications- machine used-Bulk factor-flow-cure relationship - ageing of compound. Preforming, preheating-Methods, machines used, merits & demerits - Influence of process variables such as temperature, pressure, part size & configuration on quality and cycle time - Compression moulding of Thermoplastics. Transfer Moulding: Principles-Types of process-Machines used-pot transfer, Plunger transfer & screw transfer moulding techniques-moulding cycle-specification-merits and demerits of transfer moulding.

UNIT IV EXTRUSION (9)

Introduction-principles-classification of extruders. Single screw extruder: specification- screw nomenclature-types of screws L/D ratio, compression ratio-back pressure-factors governing back pressure-output and factors affecting output-heating & cooling systems breaker plate-screen pack & its functions-screw & hopper cooling-die entry effects and die exit instabilities-shark skin, melt fracture & bambooing. Twin screw extruder: principle-types–process-merits & demerits -Vented barrel extruder - Process, machinery-downstream equipments-dies for producing products such as blown film, cast film, -Sheets, - Tubes/pipes, corrugated pipes - Mono filaments - Coating/Lamination – Profiles.

UNIT V BLOW MOULDING (9)

Introduction-principle-processes-Types of machines-Extrusion blow moulding-Injection blow moulding Stretch blow moulding –Process control Moulds & Dies, parison programming -Machine used constructional features-material and design factors affecting blow mould product-Trouble shooting.

TOTAL: 45 PERIODS**Course Outcomes**

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

- CO1: Gain knowledge in selection, processing and thermoforming of polymers
- CO2: Acquire the knowledge in Injection moulding processes and its implications.
- CO3: Learn the various compression moulding techniques.
- CO4: Understand the procedures involved in polymer extrusion.
- CO5: Get exposure in rapid tooling techniques and applications.

Text Books

- T1 Plastics materials and Processes, Author : Seymour S. Schwartz & Sidney H. Goodman Publisher : Van Nostrand Reinhold Company, New York.
- T2 Injection Moulding, Author : A.S. Athalya, Publisher : Multi-tech Publishing Co., New Delhi



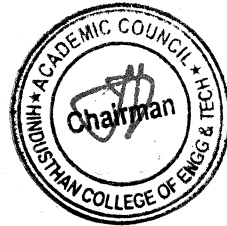
References


- R1 Injection Moulding Technology, Author : M.S. Welling, Publisher : VDI-Verlag GmbH
- R2 Blow Moulding Design Guide, Author : Lee, Publisher : Hanser Publishers, Munich
- R3 Plastics Extrusion Technology Author : Friedhelm Hensen, Publisher : Hanser Publishers Vienna, New York

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	1	1	-	-	-	-	-	-	2	-	-	2	2
CO2	3	1	1	-	-	-	-	-	-	2	-	1	2	2
CO3	3	1	1	1	1	-	-	-	-	2	-	2	2	2
CO4	3	1	1	-	2	-	-	-	-	2	-	2	2	2
CO5	2	2	2	-	-	1	1	-	-	2	2	-	3	2
AVG	2.8	1.2	1.2	1	1.5	1	1	-	-	2	2	1.667	2.2	2


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21AU5306R

COMPOSITE MATERIALS

L T P C
3 0 0 3

Course Objectives

- 1 To understand the types of matrix and reinforcements of composite materials
- 2 To demonstrate the various methods of manufacturing processes and applications of composite
- 3 To identify the distribution of reinforcements in the matrix
- 4 To equip them with knowledge on how to carry out standard microscopic analysis on composites.
- 5 To discuss the various automobile applications of different composites

UNIT I INTRODUCTION (9)

Definition—Classification based on matrix – Types of Reinforcements --Constituents—Interfaces and Interphases—Distribution of constituents—Introduction to Nano-composites

UNIT II METAL MATRIX COMPOSITES (9)

Fabrication of MMC— Types of Matrices—Requirements—Selection of constituents—Solid State Methods- Powder Metallurgy, Diffusion Bonding—Liquid state Methods—Stir Casting, Liquid infiltration, Squeeze Casting, Spray Deposition, Electro Plating and Electroforming, Reactive Processing—Vapor Deposition—Synthesis of In situ Composites

UNIT III POLYMER AND CERAMIC MATRIX COMPOSITES (9)

Polymer Matrix Composites –Matrices-Types- Selection of Constituents—Moulding method—Low pressure closed moulding, Pultrusion, Filament winding Ceramic matrix composites - Various techniques of vapour deposition—Liquid Phase method and Hot pressing

UNIT IV CHARACTERISATION OF COMPOSITES (9)

Particle/Fibre—Control, Porosity content and Distribution—Interfacial Reaction of Matrix and Reinforcement—Coating of reinforcing component—Microscopic analysis- XRD,SEM,TEM

UNIT V COMPOSITE MATERIALS FOR AUTOMOTIVE INDUSTRY (9)

Automotive Applications-High-Volume Thermoplastic Composite Technology -Development of Low-Cost Carbon Fibre composites - Composite Structures for Crashworthiness-Hybrid Structures Consisting of Sheet Metal and Fibre Reinforced Plastics for Automotive Structures -Case Studies and Designs

TOTAL: 45 PERIODS

Course Outcomes

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

- CO1: Classify different composite materials based upon their properties
- CO2: Able to explain the methods employed in composite fabrication
- CO3: Develop expertise on the applicable engineering design of composite
- CO4: Identify and explain the types of composite materials and their characteristic features
- CO5: Able to Select Material for Automobile Application

Text Books

- T1 Krishan K. Chawla, Composite Materials Science and Engineering, Third Edition, Springer
- T2 K. Srinivasan, Composite Materials, Narosa Publishing House, Reprint 2012

References

- R1 Domenico Brigante New Composite Materials, Selection, Design, and Application, Springer
- R2 DE GRUYTER, Metal Matrix Composites, Materials, Manufacturing and Engineering, Springer

Web Sources

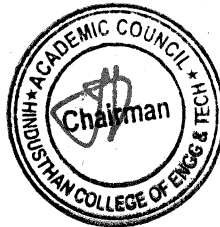
- W1 http://nptel.ac.in/courses/Webcourse-contents/IISc BANG/Composite%20Materials/Pdf/Lecture_Notes/LNm1.pdf
- W2 http://www.asminternational.org/documents/10192/1849770/05287G_Sample_Chapter.pdf

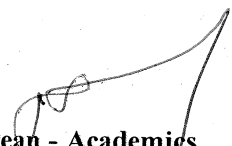


CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	1	1	-	-	-	-	-	-	2	-	-	2	2
CO2	3	1	1	-	-	-	-	-	-	2	-	1	2	2
CO3	3	1	1	1	1	-	-	-	-	2	-	2	2	2
CO4	3	1	1	-	2	-	-	-	-	2	-	2	2	2
CO5	2	2	2	-	-	1	1	-	-	2	2	-	3	2
AVG	2.8	1.2	1.2	1	1.5	1	1	-	-	2	2	1.667	2.2	2


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Programme	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech.	21AU5601	AUTOMOTIVE ENGINES	4	0	0	3

- **Course Objective**
 - To impart knowledge on various engine components and working cycles
 - To acquire knowledge in injection and ignition system
 - To understand the combustion process in SI and CI engines
 - To understand the requirements of cooling and lubrication systems.
 - To identify the nature of pollutant formation and control techniques

Unit	Description	
	INTERNAL COMBUSTION ENGINES FUNDAMENTALS	
I	Engine types and their operation- classifications – Terminology- Four stroke and two stroke cycle Engine components, working principle and materials - Engine operating parameters- Engine cycles- Air Standard cycles- Otto cycle- Fuel – air and actual cycle analysis – Engine emissions – Two stroke engine terminology – types – Merits and Demerits	9
	INJECTION AND IGNITION SYSTEMS	
II	Diesel fuel injection systems-types-Function- Fuel Injection Pump, Jerk distributor, mechanical and Pneumatic speedgovernor-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	9
	COMBUSTION AND COMBUSTION CHAMBERS	
III	Stages of combustion in SI engines, Factors affecting ignition delay and flame propagation, Abnormal combustion-knocking, control of knock, octane rating of SI engine fuel, Combustion chambers for SI engines, Stages of combustion in CI engines- factors affecting ignition delay, CI engine knock, cetane rating of CI engine fuel, - importance of swirl, squish and turbulence in CI engines..	9
	COOLING AND LUBRICATION SYSTEMS	
IV	Need for cooling, Effects of over cooling, Air and liquid cooling systems- thermo siphon, forced circulation and pressure cooling systems, components liquid cooling system, Requirements of coolants anti freezing agents, Requirements of lubrication system, Types- mist, pressure feed, dry and wet sump systems	9
	ENGINE PERFORMANCE AND EMISSION STANDARD	
V	Indicated power, Brake power, Engine Torque ,Mechanical Efficiency, Air standard Efficiency -Emissions-Types-CO,HC,NOx,SO2 - Emission control measures for IC engines, Barot Stage (BS) & Norms, BS - I,II,III,IV&VI Engines-Effect of emissions on environment and human beings.	9
	Total Instructional Hours	45

Course Outcome

- Upon completion of the 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: Differentiate spark ignition and compression ignition combustion chambers used in automotive engines.
 - CO4: Select appropriate cooling system for automobile engines..
 - 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

REFERENCE BOOKS:

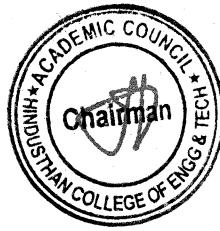
- R1 K. K. Ramalingm, Internal Combustion Engines, Scitech publications, Chennai, 2003.
- R2 Heldt, P.M., High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta
- R3 Obert, E.F., Internal Combustion Engine analysis and Practice, International Text Book Co.,Scranton,Pennsylvania, 1988.

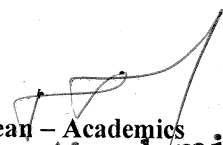


CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	3	3	3	-	-	2	-	3
CO2	3	3	2	2	2	2	2	-	-	2	-	2
CO3	2	2	-	3	3	3	3	-	-	2	-	3
CO4	2	2	2	2	2	2	2	-	-	2	-	2
CO5	3	3	2	2	3	2	2	-	-	2	-	2
AVG	2.6	2.4	2	2.4	2.6	2.4	2.4	-	-	2	-	2.4


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21AU52XX

FUNDAMENTALS OF ELECTRIC AND HYBRID VEHICLES

L	T	P	C
3	0	0	3

Course Objectives

1. To learn the concept of Electric and Hybrid Vehicles, including architectures, modeling, sizing, sub system design and hybrid vehicle control.
2. To Understand about dynamics characteristics of Electric vehicles.
3. To learn the requirement of energy storage devices in Electric vehicles.
4. To study about the suitable electric propulsion systems
5. To understand vehicle networking and energy management system.

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. Power Split devices for Hybrid Vehicles - Operation modes - Control Strategies for Hybrid Vehicle- Economy of 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 ENERGY MANAGEMENT SYSTEMS

(9)

Communications, supporting subsystems: In vehicle networks- CAN, Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies

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 dynamics characteristics of 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: Learn the concept of vehicle networking and energy management system.

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

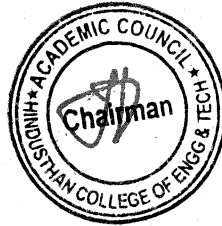
- R1 Sandeep Dhameja, “Electric Vehicle Battery Systems” NEWNES, 2002
- R2 James Larminie and John Lowry, “Electric Vehicle Technology Explained “John Wiley & Sons, 2003
- R3 Ron Hodkinson, “Light Weight Electric/ Hybrid Vehicle Design”, Butterworth Heinemann Publication,2005

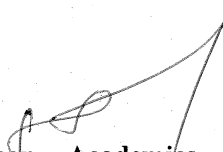


CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	2	2	3	3	-			2	-	3	3	2
CO2	3	2	2	2	3	3	2			2	-	3	3	2
CO3	2	3	2	2	2	3	-			2	-	2	3	3
CO4	2	3	2	2	2	2	-			2	-	2	3	3
CO5	3	2	2	2	2	3	-			2	-	2	3	3
AVG	2.4	2.4	2	2	2.4	2.8	2	-	-	2	-	2.4	3	2.6


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Programme	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech.		AUTOMOTIVE PRODUCT DESIGN AND DEVELOPMENT	3	0	0	3

- Course Objective**
- To understand Product development and customer need.
 - To learn the Concept Generation and Selection in Product Design
 - To provide a knowledge about product architecture.
 - To learn about industrial design
 - To study the design for manufacturing and product development

Unit	Description	Instructional Hours
I	<p>INTRODUCTION</p> <p>Need for IPPD – Strategic importance of Product development – integration of customer, designer, material supplier and process planner, Competitor and customer – Behaviour analysis. Understanding customer – prompting customer understanding – involve customer in development and managing requirements – Organization – process management and improvement – Plan and establish product specifications.</p>	9
II	<p>CONCEPT GENERATION AND SELECTION</p> <p>Task – Structured approaches – clarification – search – externally and internally – explore systematically – reflect on the solutions and processes – concept selection – methodology – benefits.</p>	9
III	<p>PRODUCT ARCHITECTURE</p> <p>Implications – Product change – variety – component standardization – product performance – manufacturability – product development management – establishing the architecture – creation – clustering – geometric layout development – fundamental and incidental interactions – related system level design issues – secondary systems – architecture of the chunks – creating detailed interface specifications.</p>	9
IV	<p>INDUSTRIAL DESIGN</p> <p>Integrate process design – Managing costs – Robust design – Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically – Need for industrial design – impact – design process – investigation of for industrial design – impact – design process – investigation of customer needs – conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.</p>	9
V	<p>DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT</p> <p>Definition – Estimation of Manufacturing cost – reducing the component costs and assembly costs – Minimize system complexity – Prototype basics – principles of prototyping – planning for prototypes – Economic Analysis – Understanding and representing tasks – baseline project planning – accelerating the project – project execution.</p>	9
Total Instructional Hours		45
Course Outcome	<p>Upon completion of the course, students will be able to</p> <p>CO1: Develop the Product development based on customer need.</p> <p>CO2: Make use of the knowledge in product design and development</p> <p>CO3: knowledge about product architecture.</p> <p>CO4: Use of Smart tools for product development</p> <p>CO5: Economic project planning development</p>	



TEXT BOOKS:

T1 - Product Design and Development, Karl T.Ulrich and Steven D.Eppinger, McGraw –Hill International Edns.1999

REFERENCE BOOKS:

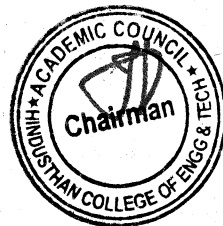
R1 - Concurrent Engg./Integrated Product Development. Kemneth Crow, DRM Associates, 6/3,ViaOlivera, Palos Verdes, CA 90274(310) 377-569,Workshop Book

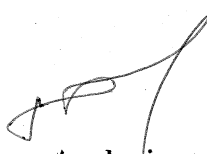
R2 - Effective Product Design and Development, Stephen Rosenthal, Business One Orwin, Homewood, 1992,ISBN, 1-55623-603-4

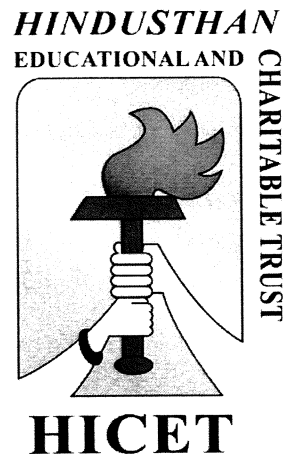
CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
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CO2	3	2	2	2	3	3	2			2	-	3	3	2
CO3	2	3	2	2	2	3	-			2	-	2	3	3
CO4	2	3	2	2	2	2	-			2	-	2	3	3
CO5	3	2	2	2	2	3	-			2	-	2	3	3
AVG	2.4	2.4	2	2	2.4	2.8	2	-	-	2	-	2.4	3	2.6


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HINDUSTHAN
COLLEGE OF ENGINEERING AND TECHNOLOGY
(An Autonomous Institution)
Coimbatore – 641032

DEPARTMENT OF AUTOMOBILE ENGINEERING
Revised Curriculum and Syllabus for the Batch 2020-2024
(Academic Council Meeting Held on 19.06.2023)

2019 REGULATIONS





CURRICULUM AND SYLLABUS
CBCS PATTERN
UNDERGRADUATE PROGRAMMES
AUTOMOBILE ENGINEERING
REGULATION – 2019 (Revised on July 2020)
(For the students admitted during the academic year 2020 – 2021 onwards)

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 WITH 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	0	0	2	1	100	0	100
MANDATORY COURSE										
9	19HE1072	Career Guidance Level - I Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10	19HE1073	Entrepreneurship and Innovation	EEC	1	0	0	0	100	0	100
Total				15	2	12	20	550	350	900
As Per AICTE Norms 3 Weeks Induction Programme is Added in The First Semester as an Audit Course										

**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	19MA2101R	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 WITH LAB COMPONENT										
4	19PH2151	Material Science	BS	2	0	2	3	50	50	100
5	19CY2151	Environmental Studies	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	0	0	2	1	100	-	100
MANDATORY COURSE										
9	19HE2072	Career Guidance Level – II Personality, Aptitude and Career Development	EEC	2	0	0	0	100		100
Total				16	2	12	22	475	425	900

SEMESTER III

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19MA3103	Fourier Analysis and Numerical Methods	BS	3	1	0	4	25	75	100
2	19AE3201	Elements of Aeronautics	PC	3	1	0	4	25	75	100
3	19AE3202	Engineering Fluid Mechanics	PC	3	0	0	3	25	75	100
4	19AE3203	Solid Mechanics	PC	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
5	19AU3251	Automotive Structures and Design	PC	2	0	2	3	50	50	100
PRACTICAL										
6	19AU3001	Automotive Components Lab*#	PC	0	0	3	1.5	50	50	100
7	19AU3002	Computer Aided Drawing Lab##	PC	0	0	3	1.5	50	50	100
MANDATORY COURSE										
8	19MC3191	Indian Constitution	MC	2	0	0	0	100	0	100
9	19HE3072	Career Guidance – Level III Personality, Aptitude and Career Development	EEC	2	0	0	0	100	-	100
10	19HE3073	Leadership Management Skills	EEC	1	0	0	0	100	-	100
Total				19	2	8	20	550	450	1000

**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
THEORY WITH LAB COMPONENT										
5	19AU4251	Fundamentals of Heat Transfer	PC	2	0	2	3	50	50	100
PRACTICAL										
6	19AU4001	Computer Aided Automotive Engine Components Design Lab###	PC	0	0	3	1.5	50	50	100
7	19AU4002	Two and Three Wheelers Technology Lab#	PC	0	0	3	1.5	50	50	100
MANDATORY COURSE										
8	19MC4191	Essence of Indian Traditional Knowledge	MC	2	0	0	0	100	-	100
9	19HE4072	Career Guidance – Level IV Personality, Aptitude and Career Development	EEC	2	0	0	0	100	-	100
10.	19HE4073	Ideation Skills	EEC	1	0	0	0	100	0	100
Total				19	3	8	21	450	450	900

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 WITH 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
MANDATORY COURSE										
9	19HE5071	Soft Skill I	EEC	1	0	0	1	100	-	100
10	19HE5072	Design Thinking	EEC	1	0	0	1	100	-	100
Total :				18	1	10	24	500	500	1000

**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 WITH 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
MANDATORY COURSE										
8	19AU6701	Internship Training / In plant Training	EEC	0	0	0	1	100		100
9	19HE6071	Soft Skill-II	EEC	1	0	0	1	100	-	100
10	19HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	100	-	100
Total :				19	1	6	24	525	475	1000

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 WITH LAB COMPONENT										
5	19AU7251	Electric and Hybrid Vehicle ^{\$S}	PC	2	0	2	3	50	50	100
PRACTICAL										
6	19AU7001R	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
PROJECT										
8	19AU7901	Project Work – Phase I	EEC	0	0	4	2	50	50	100
Total				14	0	12	20	300	500	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
PROJECT										
3	19AU8901	Project Work – Phase II	EEC	0	0	16	08	100	100	200
Total :				6	0	16	14	150	250	400

Credit Distribution - Semester Wise

Sem	I	II	III	IV	V	VI	VII	VII	Total
Credits	20	22	20	21	24	24	20	14	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

**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	19AU5304R	Battery Technology	3	0	0	3	25	75	100
5	19AU5305R	Plastic Parts Manufacturing Technology	3	0	0	3	25	75	100
6	19AU5306R	Composite Materials	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE II									
1	19AU6301	Automotive Airconditioning	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	19AU6304R	Additive Manufacturing	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	19AU7302R	Digital Supply Chain Management	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	19AU7305R	Entrepreneurship Development	3	0	0	3	25	75	100
6	19AU7306R	Automotive Embedded Systems	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE IV									
1	19AU8301R	Digital Vehicle Monitoring	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

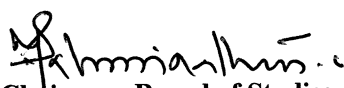


PROFESSIONAL ELECTIVE V									
S.No	Course Code	Course Name	L	T	P	C	CIA	ESE	TOTAL
1	19AU8306	Automotive Cyber Security	3	0	0	3	25	75	100
2	19AU8307	Industry 4.0	3	0	0	3	25	75	100
3	19AU8308	Autonomous Vehicle Technology	3	0	0	3	25	75	100
4	19AU8309	Off Road Vehicles	3	0	0	3	25	75	100
5	19AU8310	Unconventional Machining Processes	3	0	0	3	25	75	100
6	19AU8311	Vehicle Transport Management	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
LIFE SKILL OPEN ELECTIVES COURSES									
1	19LSX401	General Studies for Competitive Examinations	3	0	0	3	25	75	100
2	19LSX402	Human Rights, Women's Rights and Gender Equality	3	0	0	3	25	75	100
3	19LSX403	Indian Ethos and Human Values	3	0	0	3	25	75	100
4	19LSX404	Indian Constitution and Political System	3	0	0	3	25	75	100
5	19LSX405	Yoga for Human Excellence	3	0	0	3	25	75	100

CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	26	24	18	14	165

* Student can earn extra credit 35 over and above the total credits


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COIMBATORE - 641 032.



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19AU7201

ADVANCED ELECTRICAL AND ELECTRONICS
 (Courses offered in Collaborations with Hindusthan – Eicher Centre of Excellence
 Regional Competency Development Centre)

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 electronic engine controls.
4. To know about safety electronics and working principle of sensors.
5. To acquire knowledge about future automotive electronics.

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 ELECTRONIC ENGINE CONTROLS (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 SAFETY ELECTRONICS AND SENSORS IN AUTOMOBILES (8)

Safety electronic systems – Anti lock braking system - Traction Control System - Electronic stability program - Cruise Control System -Microcontrollers - Sensor Sensors in automobile - sensor for speed, throttle position, exhaust oxygen level, manifold pressure, air mass flow.

UNIT V FUTURE AUTOMOTIVE ELECTRONIC SYSTEMS (9)

Electric and Hybrid vehicles - Collision Avoidance - Radar warning Systems - Heads Up display - Navigation – Navigation Sensors - Radio Navigation - Signpost navigation - dead reckoning navigation - Voice Recognition Cell Phone dialing - Automatic driving Control - Key less entry system

TOTAL: 45 PERIODS

Course Outcomes

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

- CO1: Understand the functions of batteries and charging system.
- CO2: Know about the charging and lighting system.
- CO3: Organize the fundamentals of electronic engine controls.
- CO4: Make use of the safety electronics.
- CO5: Analyze the future automotive electronics systems.

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.

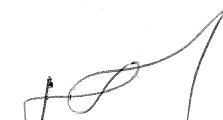
References

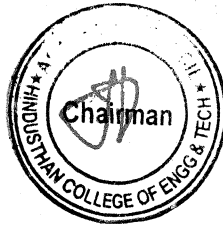
- R1 Barry Holebeak, “Automotive Electrical and Electronics” , Delmar Publishers, Clifton Park,USA,2010
- R2 Tom Denton, “Automotive Electrical and Electronics Systems,” Third Edition, 2004, SAE International
- R3 William Ribbens, "Understanding Automotive Electronics - An Engineering Perspective," 7th Edition, Elsevier Butterworth-Heinemann Publishers, 2012.
- R4 James D Halderman, “ Automotive Electrical and Electronics” , Prentice Hall, USA, 2013

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	1	2	-	-	3	-	-	2	-	3	2	2
CO2	3	3	3	2	-	-	3	-	-	2	-	3	2	2
CO3	3	3	3	1	2	-	2	-	-	2	-	3	2	3
CO4	3	2	2	2	2	2	2	-	-	2	-	2	2	2
CO5	3	2	3	2	2	3	2	-	-	2	-	2	2	2
AVG	3	2.6	2.4	1.8	2	2.5	2.4	-	-	2	-	2.6	2	2.2



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CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	1	2	-	-	3	-	-	2	-	3	2	2
CO2	3	3	3	2	-	-	3	-	-	2	-	3	2	2
CO3	3	3	3	1	2	-	2	-	-	2	-	3	2	3
CO4	3	2	2	2	2	2	2	-	-	2	-	2	2	2
CO5	3	2	3	2	2	3	2	-	-	2	-	2	2	2
AVG	3	2.6	2.4	1.8	2	2.5	2.4	-	-	2	-	2.6	2	2.2


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

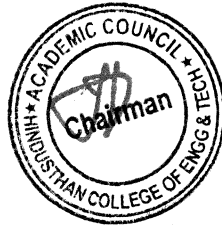
- R1 Gasoline Engine Management: Motronic Systems: Bosch Technical Instruction Robert Bosch GmbH November 1, 2003.
- R2 Engine Management: Advanced Tuning 1st Edition CarTech; 1st edition April 10, 2007.




CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	2	2	3	3	-			2	-	3	3	2
CO2	3	2	2	2	3	3	2			2	-	3	3	2
CO3	2	3	2	2	2	3	-			2	-	2	3	3
CO4	2	3	2	2	2	2	-			2	-	2	3	3
CO5	3	2	2	2	2	3	-			2	-	2	3	3
AVG	2.4	2.4	2	2	2.4	2.8	2	-	-	2	-	2.4	3	2.6


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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 ENERGY MANAGEMENT SYSTEMS (9)

Communications, supporting subsystems: In vehicle networks- CAN, Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies

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



CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	2	2	3	3	-			2	-	3	3	2
CO2	3	2	2	2	3	3	2			2	-	3	3	2
CO3	2	3	2	2	2	3	-			2	-	2	3	3
CO4	2	3	2	2	2	2	-			2	-	2	3	3
CO5	3	2	2	2	2	3	-			2	-	2	3	3
AVG	2.4	2.4	2	2	2.4	2.8	2	-	-	2	-	2.4	3	2.6


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19AU7001R ADVANCED ELECTRICAL AND ELECTRONICS LABORATORY

L T P C
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.

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. Study and on board diagnosis of Engine Management System
7. Study of Virtual Instrumentation
8. First order and Second Order System using MatLab
9. Routh Table Analysis using MatLab

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.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

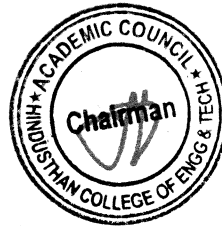
S.No.	NAME OF THE EQUIPMENT	QTY.	S.No.	NAME OF THE EQUIPMENT	QTY.
1	Battery, hydrometer, voltage tester	1 Each	8	IC timer	15
2	Starter motor, regulator, cut-out	1Each	9	Data logger	1
3	Distributor, ignition coil, spark plug	1 Each	10	8085 trainer kit	10
4	Auto electrical wiring system	1	11	ADC interface board	2
5	Rectifiers, filters	15 Each	12	DAC interface board	2
6	Bread board, Logic gates ICs	15 Each	13	Sensors like RTD, Load cell, LVDT	2
7	Amplifier	15	14	Actuators like stepper motor	2

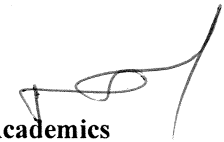


CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	2	2	1	3	3	2	-	3	1	3	3	3
CO2	3	3	2	3	1	3	3	2	-	2	1	3	2	2
CO3	3	3	2	2	3	2	2	2	-	2	1	3	2	2
CO4	3	3	1	3	3	3	3	2	-	2	1	3	3	3
CO5	3	3	2	3	3	3	3	2	-	2	1	3	3	3
AVG	3	3	1.8	2.6	2.2	2.8	2.8	2	-	2.2	1	3	2.6	2.6


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

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



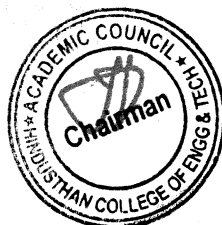
LIST OF EQUIPMENT

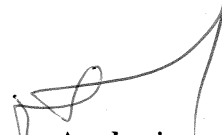
S.No.	NAME OF THE EQUIPMENT	QTY
1	Engine Analyze	1
2	Cylinder Compression Pressure Gauge	1
3	Vacuum Gauge	1
4	Spark Plug Cleaner and Tester	1
5	Cam Angle and RPM Tester	1
6	Tachometer	1
7	Wheel Alignment Apparatus	1
8	Gas Welding Equipment	1
9	Tyre Remover	1
10	Bearing Puller	1
11	Head Light Alignment 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

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	2	2	-	3	2	2	-	-	-	3	2	2
CO2	3	3	2	3	-	3	3	2	-	-	-	2	3	2
CO3	3	3	1	2	-	3	2	2	-	-	-	2	2	3
CO4	3	3	2	2	-	3	2	-	-	-	-	2	2	2
CO5	3	3	2	2	-	2	2	-	-	-	-	2	3	2
AVG	3	3	1.8	2.2	-	2.8	2.2	2	-	-	-	2.2	2.4	2.2


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19AU7901

PROJECT WORK – PHASE I

L T P C
0 0 4 2

Course Objectives


- CO 1 To practice acquired knowledge within the chosen area of technology for project development.
- CO 2 To Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.
- CO 3 To Reproduce, improve and refine technical aspects for engineering projects.
- CO 4 To Work as an individual or in a team in development of technical projects.
- CO 5 To Communicate and report effectively project related activities and findings

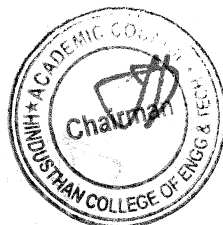
The student in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three 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	
CO 1	Able to practice acquired knowledge within the chosen area of technology for project development.
CO 2	Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.
CO 3	Reproduce, improve and refine technical aspects for engineering projects.
CO 4	Work as an individual or in a team in development of technical projects.
CO 5	Communicate and report effectively project related activities and findings

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	3	3	2	2	2	3	3	3	3	3	3	3
CO2	3	1	2	1	2	2	2	3	2	2	3	3	2	2
CO3	2	3	3	2	2	2	2	1	3	3	2	2	3	3
CO4	3	3	3	3	2	2	2	3	3	3	3	3	3	3
CO5	3	1	2	1	2	2	2	3	2	2	3	3	2	2
AVG	2.8	2.2	2.6	2	2	2	0	0	0	0	0	2.8	2.6	2.6


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19AU7301

AUTOMOTIVE VEHICLE MAINTENANCE

L	T	P	C
3	0	0	3

Course Objectives

- 1 To understand the concepts of maintenance records and schedules.
- 2 To comprehend 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

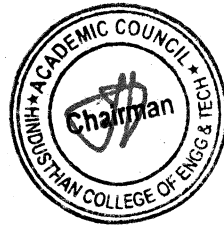
- R1 Bosch Automotive Handbook, Tenth Edition,2018
- R2 Doshi.J.A, "Vehicle Maintenance and Garage Practice", Prentice Hall India Learning Private Limited,2014.

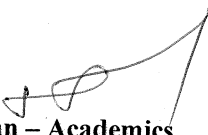


CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
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CO2	1	2	-	2	2	3	3	-	-	3	-	2	2	3
CO3	1	2	2	3	2	3	3	-	-	2	-	2	3	2
CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4


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19AU7302R

DIGITAL SUPPLY CHAIN MANAGEMENT

L T P C
3 0 0 3

Course Objectives

- 1 To know about the supply chain management concepts and its implications
- 2 To acquire the knowledge about strategic sourcing.
- 3 To infer about the various steps and sequences of supply chain network.
- 4 To understand the procedures involved in planning, demand, inventory and supply.
- 5 To get exposure in current trends and techniques in digital SCM.

UNIT I INTRODUCTION (9)

Supply Chain – Fundamentals –Evolution- Role in Economy - Importance - Decision Phases - Supplier-Manufacturer-Customer chain. - Enablers/ Drivers of Supply Chain Performance. Supply chain strategy - Supply Chain Performance Measures.

UNIT II STRATEGIC SOURCING (9)

Outsourcing – Make Vs buy - Identifying core processes - Market Vs Hierarchy - Make Vs buy continuum -Sourcing strategy - Supplier Selection and Contract Negotiation. Creating a world class supply base- Supplier Development - World Wide Sourcing.

UNIT III SUPPLY CHAIN NETWORK (9)

Distribution Network Design – Role - Factors Influencing Options, Value Addition – Distribution Strategies - Models for Facility Location and Capacity allocation. Distribution Center Location Models. Supply Chain Network optimization models. Impact of uncertainty on Network Design - Network Design decisions using Decision trees.

UNIT IV PLANNING DEMAND, INVENTORY AND SUPPLY (9)

Managing supply chain cycle inventory. Uncertainty in the supply chain – Analyzing impact of supply chain redesign on the inventory - Risk Pooling - Managing inventory for short life - cycle products - multiple item -multiple location inventory management. Pricing and Revenue Management

UNIT V CURRENT TRENDS (9)

Supply Chain Integration - Building partnership and trust in SC Value of Information: Bullwhip Effect - Effective forecasting - Coordinating the supply chain. . SC Restructuring - SC Mapping -SC process restructuring, Postpone the point of differentiation – IT in Supply Chain - Agile Supply Chains -Reverse Supply chain. Agro Supply Chains.

TOTAL: 45 PERIODS

Course Outcomes

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

- CO1: Know about the supply chain management concepts and its implications
- CO2: Acquire the knowledge about strategic sourcing.
- CO3: Infer about the various steps and sequences of supply chain network.
- CO4: Understand the procedures involved in planning, demand, inventory and supply.
- CO5: Get exposure in current trends and techniques in digital SCM.

Text Books

- T1 Janat Shah, Supply Chain Management – Text and Cases, Pearson Education, 2009.
- T2 Sunil Chopra and Peter Meindl, Supply Chain Management-Strategy Planning and Operation, PHI Learning / Pearson Education, Sixth edition, 2015.
- T3 Ballou Ronald H, Business Logistics and Supply Chain Management, Pearson Education, 5th Edition, 2007.

References


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

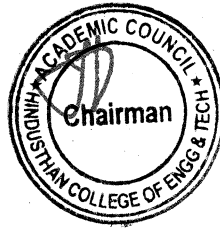


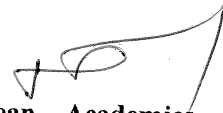
- R2 David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, Designing and Managing the Supply Chain: Concepts, Strategies, and Cases, Tata McGraw-Hill, 2005.
- R3 Altekhar Rahul V, Supply Chain Management-Concept and Cases, PHI, 2005.
Joel D. Wisner, G. Keong Leong, Keah-Choon Tan, Principles of Supply Chain Management- A Balanced Approach, South-Western, Cengage, 2012.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
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CO3	1	2	2	3	2	3	3	-	-	2	-	2	3	2
CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4


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19AU7303

ENGINE AUXILLARY SYSTEMS

L	T	P	C
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 AND 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 COOLING 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.



CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	1	1	2	3	3	-	-	3	-	3	3	2
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CO3	1	2	2	3	2	3	3	-	-	2	-	2	3	2
CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4


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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.



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.

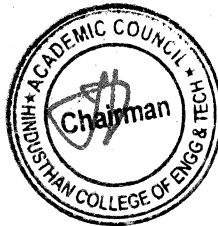
References

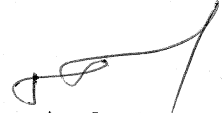
- R1 Dr. Bo N. J. Persson, "Sliding Friction Physical Principles and Applications", Springer Publications, 2nd Edition, Springer Publications, 2000.
 R2 B Bhadury and S.K. Basu, "Terotechnology: Reliability Engineering and Maintenance Management", Asian Books, New Delhi 2002.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	1	1	2	3	3	-	-	3	-	3	3	2
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CO3	1	2	2	3	2	3	3	-	-	2	-	2	3	2
CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4


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19AU7305R

ENTREPRENEURSHIP 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 – Return on Investment, Cost estimation and cost of ownership.

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

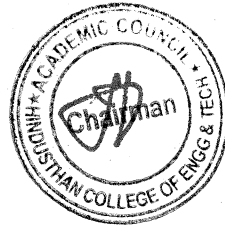
- R1 Hisrich R D, Peters M P, “Entrepreneurship” 8th Edition, Tata McGraw-Hill, 2013.
- R2 Mathew J Manimala, “Entrepreneurship theory at cross roads: paradigms and praxis”, Dream tech, 2005.
- R3 Charantimath, P. M., “Entrepreneurship Development and Small Business Enterprises”, Pearson, 2006.

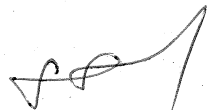


CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
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CO2	1	2	2	2	2	-	-	-	-	2	-	2	2	1
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CO4	3	1	1	2	2	-	-	2	-	2	-	2	1	1
CO5	2	2	3	2	1	-	-	-	-	2	-	2	2	1
AVG	2	1.6	2	2	1.8	-	-	2	-	2	-	2.2	1.4	1


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19AU7306R

AUTOMOTIVE EMBEDDED SYSTEM

L	T	P	C
3	0	0	3

Course Objectives

1. To facilitate students to learn basic embedded system in automobile.
2. To train the learners in embedded communication
3. To introduce the drive by wire technologies
4. To enhance knowledge in hardware module
5. To equip the trainers in software developments tool

UNIT I INTRODUCTION

(9)

Body and convenience electronics, Vehicle power supply controllers and lighting modules, Door control modules Safety electronics, Active safety systems - ABS, ASR& ESP. Passive safety systems restrained systems and their associated sensor in an automobile. Power train electronics, Petrol Engine Management, Infotainment electronics, Dashboard Instrument cluster, car audio, telematics system, navigation system, multimedia systems. Cross application technologies 42-volt vehicle power supply system

UNIT II EMBEDDED COMMUNICATIONS

(9)

A Review of Embedded Automotive Protocols, Dependable Automotive CAN Networks, Flex Ray Protocol.

UNIT III DRIVE BY WIRE

(9)

Challenges and opportunities of X by Wire: System and design requirements steer by wire, brake by wire, suspension by wire, gas by wire, power by wire, and shift by wire. Future of automotive Electronics.

UNIT IV HARDWARE MODULES

(9)

MC9S12XD family features Modes of operation: functional block diagram overview, Programming model Map Overview Pulse width Modulator (PWM) On chip ADC serial communication protocol SCI,SPI,IIC,CAN.

UNIT V SOFTWARE DEVELOPMENTS TOOLS

(9)

Introduction to HCS12XDT512 Student learning kit & PBMCU (Project board), Introduction to code warrior IDE editing, debugging simulating simple programs. Flashing code into HCS12XDT512 SLK board and testing.

TOTAL: 45 PERIODS

Course Outcomes

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

- CO1: Understand the basic embedded system in automobile
- CO2: Practiced in embedded communication.
- CO3: Introduced to gain information of drive by wire technology.
- CO4: Acquired various types of hardware module.
- CO5: Gain knowledge in software developments tool

Text Books

- T1 William B. Ribbens, "Understanding Automotive Electronics- An Engineering Perspective", Seventh edition. Butterworth-Heinemann Publications.
- T2 Ronald K. Jurgen. "Automotive Electronics Handbook", Mc-Graw Hill.

References


- R1 Kiencke, Uwe. Nielsen&Lars. "Automotive Control Systems for Engine, Driveline and Vehicle", Second edition, Springer Publication.
- R2 Tao Zhang, Luca Delgrossi. "Vehicle Safety Communications: Protocols, Security and Privacy", Wiley Publication.
- R3 Robert Bosch, "Automotive Hand Book", Fifth edition, SAE Publications.

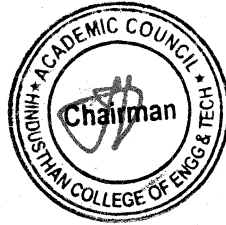
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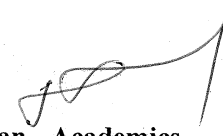


CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
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CO5	2	2	3	2	1	-	-	-	-	2	-	2	2	1
AVG	2	1.6	2	2	1.8	-	-	2	-	2	-	2.2	1.4	1


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