INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM - CHENNAI
ACCREDITED BY NAAC WITH 'A' GRADE
Marching Beyond 30 Years Successfully
INSTITUTION WITH UGC 12B STATUS

SCHOOL OF ENGINEERING

5RD BOARD OF STUDIES MEETING – MINUTES

VENUE: AUTOMOBILE ENGINEERING

DATE & TIME

26.03.2022 & 03. 00 pm

VELS
INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
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Date: 26.3.2022

MINUTES OF MEETING OF THE BOARD OF STUDIES

SCHOOL OF ENGINEERING

The meeting of the Board of Studies in **School of E n g i n e e r i n g** (UG) of the Department of Automobile Engineering, School of Engineering**,** VISTAS was held on 26.3.2022 at 3.00p.m **to discuss the revision of UG Programme Curriculum & Syllabi** of B.E Automobile Engineering for the regulations 2022 which to be followed from the academic year 2022-2023.

The following members were present for the BOS meeting

S.No	Name of the Board Member	Designation	Institute / Industry
1	Dr. L. Karikalan	Internal Members Associate Professor and Head	Dept. of Automobile Engineering VISTAS, Chennai
2	Dr. M. Chandrasekaran	Director- Mechanical	Dept. of Mechanical Engineering VISTAS, Chennai
3	Dr. S. Ramasubramanian	Associate Professor	Dept. of Automobile Engineering VISTAS, Chennai
4	Dr. M. Ruban	Assistant Professor	Dept. of Automobile Engineering VISTAS, Chennai
	External Expert Members		
1	Dr. S. Padmanaban	Associate Professor	Department of Automobile Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute Of Science and Technology, Chennai-600062
2	Mr. Jerome Peter Mohandas	Chief Executive Officer	JERRY MOTOR COMPANY, Polichalur, Chennai-600074
	Alumni		
1	Mr. K. Mathan (Alumni)	Engineer	VE Commercial Vehicles Ltd., Chennai

AGENDA OF THE MEETING

Item No.	Particulars
BOS / 2022 / Auto / UG / 5.1	Review and confirm minutes of 4th BOS meeting held on 19-07-2021.
BOS / 2022 / Auto / UG / 5.2	Develop curriculum based on Choice Based Credit System (CBCS).
BOS / 2022 / Auto / UG / 5.3	To Review Revision for new syllabus for B.E. Automobile Engineering From regulation 2018 to 2022
BOS / 2022 / Auto / UG / 5.4	Feedback from Stakeholders to ensure that the syllabus of the courses include the state-of-the-art technologies focusing on skill development, employability, and entrepreneurship
BOS / 2022 / Auto / UG / 5.5	As per the AICTE Policy, effective from the Academic Year 2021-2022 is approved.

MINUTES OF THE MEETING

Dr. L.Karikalan Professor & Head, Chairman, BoS initiated the meeting with a warm welcome and introduced the external members, the internal and co-opted members, and thanked them for accepting the invitation to the Board of Studies meeting.

ITEM NO. 1 BOS / 2022 / AUTO/ UG / 5.1

The fourth BOS meeting for M.E Automobile engineering regulation 2021 was held on 19-07-2021.

ITEM NO. 2 BOS / 2022 / AUTO / UG / 5.2

- To develop the curriculum based on of Choice Based Credit System (CBCS).
- To consider present trend in the respective fields and industry relevant interdisciplinarycourses.
- To prepare the programme while following the requirements and recommendations of the new education policy.
- To replace outdated syllabus material with the current / upgraded technology, new knowledge is being introduced.
- To design the curriculum focusing on skill development, Employability andEntrepreneurship

ITEM NO. 3 BOS / 2022 / AUTO / UG / 5.3

Syllabus Revision: B.E Automobile Engineering - 27 % syllabus revision was carried out for UG (As per Annexure – I)

% of Syllabus Revision in the Program:

B.E Automobile Engineering - **27%**

S. No.	Available Course 2018-2019		Revised Course 2022-2023		
	Code	**Name**	**Code**	**Name**	% of Syllabus Revised
1	18CBAE13	MATHEMATICS-I	22CGMA11	MATHEMATICS - I (CALCULUS AND LINEAR ALGEBRA)	50%
2	18HSAU11	ENGLISH	22CBAE11	ENGLISH	37%
3	18ESAU12	ENGINEERING GRAPHICS AND DESIGN	22CBAE15	ENGINEERING GRAPHICS AND DESIGN	30%
4	18BSAU22	MATHEMATICS II	22GCMA22	MATHEMATICS - II (CALCULUS, ORDINARY DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLE)	33%
5	18PCAU31	ENGINEERING THERMODYNAMICS	22PCAU01	ENGINEERING THERMODYNAMICS	32%
6	18PCAU32	AUTOMOTIVE ENGINES	22PCAU02	AUTOMOTIVEENGINES	33%
7	18PCAU34	FLUIDMECHANICS AND MACHINERY	22PCAU03	FLUID MECHANICS AND MACHINERY	33%
8	18BSAU41	MATHEMATICS–IV (STATISTICAL AND NUMERICAL METHODS)	22BSAU08	MATHEMATICS–IV (STATISTICAL AND NUMERICAL METHODS)	33%
9	18PCAU42	ENGINEERING METALLURGY	22PCAU06	ENGINEERING METALLURGY	35%
10	18PCAU41	AUTOMOTIVE FUELSAND LUBRICANTS	22PCAU07	AUTOMOTIVE FUELS AND LUBRICANTS	33%
11	18PCAU43	AUTOMOTIVE CHASSIS	22PCAU08	AUTOMOTIVE CHASSIS	30%
12	18PCAU44	HEAT AND MASSTRANSFER	22PCAU09	HEATANDMASS TRANSFER	33%

13	18PCAU51	AUTOMOTIVE TRANSMISSION	22PCAU12	AUTOMOTIVE TRANSMISSION	44%
14	18PCAU53	VEHICLE DESIGN DATA CHARACTERISTICS	22PCAU13	VEHICLEDESIGN DATA CHARACTERISTICS	33%
15	18PCAU63	TWOANDTHREE WHEELERS	22PCAU18	TWOANDTHREE WHEELERS	30%
16	18PCAU62	AUTOMOTIVE CHASSIS COMPONENTS DESIGN	22PCAU19	AUTOMOTIVE CHASSIS COMPONENTS DESIGN	35%
17	18PEAU02	VEHICLE MAINTENANCE	22PCAU23	VEHICLE MAINTENANCE	31%
18	18PEAU03	SIMULATION OF IC ENGINE PROCESSES	22PEAU04	PROFESSIONAL ELECTIVE- III (SIMULATION OF IC ENGINE PROCESSES)	31%

New Courses Introduced

1	22GCHV21	UNIVERSAL HUMAN VALUES
2	22ESAU05	ENGINEERING MECHANICS
3	22PCAU14	MANUFACTURING PROCESS OF AUTOMOTIVE COMPONENTS
4	22PCAU15	AUTOMOTIVE ENGINE COMPONENTS DESIGN LABORATORY
5	22PCAU21	MECHATRONICS LABORATORY

Item No. 4 BOS / 2022 / AUTO / UG / 5.4

Feedback from Stakeholders:

S.No	Name & Designation	Comments	Role
1	Dr. S. Padmanaban	Latest courses like Shared Mobility, Autonomous Vehicles and Mechatronics, etc are to be included in the curriculum	Academic Expert
2	Mr. K. Mathan (Alumni)	Value added/Certificate courses can be conducted in collaboration with the industry to increase the employability and technical exposure	Alumni

Item No. 5 BOS / 2022 / AUTO / UG / 5.5

As per the UGC and AICTE Policy, effective from the Academic Year, 2022-2023 is approved.

Status of Implementation of CBCS:

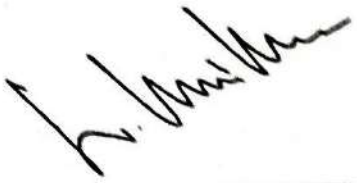
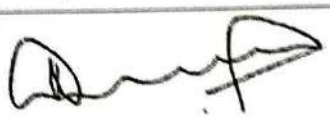
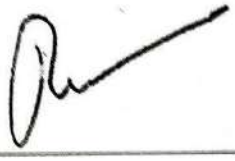
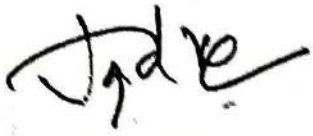
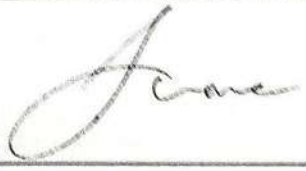
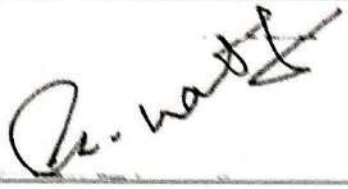
Revised Curriculum and Syllabus is based Choice Based Credit System (CBCS), Elective Course System (ECS) and template.

Considered the Program Curriculum and Syllabus presented before the Board of Studies and discussed in details and resolved as follows:

Resolved to recommend that the Curriculum & Syllabus for the B. E Automobile Engineering and designed as per the guidelines and Model Curriculum Framework of UGC and AICTE for the Academic year 2022 - 2023 has been approved by the members of Board of Studies.

Syllabus Revision of UG Programmes /courses focused on Activities/Content with direct on Employability / Competency/ Entrepreneurship / Skill development / Interdisciplinary and New courses introduced during the Academic year 2022-23 enclosed in Annexure I.

Signature of the Members:

S. No	Name of the Board Member	Designation	Signature
Internal Members			
1	Dr. L.Karikalan	Associate Professor and Head	
2	Dr. M.Chandrasekaran	Director - Mechanical	
3	Dr. S.Ramasubramanian	Associate Professor	
4	Dr. M.Ruban	Assistant Professor	
External Expert Members			
1.	Dr. S.Padmanaban	Associate Professor	
2.	Mr. Jerome Peter Mohandas	Chief Executive Officer	
Student Members			
1	Mr. K. Mathan (Alumni)	Engineer	

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B.E

AUTOMOBILE ENGINEERING

CURRICULUM AND SYLLABUS

REGULATION 2022

(Based on Choice Based Credit System (CBCS)

and

Outcome Based Education (OBE)

Effective from the Academic

year

2022-2023

Department of Automobile Engineering

School of Engineering

ANNEXURE I

SCHOOL OF ENGINEERING

Department of Automobile Engineering

Vision

To impart excellent education in Automobile Engineering to develop competent and reliable engineers for industry requirement who will also carry out research on continuous basis for the betterment of society.

Mission

1:To offer superlative learning experience through innovative teachingpractices supported with excellent laboratory facilities and exposure to recent trends in the automotive industry.

2:To develop comprehensive knowledge in automobile engineering with equal emphasis on theoretical and practical aspects and problem-solving skills.

3:To identify and develop industry attached laboratories so that students will familiarize with emerging industry practices.

4: To focus on Industry-Institute Interaction for improved understanding of the latest technologies, training, internship, research promotion and also encourage entrepreneurship.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO-1: The graduates shall have ability to understand and apply core subject knowledge to various automotive engineering problems.

PEO-2: The graduates will be able to work in team, investigate the problem, apply engineering knowledge and present a trustworthy solution.

PEO-3: The graduates shall be competent in continue their intellectual expansion ability for lifetime learning by pursuing higher education.

PEO-4: The **g**raduates will exhibitprofessionalism in their chosen career and adaptto current technologies, trends and industrial needs.

PEO-5: The graduates shall have good communication and leadership skill, high moral and social values.

PROGRAM OUTCOMES (POS)

PO-1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO-2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO-3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO-4: Conduct investigations of complex problems: Use research-basedknowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO-5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO-6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO-7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO-8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO-9: Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO-10: Communication: Communicate effectively on complex engineeringactivities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO-11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO-12: Lifelong learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOS)

PSO-1: To apply the concepts of design, development, research, innovation,analysis and maintenance of automotives in the manufacturing and servicing industries.

PSO-2: To be employable in Automotive, Manufacturing, Design, Production industries, academic institutes, Research and development organizations.

PSO-3: ToIdentify,formulateandsolveautomotiveengineeringproblemsinthe research laboratory and perform multidisciplinary tasks in Automobile Engineering and allied areas.

Competencies and Performance Indicators

Followingtable givesthesuggestivelistof competenciesandassociatedperformanceindicatorsfor eachofthePOinAutomobile Engineering Program

PO1:Engineeringknowledge: Applytheknowledgeofmathematics,science,engineeringfundamentals,andan engineeringspecialization for thesolution of complex engineering problems.	
Competency	Indicators
Demonstrate competence in mathematicalmodelling	Applymathematicaltechniquessuchascalculus,linearalgebra,and statistics to solve problems Applyadvancedmathematicaltechniquestomodelandsolve automobileengineeringproblems
1.2 Demonstrate competence in basicsciences	1.2.1Applylawsofnaturalsciencetoanengineeringproblem
1.3 Demonstrate competence inengineeringfundamentals	1.3.1 Apply fundamental engineering conceptsto solve engineering problems
1.4 Demonstrate competenceinspecialized engineeringknowledgetothe program	1.4.1 Apply automobile engineering concepts to solve engineering problems.
PO2:Problemanalysis: Identify,formulate,researchliterature,andanalyzecomplexengineeringproblems reachingsubstantiated conclusionsusing first principles ofmathematics,naturalsciences,and engineering sciences.	
Competency	Indicators
Demonstratean ability toidentifyand formulate complex engineeringproblem	Articulateproblemstatementsandidentify objectives Identifyengineeringsystems,variables,andparameterstosolvethe problems Identifythemathematical,engineeringandotherrelevantknowledgethat appliestoagivenproblem
2.2Demonstrateanability to formulateasolutionplan and methodology for an engineering problem	Reframecomplexproblemsintointerconnectedsub-problems Identify,assembleandevaluateinformationandresources. Identifyexistingprocesses/solutionmethodsforsolvingtheproblem, including formingjustifiedapproximationsandassumptions Compareandcontrastalternativesolutionprocessestoselectthebest process.
2.3Demonstrateanability to formulate and interpret a model	Combine scientific principles and engineering concepts to formulate model/s(mathematicalorotherwise)ofasystemorprocessthatis appropriateintermsofapplicabilityandrequiredaccuracy. Identify assumptions(mathematical andphysical)necessarytoallow modeling ofasystematthelevelofaccuracyrequired.

2.4Demonstrateanability toexecuteasolutionprocess and analyzeresults	Apply engineering mathematics and computations to solve mathematical models Produceandvalidateresultsthroughskillful useofcontemporary engineeringtoolsandmodels Identifysourcesoferrorinthesolutionprocess,andlimitationsofthe solution. Extract desired understanding and conclusions consistentwith objectivesandlimitationsoftheanalysis
PO 3: Design/Development of Solutions: Design solutions for complex engineering problems and design systemcomponentsorprocessesthatmeet thespecified needs with appropriateconsideration forpublichealth and safety, and cultural, societal, and environmental considerations.	
Competency	Indicators
Demonstratean abilitytodefineacomplex/ open-ended problem in engineeringterms	Recognizethatneedanalysisiskeytogoodproblemdefinition Elicitanddocument,engineeringrequirementsfromstakeholders Synthesizeengineeringrequirementsfromareviewofthestate-of-the- art Extract engineering requirements from relevant engineering Codes and Standards suchasASME,ASTM,BIS,ISOandASHRAE. Explore and synthesize engineering requirements considering health, safety risks, environmental, cultural and societalissues Determinedesignobjectives,functional requirementsandarriveat specifications
3.2Demonstrateanability togenerateadiversesetof alternative designsolutions	Applyformalideageneration toolstodevelopmultipleengineeringdesign solutions Buildmodels/prototypestodevelopadiversesetofdesignsolutions Identifysuitablecriteriafortheevaluationofalternatedesignsolutions
3.3Demonstratean abilitytoselectanoptimal designschemeforfurther development	Apply formal decision-making tools to select optimal engineering design solutions for furtherdevelopment Consultwithdomainexpertsandstakeholderstoselectcandidate engineering designsolutionforfurtherdevelopment
3.4Demonstrateanability toadvanceanengineering designtodefinedendstate	Refineaconceptualdesignintoadetaileddesignwithintheexisting constraints(of theresources) Generateinformationthroughappropriateteststoimproveorrevisethe design
PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods includingdesignofexperiments, analysisandinterpretationofdata, andsynthesisoftheinformation to providevalidconclusions.	
Competency	Indicators

Demonstrateanability toconductinvestigationsof technicalissuesconsistent withtheirlevelofknowledge andunderstanding	Defineaproblem,itsscopeandimportanceforpurposesof investigation Examinetherelevantmethods,toolsandtechniquesofexperimentdesign, systemcalibration,dataacquisition,analysisandpresentation Applyappropriateinstrumentationand/orsoftwaretoolstomake measurementsofphysicalquantities Establisharelationshipbetweenmeasureddataandunderlyingphysical principles.
4.2Demonstrateanability todesignexperimentstosolve open-endedproblems	Designanddevelopanexperimentalapproach,specifyappropriate equipmentand procedures Understand theimportanceofthestatistical designofexperiments and chooseanappropriateexperimentaldesignplanbasedonthestudy objectives
4.3Demonstrateanability toanalyzedataandreacha validconclusion	Useappropriateprocedures,toolsandtechniquestoconduct experimentsandcollectdata Analyzedatafortrendsandcorrelations,statingpossibleerrorsand limitations Representdata(intabularand/orgraphicalforms)soastofacilitateanalysisandexplan ation of the data, and drawing of conclusions Synthesizeinformationandknowledgeabouttheproblemfromtheraw datato reach appropriateconclusions
PO5:Moderntoolusage: Create,select,andapplyappropriatetechniques,resources,andmodern engineering andITtoolsincludingpredictionandmodellingtocomplexengineeringactivitieswithanunderstandingofthelimitations.	
Competency	Indicators
Demonstrateanability toidentify/createmodern engineering tools, techniquesandresources	Identify modern engineering tools such as computer-aided drafting, modeling and analysis;techniquesandresourcesforengineering activities Create/adapt/modify/extend toolsandtechniquestosolveengineering problems
5.2Demonstrateanability toselectandapplydiscipline-specifictools,techniquesand resources	Identify the strengths and limitations of tools for (i) acquiring information,(ii)modelingandsimulating, (iii)monitoringsystem performance,and (iv)creating engineeringdesigns. Demonstrateproficiencyinusingdiscipline-specifictools
5.3 Demonstrate an ability to evaluatethesuitabilityand limitationsoftoolsusedto solveanengineering problem	Discusslimitationsandvalidatetools,techniquesandresources Verifythecredibilityofresultsfromtoolusewithreferencetothe accuracyandlimitations,andtheassumptionsinherentintheiruse.
PO6:Theengineerandsociety: Applyreasoninginformedbythecontextualknowledgetoassesssocietal,health, safety,legal,andculturalissuesandtheconsequentresponsibilitiesrelevanttotheprofessionalengineeringpractice.	
Competency	Indicators

6.1Demonstrateanability to describe engineeringrolesinabroader context, e.g.pertainingtothe environment, health, safety, legal andpublicwelfare	6.1.1 Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at the global, regional andlocal level
6.2 Demonstrate anunderstanding of professionalengineering regulations, legislation and standards	6.2.1 Interpret legislation, regulations, codes, and standards relevant to your disciplineandexplainitscontributiontotheprotectionofthepublic
PO7:Environmentandsustainability: Understandtheimpactoftheprofessionalengineeringsolutionsin societalandenvironmental contexts, and demonstratetheknowledgeof, and theneed forsustainable development.	
Competency	Indicators
Demonstrate an understandingoftheimpact ofengineeringandindustrial practiceson social, environmentalandin economic contexts	Identifyrisks/impactsinthelife-cycleofanengineeringproductor activity Understand the relationship between the technical, socio- economic and environmental dimensions ofsustainability
7.2Demonstratean abilitytoapplyprinciplesof sustainable design and development	Describemanagementtechniquesforsustainabledevelopment Applyprinciplesofpreventiveengineeringandsustainable development to an engineering activityorproduct relevant tothe discipline
PO8:Ethics: Applyethicalprinciplesandcommittoprofessionalethicsandresponsibilitiesandnormsofthe engineeringpractice.	
Competency	Indicators
Demonstrateanabilityto recognize ethicaldilemmas	Identifysituationsofunethicalprofessionalconductandproposeethical alternatives
8.2Demonstrateanabilityto applytheCodeofEthics	IdentifytenetsoftheASMEprofessionalcodeofethics Examineandapplymoral&ethicalprinciplestoknowncasestudies
PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams,andinmultidisciplinarysettings.	
Competency	Indicators
Demonstrateanability toformateamanddefinea roleforeachmember	Recognizeavarietyofworkingandlearningpreferences;appreciatethe valueof diversity on ateam Implementthenormsofpractice(e.g.rules,roles,charters,agendas, etc.)ofeffectiveteamwork,toaccomplishagoal.

9.2Demonstrateeffective individual and team operations--communication,problem-solving,conflictresolution and leadershipskills	Demonstrate effective communication, problem-solving, conflict resolution and leadershipskills Treatotherteammembersrespectfully Listentoothermembers Maintaincomposureindifficultsituations
9.3Demonstratesuccessina team-basedproject	9.3.1Presentresultsasateam,withsmoothintegrationofcontributions fromall individual efforts
PO10:Communication: Communicateeffectivelyoncomplexengineeringactivitieswiththeengineering communityandwiththesociety atlarge,suchasbeingable tocomprehendandwriteeffective reportsanddesign documentation,makeeffectivepresentations,andgiveandreceiveclearinstructions	
Competency	Indicators
Demonstrate an abilitytocomprehend technical literature and document projectwork	Read,understandandinterprettechnicalandnon-technical information Produceclear,well-constructed,andwell-supportedwritten engineeringdocuments Createflowinadocumentorpresentation-alogicalprogressionofideas sothat themainpointisclear
10.2 Demonstrate competenceinlistening, speaking, andpresentation	Listentoandcomprehendinformation,instructions,andviewpointsof others Delivereffectiveoralpresentationstotechnicalandnon-technical audiences
10.3Demonstratetheability to integratedifferentmodesof communication	Create engineering-standard figures, reports and drawings to complement writing andpresentations Useavarietyofmediaeffectivelytoconveyamessageina documentorapresentation
PO 11: Project managementand finance: Demonstrate knowledge and understanding of the engineering andmanagementprinciplesandapplythesetoone'swork,asamemberandleaderinateam,tomanageprojects andinmultidisciplinaryenvironments.	
Competency	Indicators
Demonstrateanability to evaluatetheeconomicand financial performance ofan engineeringactivity	Describe various economic and financial costs/benefits of an engineering activity Analyzedifferentformsoffinancialstatementstoevaluatethefinancial statusofanengineeringproject
11.2Demonstrateanability tocompareandcontrastthe costs/benefits of alternate proposalsforanengineering activity	11.2.1Analyzeandselectthemostappropriateproposalbasedoneconomicand financialconsiderations.

11.3Demonstrateanability to plan/manageanengineering activity within time and budgetconstraints	Identify the tasks required to complete an engineering activity, and the resources requiredtocompletethetasks. Useprojectmanagementtoolstoscheduleanengineeringproject, soitiscompletedontimeandonbudget.
PO12:Life-longlearning: Recognize the needfor, andhave the preparationand abilitytoengage in independent andlife-longlearninginthebroadestcontextoftechnologicalchange.	
Competency	Indicators
Demonstrateanability toidentifygapsinknowledge andastrategytoclosethese gaps	Describetherationalefortherequirementforcontinuingprofessional development Identifydeficienciesorgapsinknowledgeanddemonstrateanabilityto source informationtoclosethisgap
12.2Demonstrateanability to identifychangingtrendsin engineering knowledge and practice	Identifyhistoricpointsoftechnologicaladvanceinengineeringthat required practitioners to seek education in order to stay current Recognizetheneedandbeabletoclearlyexplainwhyitisvitallyimportant tokeep currentregardingnewdevelopmentsinyourfield
12.3Demonstrateanability toidentifyandaccesssources for newinformation	Sourceandcomprehendtechnicalliteratureandothercredible sources of information Analyzesourcedtechnicalandpopularinformationforfeasibility, viability, sustainability,etc.

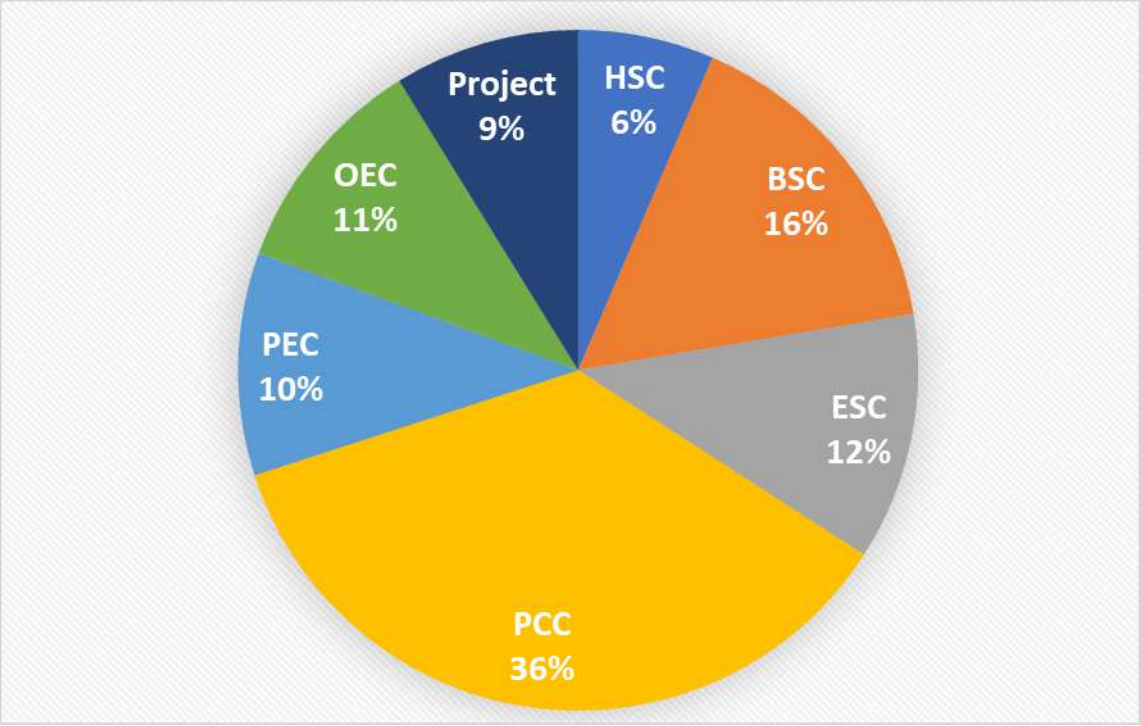
LIST OF BOARD OF STUDIES MEMBERS

S.No	Name	Affiliation	Role
1	Dr. L.KARIKALAN	*Associate Professor and Head* Dept. of Automobile Engineering VISTAS, Chennai	Chairman
2	Dr. S.PADMANABAN	*Associate Professor* Department of Automobile Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai-600062.	Academic Expert
3	Mr. JEROME PETER MOHANDAS	*Chief Executive Officer* Jerry Motor Company, Chennai	Industrial Expert
4	Dr. M.CHANDRASEKARAN	*Director- Mechanical* Dept. of Mechanical Engineering VISTAS, Chennai	Internal Member
5	Dr.S.RAMASUBRAMANIAN	*Associate Professor* Dept. of Automobile Engineering VISTAS, Chennai	Internal Member
6	Dr. M.RUBAN	*Assistant Professor* Dept. of Automobile Engineering VISTAS, Chennai	Internal Member
7	Mr.K. MATHAN	*Engineer* VE Commercial Vehicles Ltd., Chennai	Alumni

B.E(Automobile Engineering) Credits Per Semester

S. No	Course Category	1	2	3	4	5	6	7	8	TotalCredits
1	HSC	3	-	2	2	2	2	-	-	11
2	BSC	8	8	4	7	-	-	-	-	27
3	ESC	7	10	3	-	-	-	-	-	20
4	PCC	-	-	12	15	15	14	5	0	61
5	PEC	-	-	-	-	3	6	6	3	18
6	OEC	-	-	-	-	3	3	6	6	18
7	Project	-	-	-	-	-	-	5	10	15
8	MC	-	-	-	-	-	-	-	-	-
	TOTAL	18	18	21	24	23	25	22	19	**170**

HSC	HumanitiesandSocialScienceCourses
BSC	Basic Science Courses
ESC	Engineering Science Courses
PCC	Professional Core Courses
PEC	ProfessionalElectiveCourses
OEC	Open Elective Courses
EEC	EmployabilityEnhancementCourses
MC	Mandatory Courses



B.EAUTOMOBILEENGINEERING

CURRICULUM

(Totalnumberofcredits:170)

Category	Course Title	L	T	P	C	CA	SEE	Total
SEMESTER1								
HSC	English	2	-	-	2	40	60	100
BSC	Physics(Introductionto ElectromagneticTheory)	3	-	-	3	40	60	100
BSC	Mathematics-I(Calculusand LinearAlgebra)	3	1	-	4	40	60	100
ESC	BasicElectricalandElectronics Engineering	3	-	-	3	40	60	100
ESC	EngineeringGraphicsandDesign	1	-	4	3	40	60	100
HSC	EnglishLaboratory	-	-	2	1	40	60	100
BSC	Physics Laboratory	-	-	2	1	40	60	100
ESC	BasicElectricalandElectronics EngineeringLaboratory	-	-	2	1	40	60	100
MC	Constitutionof India	2	-	-	-			100
MC	StudentInductionProgram	-	-	-	-	-	-	-
		14	**1**	**10**	**18**			

SEMESTERII								
BSC	Chemistry	3	-	-	3	40	60	100
BSC	Mathematics - II (Calculus, OrdinaryDifferentialEquations andComplexVariable)	3	1	-	4	40	60	100
ESC	ProgrammingforProblem Solving	3	-	-	3	40	60	100
ESC	EngineeringMechanics	3	-	-	3	40	60	100
ESC	Workshopand Manufacturing Practices	1	-	4	3	40	60	100
BSC	ChemistryLaboratory	-	-	2	1	40	60	100
ESC	ProgrammingforProblem SolvingLaboratory	-	-	2	1	40	60	100
MC	UniversalHumanValues	2	-	-	-			100
		15	**1**	**8**	**18**			

SEMESTERIII								
BSC	Mathematics-III(FourierSeries and Transforms)	3	1	-	4	40	60	100
ESC	ElectricalDrivesandControl	3	-	-	3	40	60	100
PCC	EngineeringThermodynamics	3	-	-	3	40	60	100
PCC	AutomotiveEngines	3	-	-	3	40	60	100
PCC	FluidMechanicsandMachinery	3	-	2	4	40	60	100
PCC	AutomotiveEngineComponents Laboratory	-	-	2	1	40	60	100
PCC	ElectronicsandMicroprocessors Laboratory	-	-	2	1	40	60	100
HSC	PersonalityDevelopment-I	2	-	-	2	40	60	100
MC	BasicLifeSkills	2	-	-	-			100
		19	**1**	**6**	**21**			

SEMESTERIV								
BSC	Mathematics–IV(Statisticaland NumericalMethods)	3	1	-	4	40	60	100
PCC	EngineeringMetallurgy	3	-	-	3	40	60	100
PCC	AutomotiveFuelsand Lubricants	3	-	-	3	40	60	100
PCC	AutomotiveChassis	3	-	-	3	40	60	100
PCC	HeatandMassTransfer	3	-	2	4	40	60	100
PCC	AutomotiveChassisComponents Laboratory	-	-	2	1	40	60	100
PCC	StrengthofMaterials Laboratory	-	-	2	1	40	60	100
HSC	PersonalityDevelopment-II	2	-	-	2	40	60	100
BSC	EnvironmentalScienceand Engineering	3	-	-	3	40	60	100
MC	GenderInstitution andSociety	2	-	-	-			100
		22	**1**	**6**	**24**			

SEMESTERV								
PCC	AutomotiveTransmission	3	-	-	3	40	60	100
PCC	VehicleDesignData Characteristics	3	1	-	4	40	60	100
PEC	ProfessionalElective-I	3	-	-	3	40	60	100
OEC	OpenElective-I(Technical)	3	-	-	3	40	60	100
PCC	ManufacturingProcessof AutomotiveComponents	3	-	2	4	40	60	100
PCC	AutomotiveEngineComponents Design Laboratory	-	-	2	1	40	60	100
PCC	PerformanceandEmission Testing Laboratory	-	-	2	1	40	60	100
HSC	PersonalityDevelopment-III	2	-	-	2	40	60	100
PCC	IndustrialTraining/MiniProject/ MOOC Course (NPTEL/SWAYAM/CourseEra/ Mathworks)-Minimum4weeks	-	-	4	2			100
		17	**1**	**10**	**23**			

SEMESTERVI								
PCC	TwoandThreeWheelers	3	-	-	3	40	60	100
PCC	AutomotiveChassisComponents Design	3	1	-	4	40	60	100
PEC	ProfessionalElective- II	3	-	-	3	40	60	100
PEC	ProfessionalElectiveBlended	3	-	-	3	40	60	100
OEC	OpenElective-II(Technical)	3	-	-	3	40	60	100
PCC	AutomotiveElectrical and ElectronicsSystems	3	-	2	4	40	60	100
PCC	MechatronicsLaboratory	-	-	2	1	40	60	100
HSC	PersonalityDevelopment-IV	2	-	-	2	40	60	100
PCC	SummerInternship(4weeks)	-	-	4	2			100
		20	**1**	**8**	**25**			

SEMESTERVII								
PCC	VehicleMaintenance	3	1	-	4	40	60	100
OEC	OpenElective-III(Technical)	3	-	-	3	40	60	100
OEC	OpenElective-I(Management)	3	-	-	3	40	60	100
PEC	ProfessionalElective- III	3	-	-	3	40	60	100
PEC	ProfessionalElective	3	-	-	3	40	60	100
PCC	VehicleMaintenance& ReconditioningLaboratory	-	-	2	1	40	60	100
Project	ProjectPhaseI	-	-	10	5	40	60	100
		15	**1**	**12**	**22**			

SEMESTERVIII								
PEC	ProfessionalElective- IV	3	-	-	3	40	60	100
OEC	OpenElective-IV (Technical)	3	-	-	3	40	60	100
OEC	OpenElective-II(Management)	3	-	-	3	40	60	100
Project	ProjectPhaseII	-	-	20	10	40	60	100
		9	**0**	**20**	**19**			

B.E.- AUTOMOBILE ENGINEERING
CURRICULUM

LISTOFBASICSCIENCECOURSES

CodeNo.	Course	Hours/Week			Credits
		Lecture	Tutorial	Practical	
22BSAU01	Physics(IntroductiontoElectromagnetic Theory)	3	-	-	3
22BSAU02	Mathematics-I (CalculusandLinear Algebra)	3	1	-	4
22BSAU03	Physics Laboratory	-	-	2	1
22BSAU04	Chemistry	3	-	-	3
22BSAU05	Mathematics-II(Calculus,Ordinary Differential Equations andComplexVariable)	3	1	-	4
22BSAU06	ChemistryLaboratory	-	-	2	1
22BSAU07	Mathematics-III(FourierSeriesand Transforms)	3	1	-	4
22BSAU08	Mathematics–IV(StatisticalandNumerical Methods)	3	1	-	4
22BSAU09	EnvironmentalScienceandEngineering	3	-	-	3

LISTOFENGINEERINGSCIENCECOURSES

CodeNo.	Course	Hours/Week			Credits
		Lecture	Tutorial	Practical	
22ESAU01	BasicElectricalandElectronicsEngineering	3	-	-	3
22ESAU02	EngineeringGraphicsandDesign	1	-	4	5
22ESAU03	BasicElectricalandElectronicsEngineering Laboratory	-	-	2	1
22ESAU04	ProgrammingforProblemSolving	3	-	-	3
22ESAU05	EngineeringMechanics	3	-	-	3
22ESAU06	WorkshopandManufacturingPractices	1	-	4	5
22ESAU07	ProgrammingforProblemSolvingLaboratory	-	-	2	1
22ESAU08	ElectricalDrivesandControl	3	-	-	3

LISTOFPROFESSIONAL CORE COURSES

CodeNo.	Course	Hours/Week			Credits
		Lecture	Tutorial	Practical	
22PCAU01	EngineeringThermodynamics	3	-	-	3
22PCAU02	AutomotiveEngines	3	-	-	3
22PCAU03	FluidMechanicsMachinery	3	-	2	4

22PCAU04	AutomotiveEngineComponentsLaboratory	-	-	2	1
22PCAU05	ElectronicsandMicroprocessorsLaboratory	-	-	2	1
22PCAU06	EngineeringMetallurgy	3	-	-	3
22PCAU07	AutomotiveFuelsand Lubricants	3	-	-	3
22PCAU08	AutomotiveChassis	3	-	-	3
22PCAU09	HeatandMassTransfer	3	-	2	4
22PCAU10	AutomotiveChassisComponentsLaboratory	-	-	2	1
22PCAU11	StrengthofMaterials Laboratory	-	-	2	1
22PCAU12	AutomotiveTransmission	3	-	-	3
22PCAU13	VehicleDesignDataCharacteristics	3	1	-	4
22PCAU14	ManufacturingProcessofAutomotive Components	3	-	2	4
22PCAU15	AutomotiveEngineComponentsDesign Laboratory	-	-	2	1
22PCAU16	PerformanceandEmissionTestingLaboratory	-	-	2	1
22PCAU17	Industrial Training/ Mini Project/ MOOC Course(NPTEL/SWAYAM/CourseEra/Math works)-Minimum4weeks	-	-	4	2
22PCAU18	TwoandThreeWheelers	3	-	-	3
22PCAU19	AutomotiveChassisComponentsDesign	3	1	-	4
22PCAU20	AutomotiveElectricalandElectronicsSystems	3	-	2	4
22PCAU21	MechatronicsLaboratory	-	-	2	1
22PCAU22	SummerInternship(4weeks)	-	-	4	2
22PCAU23	VehicleMaintenance	3	1	-	4
22PCAU24	VehicleMaintenance& Reconditioning Laboratory	-	-	2	1

LISTOFPROFESSIONALELECTIVECOURSES

CodeNo.	**Course**	**Hours/Week**			**Credits**
		Lecture	**Tutorial**	**Practical**	
22PEAU01	Vehicle Dynamics	3	-	-	3
22PEAU02	AutomotiveEngineComponentsDesign	3	-	-	3
22PEAU03	AutomotivePollutionandControl	3	-	-	3
22PEAU04	SimulationofI.CEngine Processes	3	-	-	3
22PEAU05	VehicleBodyEngineering	3	-	-	3
22PEAU06	SpecialTypesof Vehicles	3	-	-	3
22PEAU07	AlternativeFuelsandenergysystems	3	-	-	3
22PEAU08	FiniteElementAnalysis	3	-	-	3
22PEAU09	TransportManagement	3	-	-	3
22PEAU10	AutomotiveAerodynamics	3	-	-	3

22PEAU11	ModernAutomobileAccessories	3	-	-	3
22PEAU12	VibrationandNoiseControl	3	-	-	3
22PEAU13	AdvancedTheoryofI.C. Engines	3	-	-	3
22PEAU14	EngineandVehicleManagementSystem	3	-	-	3
22PEAU15	MetrologyandMeasurementsforAutomobile Engineers	3	-	-	3
22PEAU16	AutomotiveSafety	3	-	-	3
22PEAU17	OffRoad Vehicles	3	-	-	3
22PEAU18	AdvancedProductionProcessesforAutomotive Components	3	-	-	3
22PEAU19	Noise,VibrationandHarshness	3	-	-	3
22PEAU20	NewGenerationandHybridVehicles	3	-	-	3
22PEAU21	AutomotiveAir-Conditioning	3	-	-	3
22PEAU22	AutomotiveTesting	3	-	-	3

LISTOFOPENELECTIVE(TECHNICAL)COURSES

CodeNo.	**Course**	**Hours/Week**			**Credits**
		Lecture	**Tutorial**	**Practical**	
22GEAU01	ComputerIntegratedManufacturingSystems	3	-	-	3
22GEAU02	HydraulicandPneumatic Systems	3	-	-	3
22GEAU03	DesignofMachineElements	3	-	-	3
22GEAU04	WasteHeatRecoveryandCo-Generation	3	-	-	3
22GEAU05	DesignandAnalysisof Composites	3	-	-	3
22GEAU06	ComputationalFluidDynamics	3	-	-	3
22GEAU07	MetrologyandInstrumentation	3	-	-	3
22GEAU08	CompositeMaterials& Structures	3	-	-	3
22GEAU09	DesignofJigs,FixturesandPressTools	3	-	-	3
22GEAU10	Robotics	3	-	-	3
22GEAU11	Superchargingand Scavenging	3	-	-	3
22GEAU12	MechanicsofMachines	3	-	-	3

LISTOFOPENELECTIVE(MANAGEMENT)COURSES

CodeNo.	**Course**	**Hours/Week**			**Credits**
		Lecture	**Tutorial**	**Practical**	
22OEAU01	PrinciplesofManagementandProfessional Ethics	3	-	-	3
22OEAU02	TotalQualityManagement	3	-	-	3
22OEAU03	QualityControlandReliabilityEngineering	3	-	-	3
22OEAU04	SupplyChainManagement	3	-	-	3

22OEAU05	OperationsResearch	3	-	-	3
22OEAU06	EnergyAuditandEnergyConservation Methods	3	-	-	3
22OEAU07	EntrepreneurshipDevelopment	3	-	-	3
22OEAU08	ValueAnalysisandValueEngineering	3	-	-	3
22OEAU09	IndustrialMarketingandMarket Research	3	-	-	3
22OEAU10	DisasterManagement	3	-	-	3
22OEAU11	NewProduct Development	3	-	-	3

LISTOFEMPLOYABILITYENHANCEMENTCOURSES

CodeNo.	**Course**	**Hours/Week**			**Credits**
		Lecture	**Tutorial**	**Practical**	
22EEAU01	ProjectPhaseI	-	-	10	5
22EEAU02	ProjectPhaseII	-	-	20	10

LISTOFHUMANITIESANDSOCIALSCIENCESCOURSES

CodeNo.	**Course**	**Hours/Week**			**Credits**
		Lecture	**Tutorial**	**Practical**	
22ELAU01	English	2	-	-	2
22ELAU02	EnglishLaboratory	-	-	2	1
22HSPD01	PERSONALITYDEVELOPMENTI	2	-	-	2
22HSPD02	PERSONALITYDEVELOPMENTII	2	-	-	2
22HSPD03	PERSONALITYDEVELOPMENTIII	2	-	-	2
22HSPD04	PERSONALITYDEVELOPMENTIV	2	-	-	2

LISTOFMANDATORY COURSES

CodeNo.	**Course**	**Hours/Week**			**Credits**
		Lecture	**Tutorial**	**Practical**	
22MCAU01	ConstitutionofIndia	2	-	-	-
22MCAU02	UniversalHumanValues	2	-	-	-
22MCAU03	BasicLifeSkills	2	-	-	-
22MCAU04	GenderInstitutionandSociety	2	-	-	2

22ELAU01	ENGLISH	L	T	P	Credits
		2	0	0	2

Course Objective:

- Toacquireabilitytospeakeffectivelyinreallifesituations.
- Towritelettersandreportseffectivelyinformalandbusinesssituations.
- Todevelop listeningskillsforacademicandprofessional purposes.
- Togain effectivespeaking andlistening skillsin communication.
- Todevelopthesoftskillsandinterpersonalskillstoexcelintheircareer.
- ToenhancetheperformanceofstudentsatPlacementInterviews,GroupDiscussions and other recruitment procedures.

UNITIVOCABULARYBUILDING **08**

General Vocabulary – Nouns- Compound nouns, Synonyms, Antonyms, Prefixes and Suffixes,Homonyms, HomographsandHomophones,Changingwordsfromoneform to another, Acronyms and Abbreviations. -Instructions.

UNITIIBASICWRITING **08**

Sentences structures –Kinds of sentences, Types of sentences, Clauses and Phrases, Punctuations, Blending and Clipping, Framing questions- Yes/No types and "Wh" questions, Summarizing, Precise writing, Paragraph Writing.

UNITIIIIDENTIFYINGCOMMONERRORSINENGLISH **08**

Articles, Prepositions, Subject-verb Agreement, Pronouns - Relative pronouns, Demonstrative pronouns, Misplaced Modifiers, Redundancies, Clichés, Infinitives& Gerund, Checklist.

UNITIVNATUREANDSTYLEOFSENSIBLEWRITING **08**

Situational Dialogues, Process description, Definitions, Numerical Expressions, Recommendation, Information Transfer- Flow chart Bar chart and Pie chart, Writing introduction and conclusion.

UNITVWRITINGPRACTICES **08**

Active voice and Passive voice, ,Making negative sentences, Tenses, Letter Writing- Formal & Informal Letters, Report Writing- Letter Report, Accident Report, Investigation Report and Survey, Essay writing, Reading Comprehension Passages.

TOTAL -40 HOURS

TextBooks:

1. DepartmentofEnglish,AnnaUniversity,Mindscapes,'EnglishforTechnologistsand Engineers', Orient Longman Pvt. Ltd, Chennai: 2012.
2. Department of Humanities and Social Sciences, Anna University, 'English for Engineers andTechnologists'CombinedEdition(Volumes1and2),Chennai:OrientLongmanPvt. Ltd., 2006.

3. DepartmentofEnglish,AnnaUniversity,Mindscapes,'EnglishforTechnologistsand Engineers', Orient Longman Pvt. Ltd, Chennai: 2012.
4. DepartmentofHumanitiesandSocialSciences,AnnaUniversity,''EnglishforEngineers and Technologists'' Combined Edition (Volumes 1 and 2), Chennai: Orient Longman Pvt. Ltd., 2006.
5. M.AshrafRizvi,"EffectiveTechnicalCommunication",TataMcGraw-HillPublishing Company Limited, New Delhi.2009.

ReferenceBooks:

1. PracticalEnglishUsage.MichaelSwan.OUP.1995.
2. RemedialEnglishGrammar.F.T. Wood.Macmillan.2007
3. OnWritingWell.WilliamZinsser.HarperResourceBook.2001
4. StudyWriting.LizHamp-Lyonsand BenHeasly.CambridgeUniversityPress. 2006.
5. CommunicationSkills.SanjayKumarandPushpLata.Oxford UniversityPress.2011.
6. ExercisesinSpokenEnglish.Parts.I-III.CIEFL, Hyderabad.OxfordUniversityPress

Weblinks:

- https://ehlion.com/magazine/technical-english/
- https://www.kkcl.org.uk/pdf/KKCL_Technical_English_for_Engineers_Brochure.pdf

COURSEOUTCOMES:

Thestudentwillacquirebasicproficiencyin Englishincludingreadingandlistening comprehension, writing and speaking skills.

CO1:	Improve the language proficiency of a technical under-graduate InEnglishwithemphasisonLearn,Speak,ReadandWriteskills.	**K3**
CO2:	Developlisteningskillsforacademicandprofessional purposes.	**K5**
CO3:	Acquirethe abilitytospeakeffectivelyinEnglishinreallifesituations	**K5**
CO4:	Providelearningenvironmenttopracticelistening,speaking,readingand writing skills.	**K5**
CO5	Varietyofself-instructionalmodesoflanguagelearninganddeveloplearner autonomy	**K5**

22BSAU01	PHYSICS(IntroductiontoElectromagnetic Theory)	L	T	P	Credits
		3	0	0	3

Course Objectives

- Tolearnthebasicsofelectrostaticsinvacuum,linerdielectricmedium,magnetostaticsin a liner magnetic medium.
- Toapplythesefundamentalprinciplestoelectromagneticwaves.

UNITIElectrostaticsin vacuum **9**

General features of the Electrostatic interaction - Basic properties of charges - Coulomb's inverse square law - Super position principle – Gauss law and its application(intensity at a point due to charged sphere and cylinder) - Laplace's and Poisson's equations forelectrostatic potential -Equipotential surface - Potential at a point due to a point charge.

UNITIIElectrostaticsin alineardielectricmedium **9**

Electricdipole – Dipole moment -Potential energy ofadipole – Electric Field -Electric field lines - Electric field due to an electric dipole (axial point and equatorial line) – Dielectrics - Types ofdielectric -Dielectric constant- Electric susceptibility - Types of polarization mechanisms in dielectrics – Internal field (Lorentz method) – Clausius-Mosotti equation.

UNITIIIMagnetostaticsin alinearmagneticmedium **9**

Magnetic behaviours - Biot-Savart law - Magnetic induction at a point due to a straight conductor carrying current - Ampere's circuital law - Field along the axis of a circular coil - Solenoid - Intensity of magnetisation - Magnetic susceptibility - Magnetic permeability - Classification of magnetic material - Domain theory of ferromagnetism – B-H curve.

UNITIVFaraday'slawandMaxwell'sequation **9**

Faraday's law - Differential form of Faraday's law - Self and mutual inductance - Self-inductance of a long solenoid- Experimental determination of self-inductance (Rayleigh's method) - Mutual inductance - Maxwell's equations and their derivation - Physical significance of Maxwell's equation.

UNITVElectromagneticwaves **9**

Wave equation - Plane electromagnetic waves in vacuum (transverse nature) - Relation between electric and magnetic fields of an electromagnetic wave - Energy carried by electromagneticwaves-Hertzexperiment:productionanddetectionofelectromagneticwave -Reflectionandtransmissionofelectromagnetic wavesatnormalincidence.

TOTAL:45 hours

TextBooks

T1: R.Murugeshan,Electricityand Magnetism,S.Chand&Co, 2017.

T2: TaiL.Chow,IntroductionToElectromagneticTheory:AModernPerspective,Laxmi Publications (2012)

ReferenceBooks:

R1: DavidGriffiths,IntroductiontoElectrodynamics,PearsonPublishers,(2015). R2: Halliday and Resnick, Physics, Wiley, (2015).

R3: Dr.WayneM.Saslow, Electricity,MagnetismandLight,AcademicPress,(2002)

WebLinks:

1. https://onlinecourses.nptel.ac.in/noc19_ph08/preview
2. https://onlinecourses.nptel.ac.in/noc19_mm16/preview
3. https://onlinecourses.nptel.ac.in/noc21_ee83/preview

COURSEOUTCOMES

Atthe end ofthis course the studentswill beable to,

CO1:	Analyzethe charges,Gausstheoremandtheirapplications.	**K3**
CO2:	Utilizethevarioustypesofpolarizationmechanismsin dielectrics.	**K5**
CO3:	Identifytheapplicationsofdielectric materials.	**K5**
CO4:	Selectthetypes ofmagneticmaterials and their applications.	**K5**
CO5:	Analyzethetheoretical aspectsofDomain theory of ferromagnetism.	**K5**

22BSAU02	MATHEMATICS-I (CalculusandLinearAlgebra)	L	T	P	Credits
		3	1	0	4

CourseObjectives:

- Explain the prospective engineers with techniques in calculus, multivariate analysis and linear algebra
- Develop the studentswithstandardconceptsandtoolsatanintermediatetoadvanced level

Unit-I: Calculus **12**

Rolle's theorem-Mean value theorems-Taylor's and Maclaurin theorems -Indeterminateforms and L'Hospital's rule-Curvature-radius of curvature – Evolutes and envelopes.

Unit-II:Multivariable Calculus **12**

Limits-continuity- partial derivative – total derivative – maxima and minima- saddle points- method of Lagrange multipliers.

Unit-III:Sequenceandseries **12**

Convergence of sequence and series – test for convergence- power series – Comparison test- Root test, D'Alembert's test andLeibnitz's test.

Unit-IV:Matrices **10**

Introduction to Matrices- Rank of matrix- Linear systems of equations-symmetric- skew symmetricmatrixandorthogonalmatrices-EigenvaluesandEigenvectorsDiagonalizationof matrices-Cayley-Hamilton theorem and orthogonal transformation.

Unit-V:Vectorspaces **14**

Vector Space- linear Independence and dependence of vectors, basis, dimension- Linear transformations (maps), range and kernel of a linear map, rank and nullity- Inner product spaces-Gram-Schmidt Orthogonalization.

TotalHours: 60

TEXTBOOKS:

T1: G.B.Thomasand R.L.Finney, Calculus and Analytic geometry, 9thEdition,Pearson,Reprint,2002.
T2: RamanaB.V., Higher Engineering Mathematics,Tata McGraw Hill New Delhi, 11,Reprint,2010
T3: N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

REFERENCEBOOKS:

R1: P. Sivaramakrishna Das and C. Vijayakumari, Mathematics-I, First Edition, Pearson India Education services Pvt. Ltd.

R2: Erwinkreyszig,AdvancedEngineeringMathematics,9th Edition,JohnWiley&Sons,2006. R3: Veerarajan T.,EngineeringMathematics for firstyear,TataMcGraw-Hill,NewDelhi,2008.

WEBLINK:

1. https://www.khanacademy.org/math/multivariable-calculus/applications-of-multivariable-derivatives/optimizing-multivariable-functions/a/maximums-minimums
2. https://www.geeksforgeeks.org/rolles-and-lagranges-mean-value-theorem/
3. https://home.iitk.ac.in/~arlal/MTH102/la.pdf

COURSEOUTCOMES:

Atthe end ofthe coursethestudents will beable to

CO1:	Applytheconceptofdifferentialcalculusandtoevaluatethecurvature, radius of curvature and envelope.	**K3**
CO2:	Evaluatetheconceptoflimits, continuityandtoevaluatederivatives.	**K5**
CO3:	Analyze the convergence of the series using root test, D'Alembert's test, Leibnitz'stest	**K5**
CO4:	Determine the concept of limits, continuity and to evaluate derivativeswithfunctionsofseveralvariablesthatisessentialinmost branchesofengineering.	**K5**
CO5:	Evaluatethelinearindependenceanddependenceofvectors,lineartransformations and inner product space.	**K5**

22ESAU01	BASICELECTRICALANDELECTRONICS ENGINEERING	L	T	P	Credits
		3	0	0	3

Course Objectives

- Toobtainbasicknowledgeonelectricalquantitiessuchascurrent,voltage,powerand energy.
- To provide employability skill of adequate working knowledge on basic DC and AC circuitsusedin electrical and electronic devices. Tounderstand theworkingprinciple, construction, applications of DC machines, AC machines & measuring instruments.

UNITI DCCircuits 12

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, Mesh and Nodal analysis, Analysis of simple circuits with dc excitation, Wye↔Delta Transformation, Superposition, Thevenin and Norton Theorems.

UNITII ACCircuits 12

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNITIII Transformers 12

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNITIV ElectricalMachines&PowerConverters 12

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Construction of Single phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. DC-DC buck and boost converters, duty ratio control. Single phase Bridge Rectifier, Single Phase voltage source inverters.

UNITV Basicsof Electronics 12

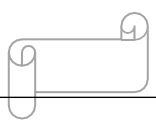
Intrinsic semiconductors, Extrinsic semiconductors – P-type and N-type, P-N junction, VI Characteristics of PN junction diode, Zener effect, Zener diode, Zener diode Characteristics. Binary Number System — Boolean Algebra theorems– Logic gates- Introduction to sequential Circuits– Flip-Flops.

TOTAL: 60 hours

TextBooks:

T1:1.D.P.KothariandI.J.Nagrath,"BasicElectricalEngineering",TataMcGrawHill, 2010.

T2:2.D.C. Kulshreshtha,"BasicElectricalEngineering",McGrawHill, 2009.



T3:JohnBird,“ElectricalCircuittheoryandtechnology”,Routledge;5thedition,2013

ReferenceBooks:

R1:3.L.S.Bobrow,“FundamentalsofElectricalEngineering”,OxfordUniversityPress, 2011.

R2:4. E. Hughes,“Electricaland Electronics Technology”, Pearson,2010.

R3:5.V.D.Toro,“ElectricalEngineeringFundamentals”,PrenticeHallIndia,1989Text book 1

WebLinks:

1. https://www.electricaltechnology.org/category/basic-electrical-fundamentals
2. https://www.electrical4u.com/electrical-engineering-articles/basic-electrical/

COURSEOUTCOMES

CO1:	UnderstandandanalyseDCcircuits	**K2**
CO2:	UnderstandandanalyseACcircuits	**K2**
CO3:	Explaintheconstruction,operationandcharacteristicsoftransformerandclassifythe types of three –phase transformer connections.	**K3**
CO4:	UnderstandandExaminethevariouselectricalmachinesandconvertercircuits	**K2**
CO5:	Identifythebasicsofelectronics	**K3**

22ESAU02	ENGINEERINGGRAPHICSANDDESIGN	L	T	P	Credits
		1	0	4	3

Course Objectives

- Tofamiliarizethestudentsinbasicconceptofconicsections,projectionsand developments of objects.
- Todeveloptheimaginationanddrafting skillsofstudents andpictorial projections.

UNITI DIMENSIONINGAND GEOMETRICALCONSTRUCTION 12

BIS - Lettering - Two systems of dimensioning, Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid, Epicycloid, Hypocycloid – construction of involutes of squad and circle – Drawing of tangents and normal to the above curves.

UNITII PROJECTIONOFPOINTS,LINES ANDPLANESURFACES 12

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

UNITIII PROJECTIONOF SOLIDS 12

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

UNITIV SECTIONOFSOLIDSANDDEVELOPMENTOF SURFACES 12

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

UNITV ORTHOGRAPHICPROJECTIONANDISOMETRIC PROJECTION 12

General principles of orthographic projection – Need for importance of multiple views and their placement - layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects. Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.

TOTAL : 60 hours

TextBooks:

T1.BhattN.D.andPanchalV.M.,—EngineeringDrawing,CharotarPublishingHouse,50th Edition, 2010.
T2.ParthasarathyN.S.andVelaMurali,—EngineeringDrawing,OxfordUniversityPress, New Delhi, 1 stEdition, 2015

ReferenceBooks:

R1:NatarajanK.V.,—AtextbookofEngineeringGraphics,DhanalakshmiPublishers, Chennai, 31st Edition, 2018.

R2:BasantAgrawalandAgrawalC.M.,—EngineeringDrawing,TataMcGrawHill Publishing Company Limited, New Delhi, 2nd Edition, 2013.

WebLinks:

1. https://nptel.ac.in/courses/112103019
2. https://alison.com/course/diploma-in-engineering-drawing-and-computer-graphics

COURSEOUTCOMES

CO1:	Sketchthedrawingstandards,conventionsandpracticesin engineering drawing	**K1**
CO2:	Drawtheorthographic projectionsofpoints, straightlinesand plane surfacesforsolvingsomeoftheengineeringproblemsinday-to-day applications.	**K1**
CO3:	Sketchtheorthographicprojectionsforthepoints,straightlinesor solids using the change of position method.	**K1**
CO4:	Drawprojectionsofsectionedsolidsanddevelopmentoflateral surfaces and apply the concept to simple sheet metal work.	**K6**
CO5:	Drawtheisometricprojectionsforthegivensolidsandcombination of solids using box method and create 3D models	**K6**

22ELAU02	ENGLISH LABORATORY	L	T	P	Credits
		0	0	2	1

Course Objectives

- Toenablethestudent toexplorethe knowledgeincommunication skills.
- To gain knowledge in the process ofPlacement Interviews, Group Discussions andother recruitment procedures.

List ofExperiments **40**

1. IntroductiontoEnglishsounds
2. Consonantsand vowels
3. SyllableandStress
4. Intonation
5. Communication Skills
6. Summarizing
7. ReportWriting
8. InformationTransfer
9. PresentationSkills
10. Group Discussion
11. LetterWriting
12. Coverletterand Resume

TextBooks:

1. DepartmentofEnglish,AnnaUniversity,Mindscapes,'EnglishforTechnologistsand Engineers', Orient Longman Pvt. Ltd, Chennai: 2012.
2. M.AshrafRizvi,"EffectiveTechnicalCommunication",TataMcGraw-HillPublishing Company Limited, New Delhi.2009.

ReferenceBooks:

1. PracticalEnglishUsage.MichaelSwan.OUP.1995.
2. CommunicationSkills.SanjayKumarandPushpLata.Oxford UniversityPress.2011.
3. ExercisesinSpokenEnglish.Parts.I-III.CIEFL, Hyderabad.OxfordUniversityPress

Weblinks:

- https://onlinemasters.ohio.edu/blog/engineering-communication/
- https://online.rice.edu/courses/communication-skills-for-engineers-specialization

Course Outcome

CO1:	Distinguishvariouslistening&writtencontextsforunderstanding the implied meanings and responding to them accordingly.	**K3**
CO2:	Useappropriatepronunciationandrhythmofspokenlanguagein Oral communication.	**K5**
CO3:	Draftandinterpretthewrittencommunicationinofficialcontextslike narrative, descriptive, creative, critical and analytical reports.	**K5**
CO4:	Inferimpliedmeaningsofdifferentgenresoftextsandcritically analyze and evaluate them for ideas, as well as for method of Oral presentation.	**K5**
CO5:	Makeuseofsuitablecommunicativestrategiestoexpresstheirpointof views convincingly in any type of discussions, negotiation and conversations.	**K5**

22BSAU03	PHYSICS LABORATORY	L	T	P	Credits
		0	0	2	1

Course Objectives

- ToenablethestudenttoexplorethefieldofElectromagnetism andPropertiesofMatter.
- To gain knowledge in the scientific methods and learn the process of measuring different Physical variables.

Any EightExperiments

1. DeterminationofRigidityModulus–Torsionalpendulum
2. Determinationofwavelengthandparticlesizeusinglaser
3. UltrasonicInterferometer
4. Determinationofbandgap ofasemiconductor material
5. Hooke'slaw–Determinationofspring constant
6. DeterminationofYoung'sModulus –UniformBending
7. DeterminationofYoung'sModulus –NonUniformBending
8. DeterminationofViscosityof aliquid-Poiseuille'smethod
9. Spectrometer–Grating
10. DeflectionMagnetometer -TanAposition
11. DeflectionMagnetometer -TanBposition
12. Potentiometer-Calibrationoflowrange Voltmeter

TextBooks:

T1: C. C. Ouseph, U. J. Rao, V. Vjiayendran, Practical Physics, 1st Edition,
T2: 2015.BiswajitSaha,PracticalPhysicsBook,LAPLAMBERTAcademicPublishing,1st Edition, 2020.

ReferenceBooks:

R1: G.L.Squires,PracticalPhysics,4thEdition,CambridgeUniversityPress,2001.
R2: D.Chattopadhyay,P.C.Rakshit,B.Saha,"AnAdvancedCourseinPractical Physics", 2nd ed., Books & Allied Ltd., Calcutta, 1990.

WebLinks:

1. http://amrita.olabs.edu.in/?sub=1&brch=5&sim=155&cnt=2
2. https://vlab.amrita.edu/index.php?sub=1&brch=280&sim=1509&cnt=4

COURSEOUTCOMES

Atthe endofthiscoursethestudents willbe able to,

CO1:	Constructacircuitforvoltmetercalibration.	**K3**
CO2:	Analyzethemagneticmomentsusingdeflection magnetometer.	**K5**
CO3:	Measurethewavelengthand bandgap ofthegiven materials.	**K5**
CO4:	Determine the compressibility of the liquid using ultrasonic interferometer.	**K5**
CO5:	Measurethe Young'smodulus ofthegivensolid materials.	**K5**

22ESAU03	BASICELECTRICALANDELECTRONICS ENGINEERING LABORATORY	L	T	P	Credits
		0	0	2	1

CourseObjectives

- ToprovidecomprehensiveideaaboutACandDCcircuitanalysis,workingprinciples and applications of basic machines in electrical engineering.
- ToexposethestudentstolearnexperimentalskillsaboutTransformers,DCMotor,Converters.

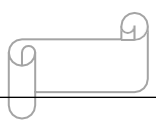
LIST OF EXPERIMENTS

1. Basicsafetyprecautions.Introductionanduseofmeasuringinstruments–voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. SinusoidalsteadystateresponseofR-L,andR-Ccircuits–impedancecalculationand verification.
3. Loading of a transformer: measurement of primary and secondary voltages and currents,and power
4. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).
5. LoadCharacteristicsof aDC Motor
6. Torque-SlipCharacteristicofan Inductionmotor
7. Threephaseinductionmotors–Directionreversalbychangeofphase-sequenceof connections.
8. DemonstrationofDC-DC Converter.
9. DemonstrationofDC-AC converter.
10. DemonstrationofAC-DC converter.

TOTAL: 30 h

COURSEOUTCOMES

CO1:	Understandthebasicsafetyprecautionsandlearntomakeuseofmeasuring instruments	**K2**
CO2:	AnalyzethesteadystateresponseofR-L,R-C circuits	**K3**
CO3:	Experiment with loading of transformer to measure the primary and secondaryvoltages,currentsandpowerandclassifythedifferenttypesof transformer connections	**K3**
CO4:	UnderstandandExperimentwithsinglephaseinductionmotorandthree phase induction motor	**K2**
CO5:	DemonstrateDC-DC,DC-ACandAC-DCconverters	**K4**



22MCAU01	CONSTITUTION OF INDIA	L	T	P	Credits
		2	0	0	0

COURSEOBJECTIVES:

1. Thepurposeofthecourseistoacquaintthestudentswithbasicprinciplesofthe Constitution of India and its working.
2. Tohelpstudentsbefamiliarwiththehistoricalandsignificantaspectsofthe constitution of India.
3. Tomakestudents awareoftheir fundamentaldutiesand rights.
4. Toknowaboutcentralandstategovernmentfunctionalitiesin India.

UNITI NATURE,OBJECT ANDSCOPE OFTHE CONSTITUTION 6

Nature, object and scope of Constitutional Law and Constitutionalism – HistoricalPerspective of the Constitution of India – Salient Features and Characteristics of Constitution of India.

UNITIIFUNDAMENTALRIGHTS 6

Nature and scope of Fundamental Rights – Scheme of Fundamental Rights – Right to Equality – Right to Freedom of Speech and Expression – Right to Life – Right against Exploitation – Right to Religious Freedom – Minority Rights.

UNIT III DIRECTIVE PRINCIPLES OF STATE POLICY AND FUNDAMENTAL DUTIES 6

Directive Principles of State Policy – Importance and Implementation – Scheme of Fundamental Duties and its Legal Status.

UNITIV FEDERAL STRUCTURE 6

Federal Structure – Distribution of Legislative and Financial Powers between the Union and the States – Parliamentary Form of Government in India – Constituent Powers and Status of the President of India.

UNITVAMENDMENTANDEMERGENCY PROVISIONS 6

Amendment of the Constitution – Procedure – Historical Perspective of the Constitutional Amendments in India – Emergency Provisions – National Emergency – President Rule – Financial Emergency – Local Self Government – Constitutional Scheme in India.

TOTAL: 30 h

TEXT BOOKS:

1. V.N.Shukla,ConstitutionalLawofIndia
2. D.D.Basu, Commentaryonthe Constitution ofIndia
3. J.N.Pandey,Constitutionof India
4. DurgaDasBasu,"IntroductiontotheConstitutionofIndia",PrenticeHallofIndia, New Delhi.
5. R.C.Agarwal,(1997) "IndianPoliticalSystem",S.ChandandCompany,New Delhi.
6. MaciverandPage,"Society:AnIntroductionAnalysis",MacMilanIndiaLtd.,New Delhi.

7.K.L.Sharma,(1997)“SocialStratificationinIndia:IssuesandThemes”,Jawaharlal Nehru University, New Delhi.

REFERENCESBOOKS:

1. V.D.Mahajan,ConstitutionalLawofIndia
2. H.M.Seervai,Constitutionof India
3. Sharma,BrijKishore,“IntroductiontotheConstitutionofIndia:,PrenticeHallof India, New Delhi.
4. U.R.Gahai,“IndianPoliticalSystem“,NewAcademicPublishingHouse,Jalaendhar.
5. R.N.Sharma,“IndianSocialProblems“, MediaPromotersandPublishersPvt.Ltd.

Weblink:

1. https://legislative.gov.in/constitution-of-india

COURSEOUTCOMES:

CO1:	Elaboratethe constitutionofIndiaanditssalientfeatures	K2
CO2:	Knowthe fundamental rights and duties	K2
CO3:	DiscusstheParliamentary FormofGovernment in India.	K2
CO4:	RecognizetheDirective PrinciplesofStatePolicy.	K3
CO5:	Understandandabidetherulesoftheconstitutionandto appreciate different culture among the people.	K3

22BSAU04	CHEMISTRY	L	T	P	Credits
		3	0	0	3

CourseObjectives

- Tolearnabout themolecularorbitals,ionic interactions andperiodicproperties.
- Rationalize periodic properties such as ionization potential, electro negativity, oxidation states and electro negativity.
- Listmajorchemical reactionsthat areused inthesynthesisofmolecules.

UNITIAtomicandmolecularstructure,Intermolecularforces andpotentialenergysurfaces **9**

Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene, benzene and aromaticity. Valence Bond Theory and the energy level diagrams for transition metal ions and their magnetic properties. Ionic, dipolar and van Der Waals interactions, potential energy surfaces of H_3, H_2F and HCN.

UNITIISpectroscopic techniquesandapplications **9**

Principles of spectroscopy and selection rules. Electronic spectroscopy. Vibrational,rotational spectroscopy of diatomic molecules, Morse equations and Mossbauerspectroscopy. Applications. Diffraction and scattering

UNITIIIUseoffree energyin chemical equilibria **9**

Thermodynamic functions: energy, entropy, free energy and fugacity. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion.

UNITIVPeriodicproperties **9**

Variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, diagonal relationship, anomalous behaviour of Lithium, carbon and Nitrogen, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

UNITVOrganicreactionsandsynthesisofadrugmolecule **9**

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization, coupling reaction and ring openings. Synthesis of a commonly used drug molecule.

TOTAL:45 hours

TextBooks

T1: Chemistry:PrinciplesandApplications,byM.J.SienkoandR.A.Plane. T2: Fundamentals of Molecular Spectroscopy, by C. N. Banwell.

T3: EngineeringChemistry(NPTELWeb-book),byB.L.Tembe,KamaluddinandM.S. Krishnan.

ReferenceBooks

R1: PhysicalChemistry,byP.W.Atkins.

R2: OrganicChemistry:StructureandFunctionbyK.P.C.VolhardtandN.E.Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp.

R3: Universitychemistry,byB.H. Mahan.

WebLinks:

1. https://opentextbc.ca/chemistry/chapter/10-1-intermolecular-forces/
2. https://nptel.ac.in/content/storage2/courses/102103044/pdf/mod2.pdf
3. https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Thermodynamics/Chemical_Energetics/Free_Energy_and_Equilibrium
4. https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Supplemental_Modules_and_Websites_(Inorganic_Chemistry)/Descriptive_Chemistry/Periodic_Trends_of_Elemental_Properties/Periodic_Properties_of_the_Elements
5. https://www.bcebhagalpur.ac.in/wp-content/uploads/2020/03/Organic-Reactions-Synthesis-of-Drug-Molecule.pdf

COURSEOUTCOMES

Atthe endofthiscourse thestudents willbeable to,

CO1:	Analyzemicroscopicchemistryintermsofatomicand molecular orbitals and intermolecular forces.	**K3**
CO2:	Distinguishtherangesoftheelectromagneticspectrumused for exciting different molecular energy levels in various spectroscopictechniques.	**K5**
CO3:	Analyzebulkpropertiesandprocessesusing thermodynamic considerations.	**K5**
CO4:	Classifythepropertiesandreactivityofdifferenttypesof elements based on the periodic table.	**K5**
CO5:	ApplythebasictermsinvolvedinanOrganicreactionsand synthesis of a drug molecule.	**K5**

22BSAU05	MATHEMATICS-II (Calculus,OrdinaryDifferentialEquations and Complex Variable)	L	T	P	Credits
		3	1	0	4

CourseObjective:

- To learn deal with advanced level of mathematics and applications that would beessential for their disciplines.
- Tointroducethefundamentalideasofthefunctionsofcomplexvariablesand developing a clear understanding of fundamental concepts of Complex Analysis.

UNITI:MULTIVARIABLECALCULUS(INTEGRATION) 12

Multiple Integration: Double integrals (Cartesian)-change of order of integration in double Integrals-Change of variables (Cartesian to polar) - Triple integrals (Cartesian)-orthogonal Curvilinearcoordinates-Green,GaussandStokestheorems(statementonly)-Simpleproblems

UNITII: FIRSTORDER ORDINARYDIFFERENTIAL EQUATIONS 12

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

UNITIII:ORDINARY DIFFERENTIALEQUATIONSOFHIGHERORDER 12

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials,

UNITIV:COMPLEX VARIABLE–DIFFERENTIATION 12

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

UNITV:COMPLEX VARIABLE-INTEGRATION 12

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula without proof)-Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues,Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.

TotalHours: 60 Hours

TextBooks:

T1:G.B.ThomasandR.L.Finney,CalculusandAnalyticgeometry,9th Edition,Pearson, Reprint, 2002.

T2:S.L.Ross,Differential Equations,3rd Edition,Wiley dia1984.

T3:E.A.Coddington,AnIntroductiontoOrdinary DifferentialEquations, PrenticeHall India, 1995.

T4:N.P.BaliandManishGoyal,AtextbookofEngineeringMathematics,Laxmi Publications, Reprint, 2008.

T5:B.S.Grewal,HigherEngineeringMathematics,KhannaPublishers,36thEdition, 2010.

ReferenceBooks:

R1: Erwin kreyszig,AdvancedEngineeringMathematics,9thEdition,JohnWiley&Sons, 2006.
R2:E.L.Ince,OrdinaryDifferentialEquations,DoverPublications,1958.
R3:J.W.BrownandR.V.Churchill,ComplexVariablesandApplications,7th Edition.Mc- Graw Hill, 2004.
R4:W.E.BoyceandR.C.DiPrima,ElementaryDifferentialEquationsandBoundary Value Problems, 9thEdn. Wiley India, 2009.

WebLinks:

1. https://nptel.ac.in/courses/111105134
2. https://nptel.ac.in/courses/111108081
3. https://nptel.ac.in/courses/111106100
4. https://nptel.ac.in/courses/111107111
5. https://nptel.ac.in/courses/111103070

COURSEOUTCOMES:

Atthe end ofthe coursethestudents will be able to

CO1:	Applyintegralcalculustoimproperintegrals.	**K3**
CO2:	Analyzethe ApplicationsofDifferentialequationsinengineering	**K4**
CO3:	Extendtheordinarydifferentialequationforlearningadvanced Engineering Mathematics.	**K2**
CO4:	Create the functions of several variables that is essential in most branchesof engineering.	**K6**
CO5:	Decidetheessentialtoolofcomplexvariable(Integration)inengineering.	**K5**

22ESAU04	PROGRAMMINGFORPROBLEMSOLVING	L	T	P	Credits
		3	0	0	3

Course Objectives

- Tounderstandthebasicconceptsofprogramming– Flowchart,Pseudocode.
- TolearnthefundamentalsofCprogramming-declarations,operators,expressionsand control statements.
- Tolearnthemanipulationof strings,functions,pointers andfile operations.
- Tounderstandtheconceptsof arrays,basicsortingandsearching algorithms.
- Tofindtheorderoftimecomplexityofbasic algorithms

UNITI INTRODUCTIONTO PROGRAMMING 9

IntroductiontoProgramming(Flowchart/pseudocode,compilationetc.), Variables(including datatypes),Input/Output-Arithmeticexpressionsandprecedence,ConditionalBranchingand Loops -Writing and evaluation of conditionals and consequent branching - Iteration and loops

UNITII ARRAYSANDBASICALGORITHMS 9

Arrays(1-D,2-D),CharacterarraysandStrings,Searching,BasicSortingAlgorithms,Finding rootsofequations,Notion oforderoftimecomplexitythroughexampleprograms

UNITIII FUNCTIONSANDPOINTERS 9

Functions(includingusingbuiltinlibraries),Parameterpassinginfunctions,callbyvalue, Passing arraystofunctions:ideaofcallbyreference,Recursionwithexampleprogramssuchas FindingFactorial,Fibonacciseries,etc.Pointers-Definingpointers,UseofPointersinself- referential structures

UNITIV STRUCTURESANDUNIONS 9

Structures-DefiningstructuresandArrayofStructures,StructurescontainingPointers,Unions -Storageclasses:auto,static,extern,register –Dynamicmemoryallocation

UNITV STRINGFUNCTIONSANDFILES 9

Strings-library string functions, pointers in strings, pointers and function arguments,Files -file Operations,processingafile,Preprocessordirectives,useoftypedef,Commandlinearguments, Enumerated data types.

TOTAL: 45 hours

Text Books:

T1:E.Balaguruswamy,“ProgramminginANSIC”,TataMcGraw-Hill

T2:ByronGottfried,“Schaum'sOutlineofProgrammingwithC”,McGraw-Hill

ReferenceBooks:

R1:BrianW.KernighanandDennisM.Ritchie,“TheCProgrammingLanguage”, PrenticeHall of India

R2:YashavantKanetkar, “Let Us C”, BPB Publications

R3:Ashok.N.Kamthane,“ComputerProgramming”,PearsonEducation(India)

WebLinks:

W1.https://www.edx.org/course/c-programming-getting-started

COURSEOUTCOMES

CO1	Constructapictorialrepresentationwithastepwiseprocedureforsolving complex Problems	**K3**
CO2	Developa highlevelprogramming codeusingclanguages	**K3**
CO3	Evaluatethe variousfunctional operationsforsolving problem	**K5**
CO4	Makeuseofvariouscoperationslikearray,pointer,stringsandsearching method	**K3**
CO5	DevelopaC modulefor agiven setof instruction	**K6**

22ESAU05	ENGINEERINGMECHANICS	L	T	P	Credits
		3	0	0	3

CourseObjectives

- At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions.
- Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium.
- He should be able to understand the laws of motion, the kinematics of motion and the interrelationship. He should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

UNITI BASICSANDSTATICSOFPARTICLES 12

Introduction–UnitsandDimensions–LawsofMechanics–Lame'stheorem,Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNITII EQUILIBRIUMOF RIGID BODIES 12

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon'stheorem– EquilibriumofRigidbodiesintwodimensions– EquilibriumofRigid bodies in three dimensions – Examples.

UNITIII PROPERTIESOFSURFACESANDSOLIDS 12

Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow sectionbyusingstandardformula–secondandproductmomentsofplanearea–Rectangle, triangle,circlefromintegration–Tsection,I section,Anglesection,Hollowsectionbyusing

standard formula – Parallel axistheorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moments of inertia.

UNITIV DYNAMICSOFPARTICLES 12

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

UNITV FRICTIONANDELEMENTSOFRIGIDBODYDYNAMICS 12

Frictionalforce–LawsofCoulombfriction–simplecontactfriction–Rollingresistance–
Belt friction. Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

TOTAL:60 Hours

COURSEOUTCOMES:

After successful completion of the Engineering Mechanics course, the students have the ability to

CO1: ToSolveengineeringproblemsdealingwithforce,displacement,velocityand acceleration.

CO2: Toevaluateproblemsonequilibriumofrigid bodies.

CO3: Todeterminetheareasand volumesof surfaceand solids.

CO4: Toexplaindynamicsofparticlesandtheir relationshipsbetweenmotions.

TEXT BOOKS:

1. Beer,F.PandJohnsonJr.E.R."VectorMechanicsforEngineers",Vol.1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, 1997.
2. Rajasekaran. S, Sankarasubramanian. G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., 2000.

REFERENCEBOOKS:

1. Hibbeller,R.C.,"EngineeringMechanics",Vol.1Statics,Vol.2Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
2. Palanichamy, M.S., Nagam, S., "Engineering Mechanics – Statics and Dynamics", Tata McGraw-Hill, 2001.
3. Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", IV Edition – Pearson Education Asia Pvt. Ltd., 2003.

4. AshokGupta,“InteractiveEngineeringMechanics–Statics–AVirtualTutor (CDROM)”, Pearson Education Asia Pvt., Ltd., 2002.

WEBLINKS:

1. https://www.youtube.com/watch?v=LG0YzGeAFxk
2. https://archive.nptel.ac.in/courses/112/106/112106286/

22ESAU06	WORKSHOPANDMANUFACTURING PRACTICES	L	T	P	Credits
		1	0	4	3

COURSEOBJECTIVS:

1. Tostudybenchfittingdrawingsformakingmaleandfemalefittingsasperthegiven dimensions and Tolerances.
2. Tostudysheetmetaldevelopmentdrawingsformakingcommonmetal parts/components as per the given dimensions.

DETAILED CONTENTS:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods (3lectures)
2. CNCmachining, Additive manufacturing (1 lecture)
3. Fittingoperations&powertools (1 lecture)
4. Electrical&Electronics (1 lecture)
5. Carpentry (1 lecture)
6. Plasticmoulding, glass cutting (1 lecture)
7. Metalcasting (1 lecture)
8. Welding(arcwelding&gaswelding),brazing (1 lecture)

WORKSHOPPRACTICE:

1. **Machineshop** **9**

Machining: Basics of Machining Processes Equipment's, Simple turning ofcylindricalsurfaceonMSrodusinglathemachinetool,TomakeFacingandplain turning, stepturning, drilling in the lathe

2. **Fittingshop** **9**

To make square, V joint in bench fitting as per the given dimension and tolerances, Tools and demonstration of producing model

3. **Carpentry** **9**

Basics of Carpentry operations, Equipment's ,To make half lap joint, dovetail, TEE Lap joint ,Cross halving joint of two wooden pieces at perpendicular direction

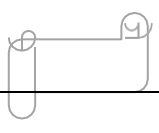
4. **Weldingshop** **9**

To make single, butt, lap and T fillet joint by arc welding with the back hand and fore hand welding techniques as per the given dimensions. To make simple Dust pan, Rectangular trays in sheet metal with the jigs as per the given Dimensions.

5. **Plumbing Works** **9**

Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings. Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

TOTAL:45 hours



TEXT BOOKS:

1. JeyachandranK.,NatarajanS.&BalasubramanianS.,APrimeron Engineering PracticesLaboratory, Anuradha Publications, 2007

2. Jeyapoovan T., Saravanapandian M. & Pranitha S., Engineering Practices Lab Manual,Vikas Publishing House Pvt.Ltd, 2006.

REFERENCEBOOKS:

1. BawaH.S.,WorkshopPractice,TataMcGraw, 2007.

2. RajendraPrasadA.&SarmaP.M.M.S.,WorkshopPractice,SreeSai Publication, 2002

WEBLINKS:

1. https://www.youtube.com/watch?v=GweENcDLvIE
2. https://www.youtube.com/watch?v=ZyN9Tw9VTSo
3. https://www.youtube.com/watch?v=PkjpmPLNKZs

COURSEOUTCOMES

CO1:	Experimentwithfacing,Turningandvarioustypesoffittingjoint	**K 1**
CO2:	Developthehalflap joint, TEELap jointcarpentry and welding.	**K 5**
CO3:	Practicecasting, moulding, & smithy trades	**K 2**
CO4:	DevelopmentsofsheetmetaljobsfromGIsheets,knowledgeofbasic concepts ofsoldering	**K 5**
CO5:	MakeaBasicpipeconnectionsforMixedpipematerialconnectionand Pipe connections with different joining components	**K 1**

22BSAU06	CHEMISTRY LABORATORY	L	T	P	Credits
		0	0	2	1

Course Objectives

- Thechemistrylaboratorycoursewillconsistofexperimentsillustratingthe principles of chemistry relevant to the study of science and engineering.
- Thestudents willlearn to:
- Estimate rate constants of reactions from concentration of reactants/products as a function of time.
- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
- Synthesizeasmall drugmolecule.

Any EightExperiments

1. Determinationoftherateconstantofareaction.
2. Determinationofthepartitioncoefficientofasubstancebetweentwoimmiscible liquids.
3. Determinationofsurface tensionandviscosity.
4. Thinlayerchromatography.
5. Determinationofchloridecontentinwater.
6. Determinationofcellconstant andconductanceof solutions.
7. Synthesis of a polymer/drug.
8. Determinationofsaponification/acidvalueof anoil.
9. Determinationofredoxpotentials andemf byPotentiometric method.
10. Estimatetheadsorptionofacetic acidbycharcoal.

Total:30hours

TextBooks

T1: S. Sundaram and K. Raghavan "Practical Chemistry", S. Viswanathan. Co. 3rd edition 2011.
T2: Gnanaprakasam,Ramamurthy,"OrganicChemistryLabManual"S.Viswanathan Pvt. Ltd. 3rd edition 2011.

ReferenceBooks

R1: Vogel's – "Textbook of qualitative organic Analysis", Longmann, 12th edition, 2011 R2: J. N.Gurtuand R. Kapoor"Advanced experimental Chemistry", S. Chand and Co. 6th edition,2010.

WebLinks

1. https://www.khanacademy.org/science/ap-chemistry-beta/x2eef969c74e0d802:kinetics/x2eef969c74e0d802:introduction-to-rate-law/v/experimental-determination-of-rate-laws
2. https://www.youtube.com/watch?v=qdmKGskCyh8
3. https://www.youtube.com/watch?v=7_6_dKlo67k

COURSEOUTCOMES

Atthe endofthiscoursethestudents willbeable to,

CO1:	Estimatetherateconstantsofreactionsandpartitioncoefficientof immiscible Liquids.	**K3**
CO2:	Findtheviscosityand to testthepurityof thecompound.	**K5**
CO3:	Estimate the amount of chlorine content present in drinking water and to know the conductance of a solution.	**K5**
CO4:	Developasmall drugmolecule andtoknow thesaponification ofan oil.	**K5**
CO5:	FindouttheunknownelementbyPotentiometricmethodandto removesomeofthetoxic chemicalbycharcoal method.	**K5**

22ESAU07	PROGRAMMINGFORPROBLEMSOLVING LABORATORY	L	T	P	Credits
		0	0	2	1

Course Objective:

- TodesignanddevelopCProgramsforvarious applications

LIST OF EXPERIMENTS:

1. Familiarizationwithprogramming environment
2. Simplecomputationalproblemsusingarithmetic expressions
3. Problemsinvolvingif-then-elsestructures
4. Iterativeproblems
5. 1DArray manipulation
6. Matrixproblems
7. String operations
8. Simple functions
9. SolvingNumericalmethodsproblems 10
.Recursive functions
11. Pointersandstructures
12. Fileoperations

Total:30 h

TextBooks:

T1:E.Balaguruswamy,“ProgramminginANSIC”,Tata McGraw-Hill
T2:ByronGottfried,“Schaum'sOutlineofProgrammingwithC”,McGraw-Hill

ReferenceBooks:

R1:BrianW.KernighanandDennisM.Ritchie,“TheCProgramming Language”,PrenticeHall of India
R2:YashavantKanetkar, “Let Us C”, BPB Publications
R3:Ashok.N.Kamthane,“ComputerProgramming”,Pearson Education (India)

WebLinks:

W1.https://www.edx.org/course/c-programming-getting-started

COURSEOUTCOMES

CO1:	DetermineheadvancedfeaturesoftheC language	**K5**
CO2:	Developthemodeldatausingprimitiveandstructuredtypes.	**K5**
CO3:	ConstructprogramsthatdemonstrateeffectiveuseofCfeaturesincluding arrays, structures, pointers and files.	**K4**
CO4:	Developstheabilitytoanalyzeaproblem,developanalgorithmtosolveit.	**K5**
CO5:	Develops the use of the C programming language to implement various algorithms,anddevelopsthebasicconceptsandterminologyofprogrammingin general.	**K6**

22MCAU02	UNIVERSALHUMAN VALUES	L	T	P	Credits
		2	0	0	0

Course Objectives:

- Developmentofaholisticperspectivebasedonself-explorationaboutthemselves(human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmonyin the human being,family,society and nature/existence
- Strengtheningofself-reflection.
- Developmentofcommitmentandcouragetoact.

UNIT ICourse Introduction - Need, Basic Guidelines, Content and Process for Value Education 6

Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basicHuman Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at variouslevels.

UNITIIUnderstandingHarmonyintheHumanBeing -HarmonyinMyself6

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understandingtheneeds ofSelf('I')and 'Body' -Sukh and Suvidha, Understanding theBody as an instrument of'I'(Ibeingthe doer,seer andenjoyer),Understandingthecharacteristicsandactivities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity indetail, Programstoensure Sanyam and Health

UNIT III Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship 6

Understandingharmony inthe Family-thebasicunit of humaninteraction , Understandingvaluesin human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*; Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship, Understanding the meaning of *Vishwas*; Difference between intention and competence, Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): *Samadhan*, *Samridhi*, *Abhay*, *Sah-astitva* as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (*AkhandSamaj*), Universal Order (*SarvabhaumVyawastha*)- from family to worldfamily!.

UNIT IV UnderstandingHarmony in the Nature and Existence - Whole existence as Co-existence 6

Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among thefour orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

UNITVImplicationsoftheaboveHolisticUnderstandingofHarmonyonProfessional Ethics **6**

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identifythescopeandcharacteristicsofpeople-friendlyandeco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.

Total 30hours

TextBooks:

1. Dr.RituSoryan,"UniversalHumanValuesandProfessionalEthics",S.K.Kataria&Sons.
2. R.R.Gaur,R.SangalandG.P.Bagaria,"AFoundationCourseinHumanValuesand Professional Ethics", Excel Books

ReferenceBooks:

1. Dr.SandhyaSrivastava,"UniversalHuman**V**alues&ProfessionalEthics",R.Narain & Co.

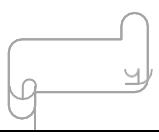
Web Links:

1. https://www.youtube.com/watch?v=P8sge0P3Ogg&list=PLWDeKF97v9SO0frdg mpaghDMjkom1eudx&index=4
2. https://www.youtube.com/watch?v=9rqRZ54woq4&list=PLWDeKF97v9SO8vvjC 1KyqteziTbTjN1So&index=3

Course Outcomes:

Oncompletionofthiscourse,thestudentswillbeable to

CO1:	Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society	**K3**
CO2:	Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.	**K5**
CO3:	Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society	**K5**



CO4:	Understandtheharmonyinnatureandexistence,andworkouttheir mutually fulfilling participation in the nature.	**K5**
CO5:	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.	**K5**

Text Books:

1. RRGaur,RSangal,GPBagaria,HumanValuesandProfessionalEthicsExcel Books, New Delhi, 2010

ReferenceBooks:

1. IvanIllich,1974,Energy&Equity,TheTrinityPress,Worcester,andHarper Collins,USA
2. E.F.Schumacher,1973,SmallisBeautiful:astudyofeconomicsasifpeople mattered, Blond & Briggs,Britain.
3. SussanGeorge, 1976,How theOtherHalf Dies,Penguin Press.Reprinted1986, 1991
4. DonellaH.Meadows,DennisL.Meadows,JorgenRanders,WilliamW.BehrensIII, 1972, Limits to Growth – Club of Rome's report, Universe Books.

22BSAU07	MATHEMATICS-III (FourierSeriesandTransforms)	L	T	P	Credits
		3	1	0	4

Course Objective:

- To learn the concept of Fourier series and Transforms for various functions in the giveninterval.
- ToSolve theboundary value problemsusing finiteand infinite transforms

UNITIFOURIER SERIES **12**

Dirichlet's conditions – Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Fourier Series and types of Harmonic analysis Complex form of Fourier Series-Parseval's identity – Harmonic Analysis.

UNITIIFOURIER TRANSFORM **12**

Fourierintegraltheorem(withoutproof)–Fouriertransformpair–FourierSineand Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNITIIIPARTIALDIFFERENTIAL EQUATIONS **12**

Formation of partial differential equations - singular integrals- Solutions of standard types of first order partial differential equations – Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of homogeneous functions.

UNITIVAPPLICATIONS OFPARTIAL DIFFERENTIAL EQUATIONS **12**

Classification PDE-Method of separation of variables – One dimensional wave equation and one dimensional heat equation of heat conduction – Steady state solution of two-dimensional heat equation of heat conduction (square plate only).

UNITVZ -TRANSFORMAND DIFFERENCE EQUATIONS **12**

Z-transform –Introduction- properties – Inverse Z-transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z- transform.

Total Hours:60Hours

TEXTBOOKS:

T1:Grewal.B.S,"HigherEngineeringMathematics",KhannaPublications,Delhi,43rd Edition, 2013.

T2:RamanaB.V,"HigherEngineeringMathematics",TataMcGrawHillPublishing Company, New Delhi, 6th reprint, 2008.

T3: SivaramakrishnaDas.P&Vijayakumari.C,A Text book of EngineeringMathematics- III

REFERENCE BOOKS:

R1: Bali.N.P.andManishGoyal'ATextbookofEngineeringMathematics',Laxmi Publications, 9th edition, 2011.

R2:ErwinKreyszig,"AdvancedEngineeringMathematics",WileyIndia,9thEdition, 2011.

R3:GlynJames,"AdvancedModernEngineeringMathematics",Pearsoneducation, 3rdEdition, 2012.

WebLinks:

1. https://nptel.ac.in/courses/111107098
2. https://nptel.ac.in/courses/111106046
3. https://nptel.ac.in/courses/111106111
4. https://www.youtube.com/watch?v=lkAvgVUvYvY
5. https://www.youtube.com/watch?v=1JnayXHhjlg

COURSEOUTCOMES

CO1:	DevelopFourierseriesfordifferenttypesoffunctions.	**K3**
CO2:	Analyzethetransformsforvarious functions.	**K4**
CO3:	Identify the basic concepts of Partial differential equations for solvingstandard Partial differential equations	**K3**
CO4:	Analyzethe heatflowproblems used in various situations.	**K4**
CO5:	Identifytheapplicationsofz-transformsanditspropertiesforvarious functions.	**K3**

22ESAU08	ELECTRICALDRIVESANDCONTROL	L	T	P	Credits
		3	0	0	3

CourseObjective:

- Tounderstandthebasicconceptsofdifferenttypesofelectricalmachinesandtheir performance.
- Tostudythedifferentmethodsofstartingofmotorsandits characteristics.

UNITI INTRODUCTION **9**

Fundamentals of electric drives – advances of electric drive-characteristics of loads – different typesofmechanical loads–choiceof anelectricdrive –control circuit components: Fuses,switches,circuit breakers, contactors, Relay – control transformers.

UNITIISPEEDCONTROLOFDCMACHINES **9**

DC shunt motors – Speed Torque characteristics - Ward Leonard method, DC series motor – series parallel control – solid state DC drives – Thyristor bridge rectifier circuits- chopper circuits.

UNITIIISPEEDCONTROLOFACMACHINES **9**

Induction motor – Speed torque Characteristics – pole changing, stator frequency variation - slip-ring induction motor – stator voltage variation - Rotor resistance variation, slip power recovery – basic inverter circuits- variable voltage frequency control.

UNITIVMOTORSTARTERSANDCONTROLLERS **9**

DC motor starters: using voltage sensing relays, current sensing relays and time delay relays - wound rotor induction motor starters – starters using frequency sensing relays - DOI –starter and auto transformers starter.

UNITVHEATINGANDPOWERRATINGOFDRIVEMOTORS **9**

Load diagram, over load capacity, insulating materials, heating and cooling of motors, service condition of electric drive – continuous, intermittent and short time – industrial application.

TOTAL45 HOURS

Text Books:

1. N.KDeandP.KSen‘ElectricDrives’PrenticeHallofIndiaPrivateLtd,2002.

2. VedamSubramaniam‘ElectricDrives’TataMcGrawHill,NewDelhi,2007.

3. V.KMehtaandRohitMehta‘PrincipleofElectricalEngineering’,SChand&Company,2008.

ReferenceBooks:

1. S.KBhattacharyaBrinjinderSingh‘ControlofElectricalMachines’NewAgeInternationalPublishers, 2002.

2. JohnBird‘ElectricalCircuittheoryandtechnology’Elsevier,FirstIndianEdition,2006.

Weblinks:

- https://nptel.ac.in/courses/108104140
- https://ekeeda.com/degree-courses/electrical-engineering/drives-and-control

COURSEOUTCOMES

CO1:	Describetheelectricaldrivesandcomponents	**K3**
CO2:	TolearnthegeneralcharacteristicsofdifferenttypesofelectricalAC&DC Motorswithrespecttotheapplications	**K3**
CO3:	TounderstandtheoperationofdifferenttypesofDCelectrical drives.	**K3**
CO4:	TounderstandtheoperationofthreePhaseInductionMotorsDrive.	**K3**
CO5:	Analyzetheperformanceofinductionmotordrivesunderdifferentconditions.	**K4**

22PCAU01	ENGINEERINGTHERMODYNAMICS	L	T	P	Credits
		3	0	0	3

CourseObjective:

- To familiarize the students fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance.
- Explain the concepts involved in engineering thermodynamics and apply the knowledge inapplications oriented situations.

(Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychometric Chart permitted)

UNITI BASICCONCEPTANDFIRST LAW 12

Basicconcepts-conceptofcontinuum,macroscopicapproach,thermodynamicsystems -closed,open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat, Concept of ideal and real gases, First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipment's.

UNITIISECONDLAWANDENTROPY 12

Second law of thermodynamics – Kelvin's and Clausius statements of second law, Reversibility and irreversibility. Carnot theorem, Carnot cycle, reversed Carnot cycle, efficiency, COP,Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy.

UNITIIITHERMODYNAMICAVAILABILITY 12

Basics – Energy in non-flow processes: Expressions for the Energy of a closed system- Equivalence between mechanical energy forms and Energy – Flow of energy associated with heat flow – Energy consumption and entropy generation. Energy in steady flow processes: Expressions for Energy in steady flow processes – Energy dissipation and entropy generation.

UNITIVPROPERTIESOFPURESUBSTANCEANDSTEAMPOWERCYCLE 12

Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces, thermodynamic properties of steam. Calculations of work done and heat transfer in non-flow and flow processes, Standard Rankine cycle, Reheat and regenerative cycle.

UNITVPSYCHROMETRY **12**

Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling, problems.

TOTAL:60HOURS

Text Books:

1. Nag.P.K.,"EngineeringThermodynamics",TataMcGraw-Hill,NewDelhi,1998.
2. LynnDRussell,GeorgeA,Adebiyi"EngineeringThermodynamics"IndianEdition,Oxford University Press, New Delhi, 2007.

ReferenceBooks:

1. YunusAangelandMichaelBoleo,ThermodynamicsanEngineeringApproach
2. E.Ratha Krishnan, Fundamentals of Engineering Thermodynamics, 2nd Edition, Prentice Hall ofIndia Pvt. Ltd, 2006.
3. AroraC.P,"Thermodynamics",TataMcGraw-Hill,NewDelhi,2003.
4. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
5. VenwylenandSontag,"ClassicalThermodynamics",WileyEastern,1987
6. Holman.J.P.,"Thermodynamics",3rdEd.McGraw-Hill,1995.

Weblinks:

- https://onlinecourses.nptel.ac.in/noc20_ae09/preview
- https://web.mit.edu/16.unified/www/FALL/thermodynamics/

COURSEOUTCOMES

CO1:	Applythefirstlawofthermodynamicsforsimpleopenandclosed systemsundersteadyandunsteadyconditions	**K3**
CO2:	Applysecondlawofthermodynamicstoopenandclosedsystemsand calculateentropyand availability	**K3**
CO3:	ApplyRankinecycletosteampowerplantandcomparefew cycle improvementmethods	**K3**
CO4:	Derivesimplethermodynamicrelationsofidealandrealgases	**K4**
CO5:	Calculatethepropertiesofgasmixturesandmoistairanditsusein psychometricprocesses	**K5**

22PCAU02	AUTOMOTIVEENGINES	L	T	P	Credits
		3	0	0	3

CourseObjective:

- Tounderstandthebasicprinciplesofenginesusedforautomobilesanddifferentsystems.
- Toknowledgeonautomotiveenginesandalongwithits functions.

UNITICONSTRUCTIONANDOPERATION **9**

Constructional details of spark ignition (SI) and compression ignition (CI) engines. Working principles. Two stroke SI and CI engines – construction and working. Comparison of SI and CI engines and four stroke and two stroke engines. Engine classification, firing order. Otto, diesel and dual cycles.

UNITII FUELSYSTEMS **9**

Air fuel ratio requirements of SI engines, Air fuel ratio and emissions, working of a simple fixed venture carburetor, Constant vacuum carburetor. Diesel fuel injectionsystems-Jerk pumps, distributor pumps, pintle and multihole nozzles, Unit injector andcommon rail injection systems. Injection pump calibration. Need for a governor for diesel engines. Description of a simple diesel engine governor.

UNITIIICOMBUSTIONANDCOMBUSTIONCHAMBERS **9**

Introductionto combustionin SIanddiesel enginesand stagesofcombustion. Dependence ofignition timing on load and sped. Knock in SI and CI engines. Combustion chambers for SI and CI engines. Direct and indirect injection combustion chambers. Importance of Swirl, squish and turbulence. combustion chamber design.

UNITIVSUPERCHARGING,TURBOCHARGINGANDENGINETESTING **9**

Supercharging and Turbocharging, Different methods of turbocharging, Intercooling, Turbocharger controls including, waster gate, variable geometry, variable nozzle types. Dynamometers, Indicated thermal, brake thermal and volumetric efficiencies. Measurement of friction, Cylinder pressure measurement. Engine performance maps, Engine testing standards.

UNITVCOOLINGANDLUBRICATIONSYSTEMS **9**

Ned for cooling, types of cooling systems- air and liquid cooling systems. Thermosyphon and forced circulation and pressurized cooling systems. Properties of coolants. Requirements of lubrication systems. Types-mist, pressure fed, dry and wet sump systems. Properties of lubricant

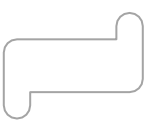
TOTAL:45HOURS

Text Books:

1. Bosch-"AutomotiveHandbook"-5thedition-SAEpublication-2000.
2. KirpalSingh,"AutomobileEngineering",Standardpublishers,Distributors,Delhi,1999.
3. G.B.S.Narang,"AutomobileEngineering",KhannaPublishers,TwelfthreprintNewDelhi, 2005.

ReferenceBooks:

1. Heisler,"AdvancedEngineTechnology"SAEPublication, 1995
2. EdwardF.Obert"InternalCombustionEngines"3Edition, 1970



Web links:

- https://onlinecourses.nptel.ac.in/noc22_de02/preview
- https://www.careers360.com/university/indian-institute-of-technology-madras/fundamentals- of-automotive-systems-certification-course

COURSEOUTCOMES

CO1:	Understandtheconstructionandoperationofengines	**K3**
CO2:	Acquireknowledgeonthefuelsystemsin engines	**K3**
CO3:	Describevarioustypesoffuelinjectionsystems	**K4**
CO4:	UnderstandvarioustypesofcombustionchamberinSIandCIengines	**K3**
CO5:	Familiarwithsupercharging,TurbochargingandEngineTesting	**K4**

22PCAU03	FLUIDMECHANICSANDMACHINERY	L	T	P	Credits
		3	0	2	4

CourseObjective:

- Tounderstandtheimportanceofvarioustypesofflowinpumpsandturbines
- Tounderstandtheimportanceofdimensionalanalysis

UNITI INTRODUCTION **9**

Units & Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension. Flow characteristics: concepts of system and control volume. Application of control volume to continuity equation, energy equation, momentum equation and moment of momentum equation.

UNITIIFLOWTHROUGHCIRCULARCONDUITS **9**

Laminar flow though circular conduits and circular annuli, Boundary layer concepts, Boundary layer thickness. Hydraulic and energy gradient, Darcy – Weisbach equation, Friction factor and Moody diagram, Commercial pipes, Minor losses, Flow though pipes in series and in parallel.

UNITIIIDIMENSIONALANALYSIS **9**

Dimensionandunits:Buckingham'sΠtheorem,Discussionondimensionlessparameters,Modelsand similitude, Navier-Stokes equations Introduction of dimensionless parameters, Applications of dimensionless parameters.

UNITIVROTODYNAMICMACHINES **9**

Homologous units, Specific speed, Elementary cascade theory, Theory of turbo machines, Euler's equation, Hydraulic efficiency, Velocity components at the entry and exit of the rotor. Velocity triangle for single stage radial flow and axial flow machines, Centrifugal pumps, turbines, performance curves for pumps and turbines.

UNITVPOSITIVEDISPLACEMENTMACHINES **9**

Reciprocating pumps Single acting, double acting-advantages and disadvantages, Indicator diagrams, air vessels-Work saved by air vessels, Rotary pumps, Classification, Working principle and performance curves.

TOTAL:45HOURS

Text Books:

1. Streeter.V.L.,andWylie,E.B.,FluidMechanics,McGrawHill, 1983.
2. Rathakrishnan.E,FluidMechanics,PrenticeHallofIndia(IIEd.),2007.

ReferencesBooks:

1. Ramamritham. S, Fluid Mechanics, Hydraulics and Fluid Machines, Dhanpat Rai & Sons, Delhi,1988.
2. Kumar.K.L.,EngineeringFluidMechanics(VIIEd.)EurasiaPublishingHouse(P)Ltd.,New Delhi, 1995.
3. Bansal,R.K.,FluidMechanicsandHydraulicsMachines,LaxmiPublications(P)Ltd.,NewDelhi.

Weblinks:

- https://onlinecourses.nptel.ac.in/noc19_me55/preview
- https://nptel.ac.in/courses/112105206

COURSEOUTCOMES

CO1:	Familiarwiththepropertiesoffluids	**K4**
CO2:	Acquiretheskillonflowthroughcircularconduits	**K3**
CO3:	Attaintheknowledgeondimensionalanalysis	**K3**
CO4:	Describetheroto-dynamicmachines	**K4**
CO5:	Attaintheknowledgeonpositivedisplacementmachines	**K3**

22PCAU04	AUTOMOTIVEENGINECOMPONENTS LABORATORY	L	T	P	Credits
		0	0	2	1

CourseObjective:

- Totrainthestudentstoknowthedetailsofdifferentenginecomponents,dismantlingand assembling them.
- Togainknowledgeonthestandardsofmeasurementand calibration.

LISTOF EXPERIMENTS

1. Dismantlingof4-cylinderpetrolengine.
2. Assemblingof4-cylinderpetrolengine.
3. Dismantlingof6-cylinderdieselengine.
4. Assemblingof6-cylinderdieselengine.
5. Studyofoilfilter,fuelfilter,fuelinjectionsystem,carburetor,MPFI
6. Studyofignitionsystemcomponents–coil,magnetoandelectronicignitionsystems.
7. Studyofenginecoolingsystemcomponents
8. Studyofenginelubricationsystem components
9. Ovalityandtapermeasurementofcylinderboreandcomparisonwithstandard specifications
10. Ovalityandtapermeasurementofenginecrankshaftandcomparisonwithstandardspecification

LISTOFEQUIPMENTS-Each1No

1. Four-cylinderpetrolengine
2. Six-cylinderdieselengine
3. Fuelfilter,fuelinjectionpump,injector,carburetor,MPFIcomponent
4. Ignitioncoil,magneto,electronicignitionsystemcomponents
5. Waterpump,thermostat,radiator,temperaturegauge
6. Lub.oilpump,pressurereliefvalve,filter,oilpressuregauge
7. Internalmicrometer,externalmicrometer,dialgauges.

TOTAL:45HOURS

Text Books:

1. KirpalSingh,"AutomobileEngineering",Standardpublishers,Distributors,Delhi,1999.
2. G.B.S.Narang,"AutomobileEngineering",KhannaPublishers,TwelfthreprintNew Delhi,2005.

ReferenceBooks:

1. Heisler,"AdvancedEngineTechnology"SAEPublication,1995
2. EdwardF.Obert"InternalCombustionEngines"3Edition,1970

Weblinks:

- https://onlinecourses.nptel.ac.in/noc22_de02/preview
- https://www.digimat.in/nptel/courses/video/107106088/L01.html

COURSEOUTCOMES

CO1:	DemonstratetheDismantlingandAssemblingof4-cylinderpetrolengine	**K3**
CO2:	DemonstratetheDismantlingandAssemblingof6-cylinderdieselengine	**K3**
CO3:	Describetheoilfilter,fuelfilter,fuelinjectionsystem,carburetor,MPFI	**K3**
CO4:	Explaintheignitionsystemcomponents –coil,magnetoandelectronic ignition systems	**K3**
CO5:	Describetheenginecoolingsystem components	**K3**

22PCAU05	ELECTRONICSANDMICROPROCESSORS LABORATORY	L	T	P	Credits
		0	0	2	1

CourseObjective:

- Tosupplementthetheoreticalknowledgewithpracticaluseofelectroniccomponentsand programming and control using micro-processors.
- LearnthedesignaspectsofVICharacteristics diode.

LISTOF EXPERIMENTS

ELECTRONICS **30**

1.VICharacteristicsofPNJunctionDiode
2.VICharacteristicsofZenerDiode 3.Characteristics of CE Transistor 4.Characteristics of JFET
5. CharacteristicsofUniJunctionTransistor
6. RCorWeinBridge Oscillator
7. StudyofLogicGates(BasicGates)
8. HalfAdderandFullAdder
9. ShiftRegistersandCounters
10. OperationalAmplifier(Adder,Subtractor,Differentiator,Integrator,InvertingandNon - Inverting

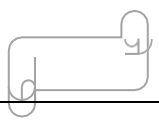
MICROPROCESSOR **15**

1. BlockTransfer
2. 8bitAddition, Subtraction
3. MultiplicationandDivision
4. Maximumandminimumofblockofdata
5. Sorting
6. StepperMotor Interfacing

TOTAL:45HOURS

LISTOF EQUIPMENTS

1. Voltmeters	5 No.
2. Ammeters	5 No.
3. PNDiode,BJT,JFET,LogicGates,ShiftRegistersand Counters	1set.
4. DigitalLogicTrainerKits	1 No.
5. Breadboards	1 No.
6. MicroprocessorKits–8085	5 No.
7. D/AConverterInterface	1 No.
8. StepperMotor Interface	1 No.
9. CRO	1 No.
10. WavefarmGenerator	1 No.
11. Multimeter	1 No.



TextBooks:

1. SunilMathur,JeebanandaPanda,MicroprocessorsandMicrocontrollers,PrenticeHall India Pvt., Limited
2. Dr.DeepaliA.Godse,AtulP.Godse,DigitalElectronicsandIntroductionto Microprocessors and Microcontrollers, UNICORN Publishing Group

ReferenceBooks:

1. A.K.Chhabra,FundamentalofDigitalElectronicsAndMicroprocessors, S.ChandLimited
2. NoelMalcolmMorris,MicroelectronicandMicroprocessor-basedSystems, Macmillan

Weblinks:

- https://nptel.ac.in/courses/108107029
- https://onlinecourses.swayam2.ac.in/cec21_cs16/preview

COURSEOUTCOMES

CO1:	DescribethecharacteristicsofPNJunctionDiodeandZenerDiode	**K4**
CO2:	DescribethecharacteristicsofCETransistor,JFETandUniJunction Transistor	**K4**
CO3:	ExplaintheRC/WeinBridgeOscillatorandLogicGates	**K3**
CO4:	ExplaintheHalfAdderandFullAdder	**K3**
CO5:	DefineShiftRegisters,CountersandOperationalAmplifier	**K3**

22MCAU03	BASICLIFESKILLS	L	T	P	Credits
		2	0	0	0

COURSEOBJECTIVE:

- To provide value education to improve the students' character, understanding of principled life, physical health, maintaining youthfulness, measures and methods in five aspects of life.

UNITIPHYSICALHEALTH **6**

Manavalakalai(SKY) Yoga: Introduction -Educationas a meansfor youth empowerment -Greatness of Education - Yoga for youth Empowerment.Simplified Physical Exercises: Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana Part I, Makarasana Part II, Body Massage, Acu pressure, Relaxation exercises - Benefits.Yogasanas: Pranamasana – Hastha Uttanasana – Pada Hasthasana – AswaSanjalana Asana – Thuvipathaasva Sanjalana asana – Astanga Namaskara - Bhujangasana–Atha Muktha Savasana – Aswa Sanjalana Asana – Pada Hasthasana–Hastha Uttanasana - Pranamasana.Pranayama: Naddisuddi - Clearance Practice - Benefits.

UNITIILIFEFORCE **6**

Reasons for Diseases - Natural reasons (Genetic / imprints, Planetary Position, Natural calamities and climatic changes) - Unnatural reasons (Food habits, Thoughts, Deeds).Philosophy of Kaya kalpa - Physical body - Sexual vital fluid - Life force -Bio-Magnetism - Mind. Maintaining youthfulness. Postponing old age - Transformation of food into seven components - Importance of sexual vital fluid Measure and method in five aspects of life - Controlling undue Passion.Kayakalpa practice - Aswini Mudra - Ojas breath - Benefits of Kaya Kalpa.

UNITIIIMENTALHEALTH **6**

Mental Frequencies - Beta, Apha, Theta and Delta wave - Agna Meditation explanation - benefits. Shanthi Meditation explanation – Benefits - Thuriya Meditation explanation – Benefits. Benefits ofBlessing - Self blessing (Auto suggestion) - Family blessing - Blessing the others - World blessing - Divine protection

UNITIV VALUES **6**

HumanValuesSelf-control-Self-confidence -HonestyContentment -Humility–ModestyTolerance - Adjustment - Sacrifice – Forgiveness Purity (Body, Dress, Environment) - Physical purity - Mental purity - Spiritual purity Social Values: Non-violence– Service Patriotism – Equality Respect for parents and elders - care and protection - Respect for teacher Punctuality - Time Management.

UNITVMORALITY(VIRTUES) **6**

ImportanceofIntrospection-I-Mine(Ego,Possessiveness).SixEvilTemperaments-Greed-Anger - Miserliness - Immoral sexual passion - Inferiority and superiority Complex – Vengeance. ManeuveringofSixTemperaments -Contentment -Tolerance-Charity -Chastity-Equality-Pardon (Forgiveness).Five essential Qualities acquired through Meditation: Perspicacity - Magnanimity - Receptivity - Adaptability – Creativity. Improved Memory Power - Success in the Examination.

TOTAL:30hours

TEXTBOOKS:

1. VethathiriMaharishi,16thEdi.2013,YogaforModernAge,VethathiriPublications,Erode.
2. VethathiriMaharishi,2014,SimplifiedPhysicalExercises,VethathiriPublications,Erode.
3. VethathiriMaharishi,3rdEdi.2014,Kayakalpam,VethathiriPublications,Erode.
4. Rev.Dr.G.U.Pope,2016,Thirukkural,GiriTradingAgency,

5. VethathiriMaharishi,1994,Mind,VethathiriPublications,Erode.
6. Iyengar,B.K.S.2008,LightonYoga,Noida,UPIndia,HarberCollinsPublishingIndiaLtd.,

REFERENCEBOOKS:

7. K.R.DhanalakshmiandN.S.Raghunathan,"PersonalityEnrichment,MarghamPublications
8. D.rV.M.Selvaraj,"PersonalityDevelopment"BhavaniPublications
9. R.S.Agarwal,"QuantitativeAptitude".
10. A.KGupta,"LogicalandAnalyticalReasoning(English)",30thEdition.

Web link:

1. https://www.mindinthemaking.org/life-skills

COURSEOUTCOMES:

Attheendofthiscoursethe studentswillbeableto,

CO1:	Utilize skills developed through participation in Manavalakalai (SKY) Yoga to help maintain lifelong health and fitness.	**K3**
CO2:	Demonstratefoundationalstanding,sitting,balancepostureswithproper alignment and Maintain youthfulness through kaya kalpa practice.	**K5**
CO3:	Explore relaxation techniques to observe thoughts and to manage emotions and stress, and reflect on those techniques which are most effective to them.	**K5**
CO4:	Demonstrate an understanding of anatomy and physiology as it applies to the intentional integration of breath, postures, and movement within the practice of yoga to understand the human values.	**K5**
CO5:	Achieveagreatersenseofawareness,wisdom,introspection,andadeeper sense of relaxation through meditation to keep up morality in life.	**K5**

22BSAU08	MATHEMATICS-IV (StatisticalandNumericalMethods)	L	T	P	Credits
		3	1	0	4

COURSEOBJECTIVE:

- Providesthenecessarybasicconceptsof afewStatisticalandNumerical methods.
- Familiarize the procedures for solving numerically different kinds of problems occurring in engineering.

UNITI TESTINGOF HYPOTHESIS **14**

Sampling distributions –Introduction to Large samples and Small samples – Tests for single mean, two mean and paired t-test – F-test – Chi-square test for goodness of fit –Independence of attributes- ANOVA – One-way classification – Two way classification.

UNITIICORRELATIONANDREGRESSION ANALYSIS **10**

Introduction to Correlation Analysis – Karl Pearson's Coefficient of Correlation – Rank Correlation-Regression Analysis – Curve fitting – Introduction – Method of least squares.

UNIT III SOLUTIONOF EQUATIONS **14**

Introduction–Newton-Raphson'smethod–Regulafalsimethod–GaussEliminationmethod -Gauss-Jordanmethods –MatrixInversionbyGauss-Jordan method.

UNITIVINTERPOLATION,NUMERICALDIFFERENTIATIONANDNUMERICAL INTEGRATION **10**

Introduction–Newton's forward and backward interpolation–Lagrange's Interpolation formula-Derivatives using Newton's forward and backward difference formula– Numerical integration using Trapezoidal ,Simpson's 1/3 rules and Simpson's 3/8 rules.

UNITVNUMERICAL SOLUTIONOFORDINARYDIFFERENTIALEQUATIONS

12

Introduction-Taylor's series method – Euler's method - Modified Euler's method –Second and Fourth order Runge-Kutta method for solving first order equations – Milne's Predictor corrector method (Simple problems).

30%

TotalHours: 60

TEXT BOOKS:

T1:Grewal,B.S.andGrewal,J.S.,"NumericalmethodsinEngineeringandScience", 9th Edition, Khanna Publishers,NewDelhi,2012.

T2:JohnsonR.A.andGuptaC.B,"MillerandFreund'sProbabilityandStatisticsfor Engineers", PearsonEducation, Asia,7th edition, 2007.

T3: Dr.Kandasamy .P,Dr.Thilagavathi,Dr.Gunavathi.K,"Statistics and Numerical methods",S. Chand and Company,first edition,2010.

REFERENCEBOOKS:

R1: Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", Tata McGraw- Hill, New Delhi, 7th Edition, 2014.

R2:WalpoleR.E,MyersR.H,MyersS.L,andYe.K,"ProbabilityandStatisticsfor Engineers and Scientists", Pearson Education, Asia, 9th edition, 2011.

WEBLINK:

1. https://nptel.ac.in/courses/111105077
2. https://www.academia.edu/35702788/2_Numerical_and_Statistical_pdf
3. https://onlinecourses-archive.nptel.ac.in/noc18_ma11/preview

COURSEOUTCOMES:

CO1:	Utilizetheskillontestingofhypothesis& ANOVA.	**K3**
CO2:	ApplytheconceptofStatisticalmeasureslikeCorrelationandRegression.	**K2**
CO3:	Evaluatetheknowledgeonsolutionofequationsandeigenvalue problems.	**K5**
CO4:	Describetheapplicationsofinterpolation,numericaldifferentiationand numerical integration.	**K4**
CO5:	Establishthenumericalsolutionofordinarydifferentialequations.	**K3**

22PCAU06	ENGINEERINGMETALLURGY	L	T	P	Credits
		3	0	0	3

CourseObjective:

- Toimpartknowledgeonthestructure,properties,treatment,testingandapplications ofmetals and non-metallic materials so as to identify and select suitable materials for various engineering applications.
- To understanding of basic structure and crystal arrangement of materials, the phase diagrams, advantages of heat treatment.

UNITIALLOYSANDPHASEDIAGRAMS 9

Constitution ofalloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron – carbon equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application.

UNITIIHEATTREATMENT 9

Definition – Full annealing, stress relief, recrystallisation and spheroidising – normalising, hardening andTemperingofsteel.Isothermaltransformationdiagrams–coolingcurvessuperimposedon I.T. diagram CCR – Hardenability, Jominy end quench test - Austempering, martempering – case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening.

UNITIIIFERROUSANDNON-FERROUSMETALS 9

Effect of alloying additions on steel- α and β stabilisers– stainless and tool steels – HSLA, Maraging steels – Cast Iron -Grey, white, malleable, spheroidal – alloy cast irons, Copper and copper alloys. Brass, Bronze and Cupronickel – Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys, Mg-alloys, Ni-based super alloys and Titanium alloys.

UNITIVNON-METALLICMATERIALS 9

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of variousthermosettingandthermoplasticpolymers(PP,PS,PVC,PMMA,PET,PC,PA,ABS,PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes) - Engineering Ceramics Properties and applications of Al_2O_3, SiC, Si_3N_4, PSZ and SIALON –Composites-Classifications-Metal Matrix and FRP - Applications of Composites.

UNITVMECHANICALPROPERTIESANDDEFORMATIONMECHANISMS 9

Mechanismsof plasticdeformation,slipandtwinning –Typesoffracture –Testing ofmaterialsunder tension,compressionandshearloads –Hardnesstests(Brinell,VickersandRockwell),hardnesstests, Impact test lzod and charpy, fatigue and creep failure mechanisms.

TOTAL:45HOURS

Text Books:

1. Avner,,S.H.,"IntroductiontoPhysicalMetallurgy",McGrawHillBookCompany,1997.
2. Williams D Callister, "Material Science and Engineering" Wiley India Pvt Ltd, Revised IndianEdition 2014

ReferenceBooks:

1. Kenneth G.Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of IndiaPrivate Limited, 2010.

2. Raghavan.V,“MaterialsScienceandEngineering”,PrenticeHallofIndiaPvt.Ltd., 2015.
3. U.C.Jindal:MaterialScienceandMetallurgy,"EngineeringMaterialsandMetallurgy",First Edition, Dorling Kindersley, 2012
4. Upadhyay.G.S.andAnishUpadhyay,“MaterialsScienceandEngineering”,VivaBooksPvt. Ltd., New Delhi, 2006.

Weblinks:

- https://onlinecourses.nptel.ac.in/noc20_mm09/preview
- https://nptel.ac.in/courses/113102080

COURSEOUTCOMES

CO1:	Explainalloysandphasediagram,Iron-Ironcarbidediagramandsteel classification	**K3**
CO2:	Explainisothermaltransformation,continuouscoolingdiagramsand different heat treatment processes	**K3**
CO3:	Summarizethemechanismofplasticdeformationandtestingmechanical properties	**K5**
CO4:	Clarifytheeffectof alloying elementsonferrousandnon-ferrous metals	**K4**
CO5:	Differentiatedifferentnon-metallic materials	**K3**

22PCAU07	AUTOMOTIVEFUELSANDLUBRICANTS	L	T	P	Credits
		3	0	0	3

CourseObjective:

- Tounderstand thepropertiesoffuelsandlubricantsforthedesignandoperationoftheI.C engines.
- ToelaboratethepropertiesoffuelsusedinIC engines.

UNITIMANUFACTUREOFFUELSANDLUBRICANTS **9**

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

UNITIITHEORYOF LUBRICATION **9**

Engine friction: introduction, total engine friction, effect of engine variables on friction,hydrodynamiclubrication,elastohydrodynamiclubrication,boundarylubrication,bearinglubrication, functions of the lubrication system, introduction to design of a lubricating system.

UNITIII LUBRICANTS **9**

Specificrequirementsforautomotivelubricants,oxidationdeteriorationanddegradationoflubricants, additives and additive mechanism, synthetic lubricants, classification of lubricating oils, properties of lubricating oils, tests on lubricants. Grease, classification, properties, test used in grease.

UNITIVPROPERTIESANDTESTINGOFFUELS **9**

Thermo-chemistryoffuels,propertiesandtestingoffuels,relativedensity,calorificvalue,flash point, fire point, distillation, vapour pressure, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point, carbon residue, copper strip corrosion etc.

UNITVCOMBUSTION&FUELRATING **9**

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

TOTAL:45HOURS

Text Books:

1. Ganesan.V., “Internal Combustion Engineering”, Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. Mathur. M.L., Sharma. R.P. “A course in internal combustion engines”, Dhanpatrai publication, 2003.
3. Obert.E.F“InternalCombustionEngineeringandAirPollution”,InternationalbookCo.,1988.

ReferenceBooks:

1. Brame,J.S.S.andKing,J.G.–"FuelsSolids,Liquids,Gaseous".EdwardArnold,1961
2. Francis,W,"FuelsandFuelTechnology",Vol.I&II,Pergamon,1965
3. Hobson,G.D.&Pohl.W"ModernPetroleumTechnology",1974

4. Lansdown.A.R.,Lubrication,"Apracticalguidetolubricantselection",Pergamonpress,1982.
5. Raymond.C.Gunther,"Lubrication",ChiltonBookCo.,1971.

Weblinks:

- https://nptel.ac.in/courses/107106088
- https://www.iip.res.in/automotive-fuel-and-lubricant-application/

COURSEOUTCOMES

CO1:	Explainthedistillationprocess,additivesforfuelsandcharacteristicsof fuels	**K3**
CO2:	Discusstheneedandperformancecharacteristicsofalternativeliquidfuels forbothSIandCI engines	**K3**
CO3:	Describetheneedandperformancecharacteristicsofalternativegaseous fuelsforbothSIand CIengines	**K4**
CO4:	CalculateandanalyseA/Fratiofortheengineoperatingconditions and alsocanestimatequantitativelytheexhaustgasconstituents	**K5**
CO5:	Explaintheneedforlubricants,factorsinfluencingtheengine lubrication andtestingoffuels	**K3**

22PCAU08	AUTOMOTIVECHASSIS	L	T	P	Credits
		3	0	0	3

CourseObjective:

- StudyoftheConstructionaldetailsandTheoryofimportantdrivelines.
- Familiarincomponentsofautomotivechassissystemsofautomobiles.

UNITILAYOUT,FRAME,FRONTAXLEANDSTEERINGSYSTEM 9

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

UNITIIDRIVELINE,FINALDRIVEANDDIFFERENTIAL 9

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

UNITIIIREARAXLES,WHEELS,RIMS ANDTYRES 9

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

UNITIVBRAKESYSTEMS 9

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

UNITVSUSPENSIONSYSTEM 9

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

TOTAL:45HOURS

Text Books:

1. K.Newton,W.SteedsandT.K.Garret,"TheMotorVehicle",13th Edition,Butterworth Heinemann, India, 2004.
2. P.M.Heldt,"AutomotiveChassis",ChiltonCo.,NewYork,1982.
3. W.Steed,"MechanicsofRoadVehicles",IlliffeBooksLtd.,London.1992.

ReferenceBooks:

1. HarbanSinghRayat,"TheAutomobile",S.Chand&Co.Ltd,NewDelhi,2000.

2. G.J.Giles,“SteeringSuspensionandTyres”,IlliffeBooksLtd.,London,1975.
3. KirpalSingh,“AutomobileEngineering”,Standardpublishers,Distributors,Delhi,1999.
4. G.B.S.Narang,“AutomobileEngineering”,KhannaPublishers,TwelfthreprintNewDelhi,2005.
5. R.P.Sharma,“AutomobileEngineering”,DhanpatRai&Sons,NewDelhi,2000.

Weblinks:

- https://nptel.ac.in/courses/107106088
- https://www.myigetit.com/Library/CourseDetails/9866?catID=11&name=NX_8_Automotive_Chassis_Training_Training_Course

COURSEOUTCOMES

CO1:	Clearlyexplainthevehiclelayoutand drives	**K3**
CO2:	Understandthesteeringsystemandits components	**K3**
CO3:	Familiarwiththedrivelinesystemcomponentsanditsworking	**K4**
CO4:	Explaintheconceptofvarioustypesofbrakingsystemandits components	**K3**
CO5:	Clearlyunderstandsuspensionsystemsanditscomponents	**K3**

22PCAU09	HEATANDMASSTRANSFER	L	T	P	Credits
		3	0	2	4

CourseObjective:

- Tolearnthethermalanalysisandsizingofheatexchangersandtounderstandthebasic.
- Tounderstandtheconceptsofheattransferthroughextendedsurfaces.

(Use of standard HMT data book permitted)

UNITI CONDUCTION **12**

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – General Differential equation of Heat Conduction – Fourier Law of Conduction – Cartesian and Cylindrical Coordinates – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Use of Heislers Chart.

UNITII CONVECTION **12**

Basic Concepts – Convective Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection – Forced Convection – Dimensional Analysis – External Flow – Flow over Plates, Cylinders and Spheres – Internal Flow – Laminar and Turbulent Flow – Combined Laminar and Turbulent– Flowover Bankoftubes –FreeConvection –DimensionalAnalysis –Flowover Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres.

UNITIIIPHASECHANGEHEATTRANSFERANDHEATEXCHANGERS **12**

Nusselts theory of condensation-pool boiling, flow boiling, correlations in boiling and condensation. Types of Heat Exchangers – LMTD Method of heat Exchanger Analysis – Effectiveness – NTU method of Heat Exchanger Analysis – Overall Heat Transfer Coefficient – Fouling Factors.

UNITIVRADIATION **12**

Basic Concepts, Laws of Radiation – Stefan Boltzman Law, Kirchoff Law –Black Body Radiation – Grey body radiation Shape Factor Algebra – Electrical Analogy – Radiation Shields –Introduction to Gas Radiation.

UNITVMASS TRANSFER **12**

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy – Convective Mass Transfer Correlations

TOTAL:60HOURS

15%

Text Books:

1. Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer" New Age International, 1995.
2. YadavR"HeatandMassTransfer"CentralPublishingHouse, 1995.

ReferenceBooks:

1. NagP.K,"HeatTransfer",TataMcGraw-Hill,NewDelhi,2002
2. HolmanJ.P"HeatandMassTransfer"TataMcGraw-Hill,2000.

3. KothandaramanC.P“FundamentalsofHeatandMassTransfer”NewAgeInternational,New Delhi, 1998
4. Frank P.Incropera and David P. DeWitt, “Fundamentals of Heat and Mass Transfer”, John Wiley and Sons, 1998.
5. VelrajR,“Heat&MassTransfer”,AneBooks,NewDelhi,2004.

Weblinks:

- https://nptel.ac.in/courses/112101097
- https://onlinecourses.nptel.ac.in/noc19_ch23/preview

COURSEOUTCOMES

CO1:	Abilitytodesignandanalyzetheperformanceofheatexchangers	**K4**
CO2:	Describethephysicalphenomenaassociatedwithconvection	**K4**
CO3:	Analyzeexternalandinternal,forcedandfreeconvectionproblems	**K4**
CO4:	Explainthephysicalmechanismsinvolvedinradiationheattransfer	**K3**
CO5:	Analyzetheradiativeheatexchangebetweensurfacesandin diffuse, gray enclosures	**K4**

22PCAU10	AUTOMOTIVECHASSISCOMPONENTS LABORATORY	L	T	P	Credits
		0	0	2	1

CourseObjective:

- Totrainthestudentstoknowthedetailsofdifferentchassiscomponents,dismantlingand assembling them.
- TodeveloptheпracticalknowledgeinthefieldofAutomobile engineering.

LISTOF EXPERIMENTS

Studyandmeasurementofthefollowingchassisframes:

1. Heavydutyvehicleframe(Leyland,Tata etc)
2. Lightdutyvehicleframe(Ambassador,Marutivanetc)
3. FrontAxle
4. RearAxle
5. Differential
6. Steeringsystemsalongwithanytwotypesofsteeringgearbox
7. Brakingsystems–hydraulicservovacuum,compressedairpowerbrakes.
8. Leafspring,coilspring,torsionbarspring,Hydraulicshockabsorber
9. Clutchassemblyofdifferent types
10. GearBox
11. Transfercase

THELISTOFEQUIPMENTS-Each1No(ForABatchof30 Students)

1. Heavydutyvehiclechassisframe(LeylandorTata)
2. Lightdutyvehiclechassisframe
3. Frontaxle
4. Rearaxle
5. Steeringsystem
2. Steeringgearbox(Rackandpinion,recirculatingBalltype)
3. Hydraulicbrakesystem
4. Airbrakesystem
5. Leafspring,coilspring,torsionbar
6. Hydraulicshockabsorber
7. Diaphragmclutchassembly
8. Gearbox(lightduty,heavy duty)
9. Transfer case

TOTAL:45 HOURS

Text Books:

1. K. Newton, W. Steeds and T.K. Garret, "The Motor Vehicle", 13th Edition, ButterworthHeinemann, India, 2004.
2. P.M.Heldt,"AutomotiveChassis",ChiltonCo.,NewYork,1982.

ReferenceBooks:

1. HarbanSinghRayat,"TheAutomobile",S.Chand&Co.Ltd,NewDelhi,2000.
2. KirpalSingh,"AutomobileEngineering",Standardpublishers,Distributors,Delhi,1999.

Weblinks:

- https://nptel.ac.in/courses/107106088
- https://www.bharathuniv.ac.in/downloads/auto/U18PCAU4L3%20%20Engine%20&%20Chassis%20Components%20Lab.pdf

COURSEOUTCOMES

CO1:	DescribetheHeavydutyvehicleframe	**K3**
CO2:	DescribetheLightdutyvehicle frame	**K3**
CO3:	DemonstratethedismantlingandassemblingofFrontAxle,RearAxle and Differential	**K3**
CO4:	DefinetheSteeringsystemsalongwithanytwotypesofsteeringgear box	**K3**
CO5:	ExplaintheBrakingsystems–hydraulicservovacuum,compressed air powerbrakes	**K3**

22PCAU11	STRENGTHOFMATERIALSLABORATORY	L	T	P	Credits
		0	0	2	1

CourseObjective:

- Tostudythemechanicalpropertiesofmaterialswhensubjectedtodifferenttypesof loading.

STRENGTHOFMATERIALS(30Hrs)

LISTOFEXPERIMENTS(AnyFiveofthefollowing)

1. Tensiontestonamildsteelrod
2. DoublesheartestonMildsteelandAluminiumrods
3. Torsiontestonmildsteelrod
4. Impacttestonmetalspecimen
5. HardnesstestonmetalsBrinnellandRockwellHardnessNumber
6. Deflectiontestonbeams
7. Compressiontestonhelicalsprings

LISTOFEQUIPMENTFORBATCHOF30 STUDENTS

S.No.	NAMEOFTHE EQUIPMENT	Qty.
1	UniversalTensileTestingmachinewithdouble1shearattachment –40Ton Capacity	1
2	TorsionTestingMachine(60NMCapacity)	1
3	ImpactTestingMachine(300JCapacity)	1
4	BrinellHardnessTestingMachine	1
5	RockwellHardnessTestingMachine	1
6	SpringTestingMachinefortensileandcompressiveloads(2500N)	1

TextBooks:

1. R.K.Rajput,Strength*ofMaterials,* S.Chand Publishing
2. RamamruthamS,*Strengthof Materials,*DhanpatRaiPublishingCompany(p)Ltd

ReferenceBook:

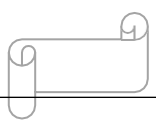
1. R.K.Bansal,ATextbookofStrengthofMaterials,LaxmiPublications

Weblinks:

- https://onlinecourses.nptel.ac.in/noc20_ce34/preview
- https://nptel.ac.in/courses/112107146

COURSEOUTCOMES

CO1:	AbilitytoperformTension,Torsion,Hardness,Compression,and DeformationtestonSolidmaterials	**K3**
CO2:	Evaluatethevaluesofyieldstress,breakingstressandultimatestressof thegivenspecimenundertensiontest	**K4**
CO3:	Conductthetorsiontesttodeterminethemodulusofrigidityof given specimen	**K3**
CO4:	Examinethestiffnessoftheopencoilandclosedcoilspringandgrade them	**K4**
CO5:	JustifytheRockwellhardnesstestoverwithBrinellhardnessand measurethehardnessofthegivenspecimen	**K3**



22BSAU09	ENVIRONMENTALSCIENCEANDENGINEERING	L	T	P	Credits
		3	0	0	3

CourseObjectives

- At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future
- To provideunderstandingof component of environment,their function ,quality,issues related to environment ,effect of quality degradation on human beings and their solutions

UNITIENVIRONMENT,ECOSYSTEMSANDBIODIVERSITY 9

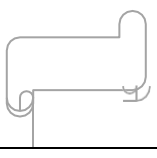
Definition – Scope and importance – Need for public awareness – Concepts of an Ecosystem – Structure and Function of an Ecosystem –Producers, Consumers and Decomposers – Energy Flow in the Ecosystem – Ecological Succession – Food Chains, Food Webs and Ecological Pyramids – Introduction, Types, Characteristic Features, Structure and Function of the (A) Forest Ecosystem (B) Grassland Ecosystem (C) Desert Ecosystem (D) Aquatic Ecosystems (Ponds, Streams, Lakes, Rivers, Oceans, Estuaries) – Introduction to Biodiversity – Definition: Genetic, Species and Ecosystem Diversity – Bio-geographical Classification of India – Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values – Biodiversity at Global, National and Local Levels – India as a Mega-Diversity Nation – Hot-Spots of Biodiversity – Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts – endangered and Endemic Species of India – Conservation of Biodiversity: In-Situ and Ex-Situ conservation of Biodiversity.Field Study of Common Plants, Insects and Birds. Field study of simple ecosystems - pond, river, hill slopes, etc.

UNITIIENVIRONMENTALPOLLUTION 9

Definition – Causes, Effects and Control Measures of (A) Air Pollution (B) Water Pollution (C) Soil Pollution (D) Marine Pollution (E) Noise Pollution (F) Thermal Pollution (G) Nuclear Hazards –Solid Waste Management:- Causes, Effects and Control Measures of municipal solid Wastes– Roleof an Individual in Prevention of Pollution – Pollution Case Studies – disaster Management - Floods, Earthquake, Cyclone and Landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNITIIINATURALRESOURCES 9

Forest resources -Use and over – Exploitation – Deforestation – Case studies – Timber extraction – Mining – Dams and their ground water – Floods – Drought – Conflicts over water –Dams – Benefits and Problems – Mineral Resources- Use and Exploitation, Environmental Effects of Extracting and UsingMineral Resources,Case Studies – Food Resources: WorldFoodProblems, Changescaused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer- Pesticide Problems, Water Logging, salinity, Case Studies – Energy Resources:- Growing Energy Needs, Renewable and Non Renewable Energy Sources, Use of Alternate EnergySources, Case Studies – Land Resources - Land asaResource,LandDegradation,ManInducedLandslides,SoilErosionandDesertification –Roleof an Individual in Conservation of Natural Resources – Equitable use of Resources for Sustainable Lifestyles.Fieldstudyoflocalareatodocumentenvironmentalassets–river/forest/grassland/hill /mountain.



UNITIVSOCIALISSUESANDTHEENVIRONMENT **9**

From Unsustainable To Sustainable Development – Urban Problems Related to energy – Water conservation, Rain Water Harvesting, Watershed Management – Resettlement and Rehabilitation of People, its Problems and Concerns, Case Studies Role of non – governmental organization - Environmental Ethics- Issues and Possible Solutions – Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust, Case Studies –Wasteland Reclamation – Consumerism and Waste Products – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and Control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act –enforcement machinery involved in environmental Legislation – Central and state pollution control boards - Public Awareness.

UNITVHUMANPOPULATIONANDTHEENVIRONMENT **9**

Population Growth, Variation among Nations – Population Explosion Family Welfare Programme – environment and Human Health – Human Rights –Value Education – HIV /AIDS – Women andChild Welfare – Role of Information Technology in Environment and Human Health – Case Studies.

TOTAL:45HOURS

Text Books:

1. GilbertM.Masters,'IntroductiontoEnvironmentalEngineeringandScience',2ndedition, Pearson Education (2004).
2. BennyJoseph,'EnvironmentalScienceandEngineering',TataMcGraw-Hill,NewDelhi,(2006).

ReferenceBooks

1. R.K.Trivedi,'HandbookofEnvironmentalLaws,Rules,Guidelines,CompliancesandStandards', Vol.I and II, Enviro Media.
2. Cunningham,W.P.Cooper,T.H.Gorhani,'EnvironmentalEncyclopedia',JaicoPubl.,House, Mumbai, 2001.
3. DharmendraS.Sengar,'Environmentallaw',PrenticehallofIndiaPVTLTD,NewDelhi,2007.
4. Rajagopalan,R,'EnvironmentalStudies-FromCrisistoCure',OxfordUniversityPress(2005)

Web Links:

1. https://onlinecourses.nptel.ac.in/noc20_ge16/preview
2. https://ggn.dronacharya.info/APSDept/Downloads/QuestionBank/ENVIRONMENTAL-STUDIES/NPTEL-Link.pdf
3. http://eagri.org/eagri50/ENVS302/pdf/lec14.pdf
4. https://onlinecourses.nptel.ac.in/noc19_ge22/preview

COURSEOUTCOMES

Attheendofthiscoursethestudentswillbeableto,

CO1:	Understandthecoreconcepts,methodsofecologicalandphysicalsciences, their application in environmental problem-solving.	**K3**
CO2:	Applysystemconceptsandmethodologiestoanalyse,understandtheinteractions between social and environmental processes.	**K5**

CO3:	Apply the ethical, cross-cultural, and historical context of environmental issues and the link between human and natural systems.	**K5**
CO4:	Develop the understanding based on the observations and illustration, drawn from the experiences of physical, biological, social and cultural aspects of life, rather than abstractions.	**K5**
CO5:	Reflectcriticallyabouttheirrolesandidentitiesascitizens,consumersand environmental actors in a complex, interconnected world.	**K5**

22MCAU04	GENDERINSTITUTIONANDSOCIETY	L	T	P	Credits
		2	0	0	0

Course Objective:
The course helps the student to understand concepts of social justice and gender justice. It provides the student with the knowledge of various institutions functioning worldwide which aim to eradicate discrimination against women. The course further aids students in understanding feminism and gender in relation to the society and to study the basic constitutional remedies available to women.

UNIT– I **06**

Social Justice and Gender Justice – Theories relating to Social Justice – Theories relating to Gender Justice – Interrelationship between Gender justice and Social Justice

UNIT– II **06**

International Conventions for protection of Women – Convention on the Elimination of All Forms of Discrimination against Women(CEDAW) – National Commission for women – Constitutional remedies available for women under Indian Constitution.

UNIT– III **06**

United Nations Entity for Gender Equality and the Empowerment of Women (UN Women) - AssociationforWomen'sRightsinDevelopment(AWID)–Womenkindworldwide–Centre for reproductive rights - Women's Environment and Development Organization (WEDO) - Global Fund for Women

UNIT– IV **06**

International Center for Research on Women (ICRW) - European Institute for Gender Equality (EIGE) – Promundo - International Alliance of Women (IAW) - International Women's Development Agency (IWDA).

UNIT– V **06**

World Health organisation – Sex and Gender – Feminism – Theories relating to Feminism – Gender and society

Total30hours

TextBooks

1. LawrelatingtoWomenandchildren,MamtaRao
2. Gender, Politics and Institutions: Towards a Feminist Institutionalism, by Mona Lena krook and Fiano Mackay,2010
3. GenderJusticeand FeministJurisprudence,Dr.Sheetal Kanwal,2015
4. Narain'sGenderandsociety, P.Jain

ReferenceBooks

1. GenderJusticeandfeminist JurisprudencebyDr.IshithaChatterjee

2. Genderand Institutions,MoiraGatens andAlisonMackkinon

SuggestedReadings:

1. WomenandGender:SocietyandCommunity,Siddhartha Sarkar

Weblink:

1. https://data.oecd.org/inequality/social-institutions-and-gender.htm

COURSEOUTCOMES:

CO1:	UnderstandtheConceptofSocial JusticeandGender Justice.	**K3**
CO2:	LearningtheInternationalConventionsandconstitutionalremedies available for women.	**K5**
CO3:	Identify the various gender Institutions and itsfunctions for development of women.	**K5**
CO4:	AssessingtheInternational agencies.	**K5**
CO5:	Summarizingthestudyonfeminismandrelationofgender and society.	**K5**

22PCAU12	AUTOMOTIVETRANSMISSION	L	T	P	Credits
		3	0	0	3

CourseObjective:

- Toimpartknowledgeinhydrodynamicdevicesandhydrostaticdevisees.
- Tounderstandtheconceptofautomotivetransmissioncomponentsanditsapplications.

UNITICLUTCHANDGEARBOX **9**

Requirement of Transmission system. Different types of clutches: Principle, construction and operation of friction clutches.Objective of the gear box. Problems on performance of automobile such as Resistance to motion, Tractive effort, Engine speed & power and acceleration. Determination of gear box ratios for different vehicle applications. Different types of gear boxes.

UNITIIHYDRODYNAMICDRIVES **9**

Principles, performance and limitations of fluid coupling Constructional details of a typical fluid coupling. Reduction of drag torque, Principle, construction and advantages of hydrodynamic torque converters. Performance characteristics, converter couplings. Multi-stage Torque converter

UNITIIIAUTOMATICTRANSMISSION **9**

Automatic transmission: relative merits and demerits when compared to conventional transmission, automatic control of gears,study of typical automatic transmissions, Ford—T-model gearbox, Wilson gearbox,Electro-magnetictransmission,Automaticoverdrive,Hydraliccontrolsystemforautomatic transmission.

UNITIVHYDROSTATICDRIVEANDELECTRICDRIVE **9**

Principle of hydrostatic drive systems. Construction and working of typical drives. Advantages and limitations. Control of hydrostatic transmissions, Principle of electric drive. Early and modified Ward Leonard control systems.

UNITVAUTOMATICTRANSMISSIONAPPLICATIONS **9**

Chevrolet "Turbo glide" transmission. Toyota's Automatic transmission with Electronic control system, Automatic Transmission with Intelligent Electronic controls system, Hydraulic Actuation system. Continuously Variable Transmission (CVT) – types – Operations.

TOTAL:45HOURS

Text Books:

1. HeldtP.M,TorqueConverters,ChiltonBookCo.,1992.
2. K.Newton,W.SteedsandT.K.Garret,"TheMotorVehicle",13thEdition,Butterworth Heinemann, India, 2004.

ReferenceBooks:

1. HaraldNaunheimer,BerndBertsche,JoachimRyborz,WolfgangNovak, "Automotive Transmissions: Fundamentals, Selection, Design and Application", 2nd ed., Springer, 2011.
2. Heinz Heisler, "Advanced Vehicle Technology", second edition, Butterworth – Heinemann, New York, 2002
3. Dr.N.K.Giri,"AutomobileMechanics",Seventhreprint,KhannaPublishers,Delhi,2005.

Weblinks:

- https://nptel.ac.in/courses/107106088
- https://www.udemy.com/course/the-automatic-transmission/

COURSEOUTCOMES

CO1:	Describetheconceptofgearmotions,driveline positions	**K3**
CO2:	Studyaboutdifferenttypesof gearboxes	**K3**
CO3:	Describethemultistageandpolyphasetorqueconverters,performance characteristics	**K3**
CO4:	StudyaboutAutomatictransmission	**K3**
CO5:	Explaintheworkingofvariouspartslikeengine,transmission,clutch, brakes	**K3**

22PCAU13	VEHICLEDESIGNDATACHARACTERISTICS	L	T	P	Credits
		3	1	0	4

CourseObjective:

- Tounderstandtheconceptsofdesigningthevehicleandvariousresistances.
- Tofamiliarizewithvehicleandengineperformancecurves.

UNITI INTRODUCTION **12**

Assumptions to be made in designing a vehicle, Range of values for Gross Vehicle Weight, Frontal Area, maximum speed, maximum acceleration, grad ability of vehicle in different gears, Basics of Automobile Design.

UNITII RESISTANCETOVECHICLEMOTION **12**

Calculation, Tabulation and Plotting of Curves for Air and Rolling Resistances at various vehicle speeds, Calculation and Plotting of Driving force, Power requirement for different loads and acceleration, Maximum Power calculation.

UNITIII PERFORMANCECURVES-I **12**

Calculation, Tabulation and Plotting of Torque and Mechanical Efficiency for different vehiclespeeds, Interpolation of Pressure – Volume diagram, Calculation of frictional Mean Effective Pressure, Calculation of Engine Cubic Capacity, Bore and Stroke Length.

UNITIV PERFORMANCECURVES-II **12**

Connecting rod length to Crank Radius Ratio, Plotting of Piston Velocity and Acceleration against Crank Angle, Plotting Gas force, inertia force and Resultant force against Crank Angle, Turning Moment and Side Thrust against Crank Angle.

UNITVGEAR RATIOS **12**

DeterminationofGearRatiosforfirst,second,thirdandtopgears,AccelerationandGradability vehicle, typical problems occur on Vehicle performance.

TOTAL:60HOURS

Text Books:

1N.K.Giri,AutomotiveMechanics,KhannaPublishers,NewDelhi,2005.
2.Heldt,P.M.,HighSpeedCombustionEngines,OxforeandI.B.H.PublishingCo.,Kolkata,2002.

ReferenceBooks:

1. HeinzHeisler,AdvancedVehicleTechnology,Butterworth-HeinemannLtd;2ndrevisededition edition. 2002.
2. R.B.Gupta,AutomobileEngineering,SatyaPrakashan,NewDelhi,2012.

Weblinks:

- https://fdocuments.in/reader/full/lecture-notes-vehicle-design-and-data-characteristics
- https://nptel.ac.in/courses/107106080

COURSEOUTCOMES

CO1:	Describetheconceptsandassumptionstobemadeindesigninga vehicle	**K3**
CO2:	Interpretthevariousdatafordesigningthevehicle	**K4**
CO3:	Identifythevariousresistancestovehiclemotionandplotthegraphs	**K3**
CO4:	Formulatetheengineperformanceparametersanddrawthe performancecurves	**K4**
CO5:	Evaluatethevariousforcesandmomentsandplotthe graphs	**K4**

22PCAU14	MANUFACTURINGPROCESSOF AUTOMOTIVE COMPONENTS	L	T	P	Credits
		3	0	2	4

Course Objective:

- This course provides required knowledge, skills and creates self confidence instudents so that they can work on shop floor independently for accurate and precise measurements and manufacturing.

UNITIPOWDER METALLURGY **5**

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

UNITIIFORMING PROCESS **15**

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

UNITIII CASTING AND MACHINING **12**

Sand casting of cylinder block and liners – Centrifugal casting of flywheel, piston rings, bearing bushes and liners, permanent mould casting of piston, pressure die casting of carburetor and other small auto parts. Machining of connecting rods – crank shafts – cam shafts – pistons – pistonpins – piston rings – valves – front and rear axlehousings – flywheel – Honing of cylinder bores – copy turning and profile grinding machines.

UNITIV GEARMANUFACTURING **5**

Gearmilling,Hobbingandshaping–Gear finishingand inspection.

UNITV RECENTTRENDS INMANUFACTURING OFAUTO COMPONENTS 8

Powder injection moulding – Shot peen hardening of gears – 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 – aluminumcomposite brake rotors.

TOTAL: 45 Hours

TEXT BOOK

1.Heldt.P.M.,HighSpeedCombustionEngines,Oxfordpublishingco.,NewYork, 1990.

REFERENCES

1. Haslehurst.S.E., Manufacturing Technology, ELBS, London,1990.

2. Rusinoff.,Forgingandformingofmetals,D.B,TaraporevlaSon&coPvtltd,Mumbai, 1995.

3. Sabroff.A.M. & Others, Forging Materials & Processes, Reinhold Book Corporation, New York, 1988.

4. Upton,PressureDieCasting,PergamonPress,1985.

5. HighVelocityFormingofmetals,ASTME,PrenticeHallofIndia(P)Ltd.,NewDelhi, 1990.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOME:

CO1:	Summarizetheknowledgeonbasicprincipleofpowdermetallurgy manufacturing process.	**K3**
CO2:	Researchonformingprocessinwhichvariousautomotivecomponents, manufacturing process.	**K3**
CO3:	Analyzethecastingandmachiningprocessinwhichvariousautomotive components manufacturing	**K4**
CO4:	Listthevariousgearmanufacturingprocess.	**K5**
CO5:	Illustratethepowderinjection moulding.	**K3**

22PCAU15	AUTOMOTIVEENGINECOMPONENTS DESIGN LABORATORY	L	T	P	Credits
		0	0	2	1

Course Objective:

➢ To familiarize the students to use modeling software to model and design the engine components design.

LIST OF EXPERIMENTS

1. Designand drawingofthe piston.
2. Pistonpinand pistonrings anddrawing ofthese components.
3. Designofconnectingrodsmallendandbigend,shankdesign,bigendcap,boltsand drawing of the connecting rod assembly.
4. Designofcrankshaft andbalancingweightcalculation.
5. Developmentofshortandlongcrankarms,frontendandrearenddetails,anddrawingof the crankshaft assembly.
6. Designand drawingofthe flywheel.
7. Ringgeardesign,drawingoftheflywheel,includingringgearteeth development.
8. Designanddrawing of theinlet andexhaust valves.
9. Designofcamand camshaft,camprofilegeneration, drawingof camand camshaft
10. Completedesign ofclutch components.

THELISTOFEQUIPMENTSFOR ABATCHOF30 STUDENTS

1. Computernodes-30Nos.
2. SoftwarelikeAutoCAD orPro-E-15 licenses

TOTAL:45 hours

Text Books:

1N.K.Giri,AutomotiveMechanics,KhannaPublishers,NewDelhi,2005.
2.Heldt,P.M.,HighSpeedCombustionEngines,OxforeandI.B.H.PublishingCo.,Kolkata,2002.

ReferenceBooks:

1. HeinzHeisler,AdvancedVehicleTechnology,Butterworth-HeinemannLtd;2ndrevised editionedition. 2002.
2. R.B.Gupta,AutomobileEngineering,SatyaPrakashan,NewDelhi,2012.

WebLinks:

1. https://nptel.ac.in/courses/112104031
2. https://nptel.ac.in/courses/112102101

COURSEOUTCOMES

CO1:	Demonstratetheknowledgeondesigningcomponentsto withstand the loads and deformations.	**K3**
CO2:	Synthesize,analyzeanddocumentthedesignofthevarious components	**K3**
CO3:	Demonstratetheabilitytouseengineeringtechniquesfor developing vehicle components with industry standards	**K3**
CO4:	Performthedesignofthecrankshaft,balancingweight calculations.	**K3**
CO5:	Understandthe complete methodologyofdesign&drafting.	**K3**

22PCAU16	PERFORMANCEANDEMISSION TESTING LABORATORY	L	T	P	Credits
		0	0	2	1

CourseObjective:

- ToconductperformancetestandemissiontestontheICengines.
- Studyandanalysisofengineperformance characteristicsandengine emissions.

LIST OF EXPERIMENTS

1. Study of Pressure pickups, charge amplifier, storage oscilloscope and signal analysers used for IC engine testing.
2. Performancestudyofpetrolanddieselenginesbothatfullloadandpartload conditions.
3. Morseteston petrolanddiesel engines.
4. Determinationofcompressionratio,volumetricefficiencyandoptimumcoolingwater flow rate in engines.
5. Heatbalanceteston anautomotiveengine.
6. Testingof2and4wheelersusingchassisdynamometers.
7. StudyofNDIRGasAnalyserandFID
8. StudyofChemiluminescentNOxanalyzer
9. MeasurementofHC,CO,CO2:, O2usingexhaustgas analyzer
10. Dieselsmoke measurement.

TOTAL: 45 hours

TextBooks:

1. InstitutionofMechanicalEngineers,InternalCombustionEngines:Improving Performance, Fuel Economy and Emissions, Woodhead Pub Ltd
2. JamesHalderman,AdvancedEnginePerformanceDiagnosis,Pearson;6thedition

ReferenceBooks:

1. GerardMeurant,Engine Testing:TheoryandPractice,ElsevierScience
2. AnthonyMartyr,MichaelAlexande,Enginetesting:TheoryandPractice, Elsevier Science

WebLinks:

- https://www.bharathuniv.ac.in/downloads/auto/U18PCAU5L2%20Engine%20Testing%20Emission%20Measurement%20Lab.pdf
- https://archive.nptel.ac.in/courses/112/104/112104033/

COURSEOUTCOMES

CO1:	DefinethePressurepickups,chargeamplifier,storage oscilloscope and signal analyzers	**K3**
CO2:	DefinethePressurepickups,chargeamplifier,storage oscilloscope and signal analyzers	**K3**
CO3:	Evaluatetheperformanceofpetrolanddieselenginesbothat full load and part load conditions	**K4**
CO4:	PerformtheMorsetestonpetrolanddiesel engines	**K3**
CO5:	PerformtheHeatbalance testonanautomotiveengine	**K3**

22PCAU17	INDUSTRIALTRAINING	L	T	P	Credits
		0	0	4	2

Course Objective:

The objective of an industrial visit is to provide the students an insight regarding the internal working of companies. Today, we all perfectly understand that theoretical knowledge is just not enough for a successful professional career. It is here that by going beyond academics, industrial visit provides students a much relevant practical perspective of the actual work place and the larger world of industries. Industrial visits provide the students with an opportunity to learn practically through interaction, working methods and employment practices. Industrial visit helps students to combine their theoretical knowledge of business operations with the practical knowledge of its actual functioning. This final report shall be typewritten form as specified in the guidelines.

22PCAU18	TWO ANDTHREE WHEELERS	L	T	P	Credits
		3	0	0	3

Course Objective:

- Tounderstandconstructionaldetails,operatingcharacteristicsandvehicle designaspects.
- Tofamiliarizewithheavy-duty andlight-duty vehicles.

UNITI POWER UNIT **9**

Two-stroke SI engine, four-stroke SI engine; merits and demerits, Symmetrical and unsymmetrical port timing diagrams, Types of scavenging processes, merits and demerits, scavenging pumps, Rotary valve engine. Fuel system, Lubrication system. Magneto coil and battery coil spark ignition system, electronic ignition system. Starting system, Kick-starter system.

UNITIICHASSISANDSUB-SYSTEMS **9**

Mainframe and its types. Chassis and shaft drive, Single, multiple plates and centrifugal clutches. Gearbox and gear controls. Front and rear suspension systems. Shock absorbers. Panel meters and controls on the handlebar.

UNITIIIBRAKES,WHEELSANDTYRES **9**

Brakes-Drum brakes, disc brakes, front and rear brake links, layouts, Wheels-Spoked wheel, cast wheel, disc wheel, and disc types. Tyres and tubes.

UNITIV TWO WHEELERS **9**

Case study of major Indian models of motorcycles, scooters and mopeds, TVS mopeds and motorcycles, Hero Honda motorcycles, Bajaj scooters and motorcycles, Yamaha, Enfield motorcycles. Servicing and maintenance.

UNITV THREE WHEELERS **9**

Case study of major Indian models of three-wheeler-, Bajaj Auto rickshaws, pickup vans, delivery vans, Apeload autos and trailer, Servicing and Maintenance: daily, weekly,monthly, Fault tracing.

TOTAL:45 hours

TextBooks:

1. Irving.P.E.– MotorCycle Engineering-Temple Press Book,London – 1992.

ReferenceBooks:

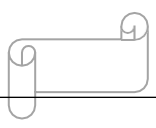
1. TheCycleMotorManual -TemplePressLimited,London -1990
2. EncyclopediaofMotorcycling -20volumeMarshall, Cavensih,UK -1989
3. BrayantR.V,Vespa-Maintenance andRepair Series –S.Chand&Co.,NewDelhi - 1986.
4. Raymond Broad Lambretta - A Practical Guide to maintenance and repair– S.Chand. &Co., New Delhi - 1987.

WebLinks:

1. https://onlinecourses.nptel.ac.in/noc22_de02/preview
2. https://nptel.ac.in/courses/107103084

COURSEOUTCOMES

CO1:	Clearlyexplainthescavengingprocesses	**K3**
CO2:	Explaintheelectronicignition system	**K3**
CO3:	Familiarwiththeshaft drive	**K3**
CO4:	DescribetheSuspension system	**K3**
CO5:	Familiarwiththedifferenttypesofbrake	**K4**



22PCAU19	AUTOMOTIVECHASSISCOMPONENTS DESIGN	L	T	P	Credits
		3	1	0	4

Course Objective:

- ➢ TostudytheConstructionaldetailsandTheoryof important drivelines.
- ➢ TofamiliarizewiththeSteering, Braking andSuspension Systemsof Automobiles.

UNITIVEHICLEFRAMEANDSUSPENSION **9**

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

UNITII FRONTAXLE ANDSTEERINGSYSTEMS **9**

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

UNITIII CLUTCH **9**

Design of single plate clutch, multi-plate clutch and cone clutch. Torque capacity of clutch. Design of clutch components, Design details of roller and sprag type of clutches.

UNITIV GEARBOX **9**

Gear train calculations, the layout of gearboxes. Calculation of bearing loads and selection of bearings. Design of three-speed and four-speed gearboxes.

UNITVDRIVELINE ANDREARAXLE **9**

Design of propeller shaft. Design details of final drive gearing. Design details of fullfloating, semi-floating and three quarter floating rear shafts and rear axle housings and design aspects of the final drive.

TOTAL: 45 hours

TextBooks:

1. Giri,N.K.,"AutomobileMechanics", Khannapublishers,NewDelhi, 2007.
2. Khurmi.R.S.&Gupta.J.K.,"AtextbookofMachineDesign",EurasiaPublishingHouse (Pvt) Ltd, 2001.

ReferenceBooks:

1. DeanAverns,"AutomobileChassisDesign", IllifeBookCo., 2001.
2. Heldt,P.M.,"AutomotiveChassis",ChiltonBookCo.,1992.

WebLinks:

1. https://nptel.ac.in/courses/107106088
2. https://www.pdfdrive.com/the-automotive-chassis-volume-1-components-design-mechanical-engineering-series-e184037673.html

COURSEOUTCOMES

CO1:	Analyzethe framesinvehicles	**K4**
CO2:	Explaintestingofframes andmaterialsusedinframes	**K3**
CO3:	Describetheconstructiondetailsofsteeringlinkages	**K3**
CO4:	Sketchthesteeringlinkageslayoutforconventionaland independent suspensions	**K3**
CO5:	Evaluatethe effect of driving thrust and torque	**K4**

22PCAU20	AUTOMOTIVEELECTRICALAND ELECTRONICS SYSTEMS	L	T	P	Credits
		3	0	2	4

CourseObjective:

➢ Tobefamiliarwithcharging, theignitionsystemusedin automobiles.

➢ Understandtheconstructionandapplicationsofelectricalandelectronicscomponents in various automotive electrical circuits.

UNITIBATTERIESANDSTARTINGSYSTEM 10

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

UNITIICHARGINGSYSTEMLIGHTINGAND ACCESSORIES 9

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

UNITIII ELECTRONICIGNITION ANDINJECTION SYSTEM 9

Spark plugs. Advanced mechanisms. Different types of ignition systems. Electronic fuel injection systems, mono and multi-point fuel injection system (MPFI).

UNITIV SAFETY SYSTEMS 8

Anti-Lock braking system, airbag restraint system, voice warning system, seat belt system, road navigation system, anti-theft system.

UNITVSENSORS ANDMICROPROCESSORSIN AUTOMOBILES 9

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

TOTAL:45 hours

TextBooks:

1. YoungA.P.&Griffiths.L.“AutomotiveElectricalEquipment”,ELBS&NewPress- 1999.
2. WilliamB.Riddens“UnderstandingAutomotive Electronics”,5thedition- Butter worth Heinemann Woburn, 1998.
3. Crouse,W.H“AutomobileElectricalEquipment”,McGraw-HillBookCo.,Inc.,New York, 3rd edition, 1986.

ReferenceBooks:

1. Bechhold“UnderstandingAutomotiveElectronics”,SAE,1998.
2. Judge A.W “Modern Electrical Equipment of Automobiles”, Chapman & Hall, London,1992.
3. Kholi. P.L “Automotive Electrical Equipment”, Tata McGraw-Hill Co., Ltd., New Delhi, 1975.
4. RobertBosch“AutomotiveHandbook”,SAE(5thEdition), 2000.

5.Ganesan.V.“InternalCombustionEngines”,TataMcGraw-HillPublishingCo.,New Delhi, 2003.

WebLinks:

1. https://www.sathyabama.ac.in/course-materials/automotive-electrical-and-electronics
2. https://nptel.ac.in/courses/107106088

COURSEOUTCOMES

CO1:	AcquiretheknowledgeofElectricalandElectronicsengineering concepts	**K3**
CO2:	Understandthepurpose,constructionandworkingofdifferent batteries and electrical systems used in Automobiles	**K3**
CO3:	Identify,demonstrateandcomparethevariouscomponentsand systems of Auto electrical systems	**K4**
CO4:	Obtainanoverviewofautomotivecomponents,subsystems, design cycles, communication protocols	**K3**
CO5:	Interfaceautomotivesensorsandactuatorswith microcontrollers	**K4**

22PCAU21	MECHATRONICSLABORATORY	L	T	P	Credits
		0	0	2	1

Course Objectives:

1. Toprovideexperimentalinsightintotheapplicationsofdifferentsensors,signal conditioning circuits and measurement techniques.
2. Torenderpracticalexperienceinthedesignanddevelopmentof Hydraulic,Pneumaticand Electric actuator circuits that is required to develop Mechatronics Systems

LIST OF EXPERIMENTS:

1. MeasurementofDisplacement,ForceandTemperatureusingTransducersandData Acquisition System
2. ModelingandAnalysisofbasicHydraulic,Pneumatic,Electro-Pneumatic,Electricaland Electronic Circuits by using simulation software
3. ActuationofdoubleactingcylinderbyusingHydraulic,PneumaticandElectro- Pneumatic circuits
4. Automatingthecylinder sequenceA+B+B-A-byusing Microcontroller
5. PLCAutomationwithTimersandCounters–CylinderSequencing–SortingofObjects on Conveyor Belt
6. DCDrives– SpeedandDirectionControl byusing Microcontroller
7. ACDrives–SpeedandDirectionControlbyusing Microcontroller
8. StepperMotor–Position,SpeedandDirectionControl
9. ServoMotor–Position,SpeedandDirection Control
10. AutomaticTemperatureControlSystem–Interfacingoftemperaturesensor,cooling system (Fan), LCD Display with Microcontroller.

TOTAL = 60 PERIODS

Text book:

1. DavidAlciatoreandMichaelHistand,IntroductiontoMechatronicsLaboratory Excercises, McGraw-Hill Education
2.

Referencebook:

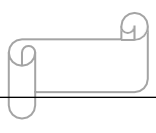
1.MusaJouaneh,LaboratoryExercisesinMechatronics,CENGAGELearning Custom Publishing

Weblink

1.https://www.uab.edu/engineering/me/research/mechatronics-lab

COURSEOUTCOMES:

CO1:	Demonstratethemeasurementofphysicalquantitysuchasdisplacement, force and temperature, and also the operation of signal conditioning circuits.	**K3**
CO2:	DeviseappropriatecircuitstoautomateandcontroltheHydraulic, Pneumatic, and Electric actuators.	**K5**
CO3:	ImplementPLC,PIDandmicrocontrollerasacontrolunitinthe Mechatronics System.	**K5**
CO4:	Developamodelofrobotbyusingsimulationsoftware,andalsoexecute real-time control over a Robot by IoT.	**K5**
CO5:	Implementimageprocessingtechniquestodevelopmachinevision systems.	**K5**



22PCAU22	SUMMERINTERNSHIP	L	T	P	Credits
		0	0	4	2

Course Objective:

The objective of the in-plant training is to enhance and improve the skill set and knowledge the automobileengineering students whichboost their performance and consequently developing them to meettheircareerobjectives.Traininghelpslearnerstoacquirethelatest Techniques,skills, methodologies and to build a strong foundation for their career growth. Three periods per week shall be allotted in the time table and this time shall be utilized by the students toreceive the directions from the faculty. The student has to undergo a training of 12 days during the semester in the automotive related industries and submit a detailed port based on the industry,products and services,things learned from the industry.This Final report shall be type written for mass specified in the guidelines.

22PCAU23	VEHICLE MAINTENANCE	L	T	P	Credits
		3	1	0	4

Course Objective:

- ➢ Tohavecomplete knowledgeof thevehiclemaintenanceprocedures.
- ➢ Toimpartknowledgeonenginemaintenance–repairand overhauling.

UNITIMAINTENANCEOFRECORDSANDSCHEDULES 10

Requirements and importance of maintenance, types of maintenance, preparation of checklists, Inspection schedule, maintenance of records, log sheets and other forms, and safety precautions in maintenance. The motor vehicle acts, insurance etc and traffic rules, motor vehicle driving rules and regulations.

UNITIIENGINE MAINTENANCE– REPAIRAND OVERHAULING 9

Dismantling of engine components and cleaning, cleaning methods, visual anddimensional inspections,minor and majorreconditioningofvariouscomponents,reconditioning methods,engineassembly,specialtoolsusedfor maintenance overhauling, engine tune-up, including modern engines.

UNITIIICHASSISMAINTENANCE-REPAIRAND OVERHAULING 10

Mechanical and automobile clutch, fluid flywheel, torque converter, automatic transmission and gearbox, servicing and maintenance. Maintenance servicing of the propeller shaft and differential system.Maintenanceservicing ofsuspension systems. Brake systems, types andservicingtechniques.Steeringsystems,overhaulingandmaintenance.Wheelalignment, computerized alignment and wheel balancing.

UNITIV ELECTRICALAND ELECTRONICSYSTEMMAINTENANCE 8

Testing methods for checking electrical and electronic components, checking the battery, starter motor, charging systems, DC generator and alternator, ignitions system, and lighting systems. Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dashboard instruments.

UNITVMAINTENANCEOFFUEL,COOLING,LUBRICATIONSYSTEMSAND VEHICLE BODY 8

Servicing and maintenance of fuel systems of different types of vehicles, calibration and tuningofengineforoptimumfuelsupply.Coolingsystems,waterpump,radiator,thermostat, anticorrosion and antifreeze additives.Lubrication maintenance, lubricating oil changing, greasing of parts. Vehicle body maintenance,minor and major repairs. Door locks and window glass actuate system maintenance.

TOTAL:45 hours

TextBooks:

1. JohnDoke“FleetManagement”,McGraw-HillCo.1984.
2. AutomotiveMechanicsW.H.crouse

ReferenceBooks:

1. JamesDHalderman- AdvancedEnginePerformanceDiagnosis–PHI1998.
2. ServiceManualsfrom DifferentVehicleManufacturers.66

3. AutomobileEngineeringbyKirpal Singh
4. BoschHand Book – 3rd Edition SAE1993.

WebLinks:

1. https://nptel.ac.in/courses/112105048
2. https://onlinecourses.swayam2.ac.in/nou21_me10/preview

COURSEOUTCOMES

CO1:	Demonstratethedismantling ofengine componentsand cleaning	**K4**
CO2:	Listtheminorandmajorreconditioningofvariousengine components	**K3**
CO3:	Illustratethemaintenanceand servicing of suspension systems	**K3**
CO4:	Analyzethetestingmethodsforcheckingthebattery,startermotor, charging systems, ignitions system	**K3**
CO5:	Discussthefaultdiagnosisandmaintenanceofmodernelectronic controls	**K4**

22PCAU24	VEHICLE MAINTENANCE & RECONDITIONINGLABORATORY	L	T	P	Credits
		0	0	2	1

Course Objective:

- ➢ Ensurethemaximumavailabilityof vehicleswithoutanymajorproblem.
- ➢ Educatethe customeraboutsafe driving.

LISTOFEXPERIMENTSFORVEHICLEMAINTENANCE

1. Studyand Layoutof AutomobileRepair Shop.
2. StudyandPreparation ofWorkshopStatements.
3. Studyand List ofTools andInstruments.
4. Minorand MajorTuning ofDiesel andPetrol Engines.
5. FaultDiagnosisof Ignition,StartingandChargingSystem.
6. FaultDiagnosisofPetrolandDieselFuelSystemandFilters&AirCleaners.
7. FaultDiagnosisof LightingSystem Horn&Wiper.
8. PerformingBodyRepairWorks.
9. AdjustmentOfPedalPlayInClutchBrake,HandBrakeandSteering Wheel.
10. A)BleedingOfHydraulicBrakeSystem andDieselFuel System.
    B) WheelBearing Adjustment.
    C) AdjustmentofHeadlights.

LISTOFEQUIPMENTSFORVEHICLEMAINTENANCELABORATORY

1. Cylinderreboring–checkingthecylinderbore.
2. Valvegrinding,valvelapping.
3. Settingthevalve angle andchecking forvalveleakage
4. Wheelalignment –testingofcamber,caster.
5. Testingkingpininclination,toe-inandtoe-out.
6. Brakeadjustment
7. Brakebleeding.
8. RemovalofTyre&Tube.

LISTOFEXPERIMENTSFORVEHICLERECONDITIONING

1. EngineAnalyzer
2. Cylindercompressionpressuregauge
3. Vacuumgauge
4. Sparkplugcleanerandtester
5. Camangleandrpmtester
6. Tacho-meter
7. Wheelalignment apparatus
8. Gaswelding equipment
9. Bearing puller
10. Headlightalignment gauge
11. Servicemanualsofpetrol,anddieselengines

LISTOFEQUIPMENTS FORVEHICLE RECONDITIONING

1. Cylinderre-boring machine
2. Valvegrinding machine
3. Valvelappingmachine

4. Wheelalignment apparatus
5. Tyre remover

TOTAL:45 hours

Text Books:

1. JohnDoke“FleetManagement”,McGraw-HillCo.1984.
2. AutomotiveMechanicsW.H. crouse

ReferenceBooks:

1. JamesDHalderman- AdvancedEnginePerformanceDiagnosis–PHI1998.
2. ServiceManualsfrom DifferentVehicleManufacturers.

WebLinks:

1. https://www.bharathuniv.ac.in/downloads/auto/U18LCAU7L2%20%20Vehicle%20Maintenance%20and%20Reconditioning%20Lab.pdf
2. https://www.thrall.org/readyref/Automobiles.html

COURSEOUTCOMES

CO1:	Explainthepreparationof workshoplayout and statements	**K3**
CO2:	Describethetoolsand instrumentsrequiredfor workshop	**K3**
CO3:	Demonstratethefaultdiagnosisofelectricalsystems.	**K3**
CO4:	Demonstratethefaultdiagnosisofairandfuel systems.	**K3**
CO5:	PerformadjustmentofClutch,BrakeandSteering	**K3**

22EEAU01	PROJECTPHASE-I	L	T	P	Credits
		0	0	10	5

Course Objective:

The objective of the project work is to enable the Student who individually carry out the project. Thi Project which involves theoretical and experimental studies related to the

Branch of study.Every project work shall have a guide who is the member of the faculty of th institution. Sixperiods perweekshallbeallottedinthetimeoftheinstitution.Sixperiod per week shall b allotted in the time table and this time shallbe utilized by the studentsreceive the directions fron the guide, on library reading, laboratory work, computer analysi orfieldworkasassignedbytheguideand also to present in periodical seminars on th progressmadeintheproject.Each student shallfinallyproduceacomprehensiverepor coverin background information, literature survey, problem statement, project work detail and conclusion. This final report shall be typewritten form as specified in the guidelines.

The continuous assessment shall be made as prescribed by the regulation.

22EEAU02	PROJECTPHASE-II	L	T	P	Credits
		0	0	20	10

Course Objective:

The objectiveofthe projectworkistodoa projectindividuallywhichinvolvestheoretica and experimental studies related to the branch of study. Every project work shall have a guid who is the member of the faculty of the institution. Six periods per week shall be allotted inthetimeoftheinstitution.Sixperiodsperweekshallbeallottedinthetimetableandthis timeshallbeutilizedbythestudentstoreceivethedirectionsfromtheguide,onlibrary reading, laboratory work, computer analysis or field work as assigned by the guide and alsotopresentinperiodicalseminarsontheprogressmadeintheproject.Eachstudentsha finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.

Thecontinuous assessment shall bemadeas prescribed by the regulation.

22PEAU01	VEHICLE DYNAMICS	L	T	P	Credits
		3	0	0	3

Course Objective:

- Tostudyaboutvibrations andhowtoreducethevibrationunderdifferent loads.
- Tofamiliarizewithspeedandroadconditions inordertoimprovethecomfortofthe passengers.

UNITI BASIC OF VIBRATION **12**

Classification of vibration, definitions, mechanical vibrating systems, mechanical vibration and human comfort. Modeling and simulation studies. Single degree of freedom, free, forced and damped vibrations. Magnification factor and transmissibility. Vibration absorber. Vibration measuring instruments. Two degrees of freedom system. Modal analysis.

UNITII TYRES **12**

Tireforcesandmoments,Tirestructure,LongitudinalandLateralforceatvariousslipangles, rolling resistance, Tractive and cornering property of tire. Performance of tireon wet surface. Ride property of tires. Test on Various road surfaces. Tire vibration.

UNITIIIPERFORMANCECHARACTERISTICSOF VEHICLE **12**

Equation of motion and maximum tractive effort. Aerodynamics forces and moments. Power plant and transmission characteristics. Prediction of vehicle performance. Braking performance- Braking Force, Brake Factor, Braking Efficiency and Stopping Distance.

UNITIV HANDLINGCHARACTERISTICS OF VEHICLES **12**

Mathematical model of handling, Fundamental condition for true Rolling Steady State Handling: Slip angle, cornering power, Neutral steer, understeer and oversteer, Steady-state response, Lateral Acceleration, Transient response characteristics. Directional stability of the vehicle.

UNITVDYNAMICS OFSUSPENSION SYSTEM **12**

Requirements of the suspension system. Spring mass frequency, wheel hop, Wheel wobble, wheel shimmy, choice of suspension spring rate. Calculation of effective spring rate. Vehicle suspension in fore and aft, Hydraulic dampers and choice of damping characteristics. Compensated suspension systems.

TOTAL:60 hours

TextBooks:

1. RaoJ.SandGupta.K"TheoryandPracticeofMechanicalVibrations",WileyEastern Ltd., 2002.
2. J.Y.Wong,'Theoryofgroundvehicle',4th Edition,JohnWileyandSonsInc., Newyork, 2008.
3. Dr. N. K. Giri, "Automobile Mechanics", Seventh reprint, Khanna Publishers, Delhi, 2005.

ReferenceBooks:

1. MassimoGuiggiani,"TheScienceofVehicleDynamics:Handling,Braking,andRide of Road and Race Cars", Springer, 2014 edition
2. Groover,"MechanicalVibration",7th Edition,NemChand&Bros,Roorkee,India, 2003.
3. W.Steeds,'Mechanicsofroadvehicle'IliffeBooks Ltd,London1992
4. JG.Giles,'Steering,Suspensiontyres', IllifeBooksLtdLondon1975
5. P.M.Heldt,'Automotivechassis',ChiltonCo.,Newyork,1982

WebLinks:

1. https://nptel.ac.in/courses/107106080
2. https://ed.iitm.ac.in/~shankarram/Course_Files/ED5220/ED5220.htm

COURSEOUTCOMES

CO1:	Describethevehiclevibrationandsimulation modeling	**K3**
CO2:	Definethe vehicledegrees of freedom	**K3**
CO3:	Describetheforceand moment on tyre	**K3**
CO4:	Clearlyexplainthetyre properties	**K3**
CO5:	FamiliarwiththeAerodynamicsforcesandmoments	**K4**

22PEAU02	AUTOMOTIVEENGINECOMPONENTSDESIGN	L	T	P	Credits
		3	0	0	3

CourseObjective:

- Tomakethestudentsunderstandthedesignconceptandprinciplesofvariousengine components. These concepts and principles are familiarized for design of components.
- Tomakestudentsfamiliarwithenginecomponents.

UNITI INTRODUCTION **9**

Engineering materials - Introduction endurance limit, notch sensitivity. Tolerances, types oftolerances and fits, design considerations for interference fits, surface finish, surface roughness, Rankine's formula - Tetmajer's formula - Johnson formula- design of push- rods.

UNITIIDESIGNOFCYLINDER,PISTONANDCONNECTINGROD **9**

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

UNITIIIDESIGNOF CRANKSHAFT **9**

Balancing of I.C. engines, significance of firing order. Material for crankshaft, design of crankshaft underbendingandtwisting,balancingweightcalculations,development of short andlongcrankarms. Front and rear-end details.

UNITIVDESIGNOF FLYWHEELS **9**

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

UNITVDESIGNOFVALVESANDVALVETRAIN **9**

Designaspectsofintake&exhaustmanifolds,inlet&exhaustvalves,valvesprings,tappetsandvalve train. Design of cam &camshaft. Design of rocker arm. Cam profile generation.

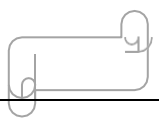
TOTAL:45HOURS

Text Books:

1. Khurmi. R.S. &Gupta.J.K., A textbook of Machine Design, Eurasia Publishing House (Pvt)Ltd, 2001.
2. GanesanV,"Internalcombustionengines",4thedition,TataMcGrawHillEducation,2012.
3. RajputR.K,"AtextbookofInternalCombustionEngines",3rdedition,LaxmiPublications (P)Ltd,2016.

Reference Books:

1. Jain.R.K,"MachineDesign",KhannaPublishers,NewDelhi,2005.
2. Giri.N.K,AutomobileMechanics,KhannaPublishers,NewDelhi, 2007.



Weblinks:

- https://onlinecourses.nptel.ac.in/noc20_de06/preview
- https://www.vidyarthiplus.com/vp/Thread-AT6601-Automotive-Engine-Components-Design-Lecture-Notes-All-Units

COURSEOUTCOMES

CO1:	Definetheconceptofinterferencefits&surfacefinish.	**K3**
CO2:	DescribetheRankine'sformula,Tetmajer'sformula&Johnson formula.	**K4**
CO3:	Explaintheconceptsofcylinderandpiston design.	**K3**
CO4:	AnalyzetheMaterialforconnectingrod.	**K4**
CO5:	Familiarwiththevarioustypesoffiringorder.	**K4**

22PEAU03	AUTOMOTIVEPOLLUTIONAND CONTROL	L	T	P	Credits
		3	0	0	3

Course Objective:

➢ To impart knowledge in automotive pollution control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engines will be taught to the students.

UNITI EMISSIONFROMAUTOMOBILES **5**

Vehicle population assessment in metropolitan cities and contribution to pollution, effects on human health and environment, global warming, various emissions from Automobiles — Formation, transient operational effects on pollution.

UNITIIEMISSIONS FROMSPARKIGNITIONENGINE ANDITS CONTROL **12**

Emission formation in SI Engines- Carbon monoxide- Unburned hydrocarbon Nitric oxide. Lead particulate—Poly-nuclear Aromatic hydrocarbon emissions—Effects of design and operating variables on emission formation- controlling of pollutants from Engine- Thermal reacts — Catalytic converters — Charcoal Canister Control for evaporative emission — Positive Crankcase ventilation system for UBHC emission reduction.

UNIT IIIEMISSIONFROMCOMPRESSIONIGNITIONENGINEANDITSCONTROL **12**

Physical and Chemical delay — Significance — Intermediate Compounds Formation — emission formation due to incomplete Combustion — Effect of Operating variables on Emission formation — White, Blue, and Black Smokes. Nitric Oxide and Particulate controlling of Emission — Operating Behavior- Fumigation EGR- Air Injection — Cetane number Effect.

UNIT–IVNOISEPOLLUTIONFROMAUTOMOBILES **8**

Causes for Noise from Automobiles—Traffic Noise—Engine Noise—Transmission Noise— vehicle structural Noise, Exhaust Noise, Noise reduction in Automobiles — Encapsulation technique for noise reduction — Silencer Design on Sound reduction in automobiles.

UNIT–VTESTPROCEDURESANDEMISSIONMEASUREMENTS **8**

Constant VolumeSampling Iand 3 (CVSI&CVS3)Systems-Sampling Procedures — Seven modeandthirteenmodecyclesforEmissionSampling —Samplingproblems —Quantifying Emissions — Measurement of CO, CO by NDIR. Hydrocarbon emission by FID- Chemiluminesecent detector for Measurement of NOR— Smoke meters — Dilution Tunnel Technique for particulate Measurement- Sound level meters.

TOTAL:45 hours

TextBooks:

1. G.P.SpringerandD.J.Patterson,EngineEmissions,Pollutantformation,Plenum Press, New York, 1986.
2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Ann Arbor Science Publication, 1985.

ReferenceBooks:

1. V.Ganesan,'InternalcombustionEngines',TataMcGrawHillBookCo,EighthReprint, 2005.
2. CrouseandAnglin,'AutomotiveEmissionControl',McGrawHillCompany. Newyork 1993.
3. L.Lberanek,'NoiseReduction',McgrawhillCompany., Newyork1993.
4. C.Duerson,'NoiseAbatment',Butterworthsltd., London1990.

WebLinks:

1. https://nptel.ac.in/courses/112104033
2. https://quizxp.com/nptel-air-pollution-and-control-assignment-4/

COURSEOUTCOMES

CO1:	Analyzethe impact ofvehiclepopulation on pollution	**K4**
CO2:	Describetheemissionanditseffectonhumanhealthand environment	**K3**
CO3:	Describetheformation ofpollutant in SIengine	**K3**
CO4:	Identifytheformation ofpollutant inCIengine	**K4**
CO5:	Clearlyexplainthevariousnoiseandnoisereductionin automobile	**K3**

22PEAU04	SIMULATIONOF IC ENGINE PROCESSES	L	T	P	Credits
		3	0	0	3

Course Objective:

- ➢ Tounderstandcombustionphenomenoninsidethecylinderanditscomputer simulation.
- ➢ Toimpart knowledgein thesimulation of IC engineprocesses.

UNITIINTRODUCTION **9**

Introduction. The heat of reaction, complete combustion in C/H/O/N Systems, Constant volume adiabatic combustion, constant pressure adiabatic combustion. Calculation of adiabatic flame temperature.

UNIT IISI ENGINE SIMULATION **9**

Deviation between actual and air standard cycles of operation- problems, SI enginesimulation with adiabatic constant volume combustion with fuel and air being considered, calculation of temperature drop due to fuel vaporization,calculation of mean effective pressure, torque and thermal efficiency at full throttle, part throttle and supercharged conditions.

UNITIIIACTUAL CYCLESIMULATIONINSI ENGINES **9**

Progressive combustion; gas exchange process, heat transfer process, friction. Validation of the computer code with experimental data based on performance parameters and pressure crank angle diagram.

UNITIVSIMULATIONOF 2-STROKE SIENGINE **9**

Simulation of the scavenging process, determination of the pressure-crank angle variation, computation of performance parameters.

UNITVDIESELENGINE SIMULATION **9**

Main difference between SI and CI engine simulation, differences between ideal and actual cycles, zero-dimensional combustion model for diesel engine, heat transfer and gas exchange processes. Performance prediction and comparison of results.

TOTAL:45 hours

TextBooks:

1.Ganesan.V.-ComputerSimulationofsparkignitionengineprocess,-UniversitiesPress (I)Ltd, 1996.

2. Ganesan. V. - Computer Simulation of compression ignition engine process – Universities Press (I) Ltd, 2000.

3. AshleyCampbel - Thermodynamicanalysisof combustionengines -JohnWileyandSons, New York - 1986.

ReferenceBooks:

1. Benson.R.S.,Whitehouse.N.D., - Internal CombustionEngines -Pergamon Press, oxford, 1979

2. Ramoss.A.L.,-ModellingofInternalCombustionEnginesProcesses-McGraw-Hill Publishing Co., 1992

WebLinks:

1. https://coursesity.com/course-detail/internal-combustion-engines-online-video-course
2. https://nptel.ac.in/courses/112103262

COURSEOUTCOMES

CO1:	Describetheclassificationsandapplicationsofenginecycle simulation model	**K3**
CO2:	Graspthemajormodelingandsimulationmethodsandthe influence of model	**K4**
CO3:	Familiarwiththemodelingoffilling/emptyingmethodand ability to build up control-oriented simulation model	**K3**
CO4:	Familiarwiththeessentialmodelsofenginecyclesimulation and calculation of engine parameters	**K3**
CO5:	Simulatethedifferentengine processes	**K4**

22PEAU05	VEHICLE BODYENGINEERING	L	T	P	Credits
		3	0	0	3

Course Objective:

- ➢ Toimpart knowledgeintheconstruction ofvehicles.
- ➢ Tofamiliarizethe aerodynamicconcept&panelingofthepassengercarbody.

UNITI CAR BODYDETAILS **9**

Typesofcarbodies-visibility:regulation,driver'svisibility,methodsofimprovingvisibility- safety: safety design, safety aspects. Constructional details of a passenger car.

UNITIIBUS BODYDETAILS **9**

Classificationofbusbodies–based ondistancetraveled,basedon thecapacityofthebus and based on style & shape. Types of metal sections used in the construction. Construction of Conventional and integral type buses.

UNITIII CAR AERODYNAMICS **9**

Objects — Vehicle types of drag. Various types of forces and moments. Effects of forces and moments.Various body optimization techniques for minimum drag. Principle of wind tunnel technology. Flow visualization techniques. Test with scale models.

UNITIV COMMERCIALVEHICLE DETAILS **9**

Classification of commercial vehicle bodies. Construction of Tanker body and Tipper body. Dimensions of driver's seat in relation to controls. Driver's cab design. The compactness of the Driver's cab. Segmental construction of driver's cab.

UNITVCOMMERCIALVEHICLE AERODYNAMICS **9**

Effects of rounding sharp front body edges. Effects of the different cab to trailer body for body pressure distribution. Effects of a cab to trailer body roof height. Commercial vehicle drag-reducing devices. Modern painting process of a passenger car body.

TOTAL:45 hours

TextBooks:

1. Pawloski,J.,'VehicleBodyEngineering',BusinessBooksLtd,1970
2. J.G.Giles,'BodyConstructionandDesign',ButterworthandCo.,1975

ReferenceBooks:

1. John Fenton 'Vehicle Body layout and analysis',Mechanical Engineering Publication Ltd., 1984
2. HeinzHeisler,"AdvancedVehicleTechnology",secondedition,Butterworth– Heinemann, New York, 2002

WebLinks:

1. https://nptel.ac.in/courses/107103084
2. https://nptel.ac.in/courses/107106088

COURSEOUTCOMES

CO1:	Describetheconcept ofcarbody design	**K3**
CO2:	Explainthepassenger safety,crumplezoneandcrash testing	**K3**
CO3:	Explaintheconceptsofwindtunnel testing	**K3**
CO4:	Analyzevehiclebodyoptimizationtechniquestoreducedrag	**K4**
CO5:	Familiarwith thevarious typesofbusbody construction	**K3**

22PEAU06	SPECIALTYPES OFVEHICLES	L	T	P	Credits
		3	0	0	3

Course Objective:

➢ Tounderstandtheconceptandprincipleofoperationofspecialvehiclessuchas Bulldozers, Ditchers, Bucket excavators, farm equipment, military vehicles etc.

➢ Toenhancetheknowledgeofthestudentsaboutthevariousequipmentusedinearthmoving applications.

UNITITRACTORSANDFARMEQUIPMENTS **9**

Classification and power required - Design consideration - Ride and stability characteristicsof power plants and transmission – Special features and constructional detail- Farm equipment.

UNITIIEARTH MOVING MACHINES **9**

Constructionlayout,capacityandapplicationsofearthmovers fordumpers,front-endloaders, bulldozers, excavators, backhoeloaders, scrapers, and motorgraders etc. criteriaforselection of prime mover from dumpers and front end loaders based on vehicle performance characteristics.

UNITIIIPOWERTRAINCONCEPTS **9**

Engine – converter match curves. Epicyclic type transmissions. Selection criteria foruniversal joints. Constructional details of steerable and drive axles of the dumper.

UNITIVSPECIAL PURPOSEVEHICLESFORINDUSTRIAL APPLICATIONS **9**

Constructional features, capacity and stability of jib cranes. Vibratory compactors. Special features and constructional detail-Stackers, bore well machines, concrete mixtures.

UNITVTWOAND THREE WHEELERS **9**

Constructional details of engine components in moped, scooter, motorcycle and three- wheelers. Magneto ignition systems multiple disc clutch and centrifugal clutch details. Types of gearboxes, types of driver–chain drive, shaft drive, frame and front forks, and two-wheeler suspension system.

TOTAL:45 hours

TextBooks:

1. ConstructionPlanning,EquipmentandMethods–RobertL.Peurifoy,WilliamB. Ledbetter, Clifford J. Schexnayder - McGraw-Hill, Fifth Edition.

ReferenceBooks:

1. A.Gurevich andE.Soreking,TractorsMirPublishers,Moscow, 1967.
2. V.Rodichev&G.Rodicheva,Tractorsandautomobiles,MIRPublishers,Moscow.

WebLinks:

1. https://nptel.ac.in/courses/108103009
2. https://nptel.ac.in/courses/107106080

COURSE OUTCOMES

CO1:	Describethevarious earth-moving equipment	**K3**
CO2:	Familiarwiththevehicleperformance characteristics	**K4**
CO3:	Describetheconvertermatchcurves	**K3**
CO4:	Explaintheconstructionaldetailsofsteerableanddriveaxles of dumper	**K3**
CO5:	DefinetheOCDBanddrydisccaliperbrakes	**K3**

22PEAU07	ALTERNATIVEFUELSANDENERGY SYSTEMS	L	T	P	Credits
		3	0	0	3

Course Objective:

➢ Toacquireknowledgeinenginedesignforhandlingandunderstandingvariousenergy systems for use in automobiles.

➢ Toaddresstheunderlyingconceptsandmethodsbehindalternatefuelandenergy systems.

UNITIINTRODUCTION **12**

Need for alternate fuel, availability and properties of alternate fuels, general use of alcohols, LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas, merits and demerits of various alternate fuels, introduction to alternative energy sources. Like EV, hybrid, fuel cell and solar cars.

UNITIIALCOHOLS **12**

Properties as engine fuel, alcohols and gasoline blends, performance in SI engine, methanol andgasolineblends,combustioncharacteristicsinCIengines,emissioncharacteristics,DME, DEE properties performance analysis, performance in SI & CI Engines.

UNITIIINATURALGAS,LPG,HYDROGENANDBIOGAS **12**

Availability of CNG, properties, modification required to use in engines, performance and emission characteristics ofCNGusing LPGin SI& CIengines, performance and emission of LPG. Hydrogen; storage and handling, performance and safety aspects.

UNITIVVEGETABLEOILS **12**

Various vegetable oils for engines, desertification, performance in engines, performance and emission characteristics, biodiesel and its characteristics

UNITVELECTRIC,HYBRID, FUELCELLAND SOLARCARS **12**

Layout of an electric vehicle, advantages and limitations, specifications, system components, electronic control system, high energy and power density batteries, hybrid vehicle, fuel cell vehicles, solar-powered vehicles.

TOTAL:60 hours

TextBook:

1. Richard.L.Bechfold–AlternativeFuelsGuideBook-SAEInternationalWarrendale- 1997.

ReferenceBooks:

1. MaheswarDayal-“Energytoday&tomorrow”- I&BHorishrIndia-1982.
2. Nagpal-“PowerPlantEngineering”- Khanna Publishers- 1991.
3. “Alcohols as motor fuels progress in technology” - Series No.19 - SAE Publication USE - 1980.
4. SAEpapernos. 840367,841333, 841334,841156, Transactions,SAE, USA.

WebLinks:

1. https://www.sathyabama.ac.in/course-materials/alternate-fuels-and-energy-systems
2. https://nptel.ac.in/courses/121106014

COURSEOUTCOMES

CO1:	Describetheneedofthealternativefuels	**K3**
CO2:	Explaintheneedofthe Gaseous fuels	**K3**
CO3:	Describeandethanolusage,storage,chemicalstructure,pros and cons	**K3**
CO4:	Evaluatetheperformancecharacteristicsofalcoholsfuels	**K4**
CO5:	Describethenaturalgas,LPG,hydrogen,andbiogas	**K3**

22PEAU08	FINITEELEMENT ANALYSIS	L	T	P	Credits
		3	0	0	3

Course Objective:

- ➢ Tounderstandtheprinciplesinvolvedindiscretizationandfiniteelementapproach.
- ➢ Tolearnto formstiffness matricesand forcevectors forsimpleelements.

UNITIINTRODUCTION **12**

Historical background – Matrix approach – Application to the continuum – Discretisation – Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Ritz method

UNITIIONE DIMENSIONAL PROBLEMS **12**

Finite element modeling – Coordinates and shape functions- Potential energy approach – Galarkin approach – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions – Applications to plane trusses

UNITIIITWO DIMENSIONAL CONTINUUM **12**

Introduction – Finite element modeling –Scalarvalued problem – Poisson equation –Laplace equation – Triangular elements – Element stiffness matrix – Force vector – Galarkinapproach - Stress calculation – Temperature effects

UNITIVAXISYMMETRIC CONTINUUM **12**

Axisymmetric formulation – Element stiffness matrix and force vector – Galarkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures – Rotating discs

UNITVISOPARAMETRICELEMENTSFORTWODIMENSIONALCONTINUUM

12

The four node quadrilateral – Shape functions – Element stiffness matrix and force vector – Numerical integration - Stiffness integration – Stress calculations – Four node quadrilateral for axisymmetric problems.

TOTAL:60 hours

TextBooks:

1. Chandrupatla T.R., and Belegundu A.D., Introduction to Finite Elements in Engineering, Pearson Education 2002, 3rd Edition.
2. DavidVHutton"FundamentalsofFiniteElementAnalysis"2004.McGraw-Hill Int.Ed.

ReferenceBooks:

1. RaoS.S.,theFinite ElementMethodin Engineering,PergamonPress, 1989
2. LoganD.L.,AFirstCourseintheFiniteElementMethod,ThirdEdition,ThomsonLearning, 2002.
3. RobertD.Cook.,David.S,MalkucsMichaelEPlesha,"ConceptsandApplicationsof Finite Element Analysis", 2003.
4. Ed.Wiley.ReddyJ.N.,anIntroductiontoFiniteElementMethod,McGraw-HillInternational Student Edition, 1985.

5.O.C.ZienkiewiczandR.L.Taylor,theFiniteElementMethods,Vol.1.Thebasicformulation and linear problems, Vol.1, Butterworth Heineman, 5th Edition, 2000.

WebLinks:

1. https://nptel.ac.in/courses/112104193
2. https://onlinecourses.nptel.ac.in/noc20_me91/preview

COURSEOUTCOMES

CO1:	Familiarizethebasicconceptoffiniteelementmethods	**K4**
CO2:	Acquiretheknowledgeonone-dimensional problems	**K3**
CO3:	Acquirethe knowledgeon two-dimensional continuum	**K3**
CO4:	DeveloptheskillonapproachingtheHeattransferandfluid flow problems	**K4**
CO5:	Gainknowledgeonapplicationoffiniteelementmethodin Automobiles	**K4**

22PEAU09	TRANSPORT MANAGEMENT	L	T	P	Credits
		3	0	0	3

Course Objective:

➢ Aftercompletionofthiscoursethestudentsareabletomanageatransportfleetand their related activities for minimizing operational cost

UNITIINTRODUCTION **9**

Personnel management and functions of personnel management, psychology, sociology and their relevance to the organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training, advantages, methods of training, training procedure, psychological tests.

UNITIITRANSPORTSYSTEMS **9**

Introduction to various transport systems. Advantages of motor transport. The principle function of administrative, traffic, secretarial and engineering divisions. Chain of responsibility, forms of ownership by the state, municipality, public body and private undertakings.

UNITIIISCHEDULING ANDFARESTRUCTURE **9**

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up a fare table. Various types of fare collecting methods. Basic factors of bus schedules. Problems with bus scheduling.

UNITIVMOTORVEHICLE ACT **9**

Traffic signs, fitness certificate, registration requirements, permit insurance, construction regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

UNITVMAINTENANCE **9**

Preventive maintenance system in the transport industry, tyre maintenance procedures.Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

TOTAL:45 hours

TextBooks:

1. JohnDuke-FleetManagement–McGraw-Hill Co,USA -1984.

ReferenceBooks:

1. GovernmentMotorVehicleAct –EasternBookCompany,Lucknow-1989
2. Kitchin.L.D.,-BusOperation- IlliffeeandSonsCo.,London,IIIedition-1992
3. Themotor vehicleAct 1939 -EjazAhmad,Ashoklawhouse,India– 1989

WebLinks:

1. https://nptel.ac.in/courses
2. https://swayam.gov.in

COURSEOUTCOMES:

CO1:	DescribethefunctionsofPersonnelManagementandtheirrelevancetothe organization.	**K3**
CO2:	JustifytheEmploymenttests,trainingprocedureandpsychologicaltests.	**K3**
CO3:	Illustratetheprincipalfunctionofadministrative,traffic,secretarialand engineering divisions.	**K4**
CO4:	Describetheresponsibilityinformsofstate,municipality,publicandprivate undertakings.	**K5**
CO5:	Statetheprincipalfeaturesof operatingcostsfortransport vehicles.	**K3**

22PEAU10	AUTOMOTIVEAERODYNAMICS	L	T	P	Credits
		3	0	0	3

Course Objective:

➢ Attheendofthecourse,thestudentswillbeabletoapplybasicprinciplesofaerodynamics for the design of vehicle body

UNITIINTRODUCTION **9**

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

UNITIIAERODYNAMIC DRAGOF CARS **9**

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

UNITIIISHAPEOPTIMIZATIONOF CARS **9**

Front end modification, front and rear windshield angle, boat tailing, hatchback, fastback and square back, dust flow patterns at the rear, effects of gap configuration, effect of fasteners.

UNITIVVEHICLEHANDLING **9**

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

UNITVWIND TUNNELSFORAUTOMOTIVE AERODYNAMICS **9**

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

TOTAL:45 hours

TextBooks:

1. Hucho.W.H. -"AerodynamicsofRoadVehicles"-ButterworthsCo.,Ltd., -1997.

ReferenceBooks:

1. Pope-"Wind Tunnel Testing"-John Wiley & Sons-2nd Edition, New York -1974.
2. AutomotiveAerodynamic: UpdateSP706 -SAE– 1987.
3. VehicleAerodynamics -SP1145-SAE– 1996.

WebLinks:

1. https://nptel.ac.in/courses
2. https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Evaluatebasic fluidtheory.	**K3**
CO2:	Demonstrateknowledgeandunderstandingofaerodynamicsinthe automotive field.	**K3**
CO3:	Explaintheprinciplesandfunctionsofwind tunnels.	**K4**
CO4:	Conceptualunderstandingofmathematics,numericalanalysis,statistics,and computer and information.	**K5**
CO5:	Applicationofestablishedengineeringmethodstocomplexengineering problem solving.	**K3**

22PEAU11	MODERNAUTOMOBILE ACCESSORIES	L	T	P	Credits
		3	0	0	3

Course Objective:

➢ Tointroducethemodern developmentsin-vehicle technology.

UNITIENGINEMANAGEMENT SYSTEMS **9**

ElectronicallycontrolledSIandCIenginefuelinjectionsystems,relatedhardwareandsoftware. Closed-loop ignition system. Catalytic converters and particulate traps.

UNITIICHASSIS **9**

Suspensions–frontandrearActivesuspensioncontrol-RideComfort,SuspensionTravel, Road Handling - advantages, disadvantages, Pneumatic suspensions.

UNITIIIHEATINGAND AIR CONDITIONING **9**

Vehicleairconditioning and heating- Compressor, condenser evaporator, working Principles, TXV operation working principle of vehicle air conditioning.

UNITIVCOMFORTAND CONVENIENCE **9**

Adaptivecruisecontrol,carentertainment,powerwindows,navigationsystem,adaptive noise control, electric seats, driver information system. Power windows, power steering.

UNITVSAFETY ANDSECURITY SYSTEMS **9**

Airbags, seat belt-tightening system, collapsible and tilt-able steering column, Anti-theft system, anti-lock braking system, electronic stability control system/traction control system, rollover protection system.

TOTAL:45 hours

TextBooks:

1. TomDenton -"AutomobileElectricalandElectronicSystems" -Edward Arnold,London - 1995.
2. EricChowanietz -'AutomotiveElectronics' -SAE InternationalUSA- 1995.

Reference:

1. BoschAutomotive Handbook -5thEdition-SAEPublication,USA-2000.

WebLinks:

1. https://nptel.ac.in/courses
2. https://swayam.gov.in

COURSEOUTCOMES:

CO1:	FamiliarwiththeadvancedfuelinjectionsystemstechniquesinboththeSI and CI engines	**K3**
CO2:	DescribetheKnowledge of pneumatic&activesuspensioncontrol systems.	**K3**
CO3:	Describetheheatingandairconditioningsystem.	**K4**
CO4:	Familiarwiththenavigationsystems,powersteering,andpowerwindows.	**K5**
CO5:	Gainknowledgeaboutvarioussafety&securitysystemssuchasairbags, seat belts, ABS, and EBS.	**K3**

22PEAU12	VIBRATION ANDNOISECONTROL	L	T	P	Credits
		3	0	0	3

Course Objective:

➢ The students will be able to understand the sources of vibration and noise in automobiles and make design modifications to reduce the vibration and noise and improvethe life of the components

UNITIBASICS OF VIBRATION **9**

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and nonlinear vibration, the response of damped and undamped systems under harmonic force, analysis of single degree and two degrees of freedom systems, torsion vibration, determination of natural frequencies.

UNITIIBASICS OFNOISE **9**

Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.

UNITIII AUTOMOTIVENOISE SOURCES **9**

NoiseCharacteristicsofengines,engineoverallnoiselevels,assessmentofcombustionnoise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.

UNITIVCONTROLTECHNIQUES **9**

Vibration isolation, tuned absorbers, unturned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNITVSOURCEOF NOISE AND CONTROL **9**

Methodsforcontrolofenginenoise,combustionnoise,mechanicalnoise,predictiveanalysis, palliativetreatmentsandenclosures,automotivenoisecontrolprinciples,soundinenclosures, sound energy absorption, sound transmission through barriers

TOTAL:45 hours

TextBooks:

1. Singiresu S.Rao - “Mechanical Vibrations'' - Pearson Education, ISBM –81-297-0179-0 – 2004.
2. KewalPujara“VibrationsandNoiseforEngineers, DhanpatRai &Sons, 1992.

ReferenceBooks:

1. BernardChallenandRodicaBaranescu-“DieselEngineReferenceBook''–Second edition - SAE International.

2. JulianHappian-Smith-“AnIntroductiontoModernVehicleDesign”-Butterworth- Heinemann, 2004.
3. JohnFenton-“HandbookofAutomotivebodyConstructionandDesignAnalysis-Professional Engineering Publishing, ISBN 1-86058-073- 1998.

WebLinks:

1. https://nptel.ac.in/courses
2. https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Describethebasicconcepts of vibration.	**K3**
CO2:	Identityto simulate noisecontrol andbeableto design systems accordingly.	**K3**
CO3:	Illustratetheperformanceofspatial,modalandresponsemodelsofvibrating systems.	**K4**
CO4:	Describetheconceptsofengineeringnoiseandvibration,measurement techniques and instruments.	**K5**
CO5:	Describetheknowledgeofapplicationdynamicforcesgeneratedby IC engines.	**K3**

22PEAU13	ADVANCEDTHEORYOFI.C. ENGINES	L	T	P	Credits
		3	0	0	3

Course Objective:

➢ Attheendofthecourse,thestudentswillbeabletounderstandthesignificanceof various processes in I.C Engines.

UNITICYCLEANALYSIS **9**

Otto, Diesel, Dual, Stirling and Brayton cycles, comparison of air standard, fuel-air andactual cycles, simple problems on the above topics.

UNITII COMBUSTION **9**

Combustionreactionsandstoichiometry,theheat ofreaction,theadiabaticflametemperature in constant pressure and constant volume systems, fuels for internal combustion engines and their properties, premixed and diffusion combustion as applicable to SI and CI engines, concepts of burning rate and flame velocity, fuel spray characteristics and combustion in diesel engines.

UNITIII COMBUSTIONMODELLING **9**

Basic concepts of engine simulation, governing equations, and simulation of various engine processes for SI and CI engines. Adiabatic flame temperature, Heat release calculations. Thermodynamic and Fluid mechanics-based models.

UNITIV ADVANCESINIC ENGINES **9**

LHR engines, surface ignition concept and multi-fuel engines, stratified chargeand lean-burn engines, performance and emission characteristics, merits and demerits.

UNITVELECTRONICENGINE MANAGEMENT **9**

Computer control of SI & CI engines for better performance and low emissions, closed-loop control of engine parameters of fuel injection and ignition

TOTAL:45 hours

TextBooks:

1. Ganesan.V-"ICEngines" -TataMcGraw-Hill, 2003.
2. JohnB.Haywood,"InternalCombustionEngineFundamentals",McGraw-Hill Automotive Technology Series ISBN 0-07 1000499-8, 1988.

ReferenceBooks:

1. Ganesan. V – 'Computer Simulation of Spark Ignition Processes' – Universities ProcessLtd, Hyderabad - 1993.
2. Ganesan.V. – Computer Simulation of compression ignition engines – Orcent Longman – 2000.
3. RichardStone–"IntroductiontoICEngines'' – 2ndedition–Macmillan–1992.

WebLinks:

1. https://nptel.ac.in/courses

2. https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Comparevariouscycles withactual cycles.	**K3**
CO2:	Familiarwithcombustionreactionsand stoichiometry.	**K3**
CO3:	Understandpremixed and diffusion combustion inSIand CIengines.	**K4**
CO4:	Optimizethe conceptsofenginesimulation governing equations.	**K5**
CO5:	Describesimulation ofvarious engine processes for SIand CIengines.	**K3**

22PEAU14	ENGINEANDVEHICLEMANAGEMENT SYSTEM	L	T	P	Credits
		3	0	0	3

Course Objective:

- Toexplaintheprincipleofenginesandvehicleelectronicmanagementsystemand different sensors used in the systems.

UNITIFUNDAMENTALSOFAUTOMOTIVEELECTRONICS **9**

Microprocessor architecture, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI engines and in the other parts of the automobile.

UNITIISENSORS **9**

Inductive, Hall effect, hot wire, thermistor, piezo electric, piezoresistive, based sensors. Throttle position, mass air flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, crash, exhaust oxygen level (two step and linear lambda), knock, engine temperature, manifold temperature and pressure sensors, gyro sensors.

UNITIIISIENGINEMANAGEMENT **9**

Three way catalytic converter, conversion efficiency versus lambda. Layout and working of SI engine management systems like Bosch L-Jetronic and LH-Jetronic. Group and sequential injection techniques. Working of the fuel system components. Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, open loop control of fuel injection and closed loop lambda control. Electronic ignition systems and spark timing control. Closed loop control of knock.

UNITIVCIENGINEMANAGEMENT **9**

Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Pilot,main, advanced post injection and retarded post injection. Electronically controlled Unit Injection system. Layout of the common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter, EGR valves

UNITVVEHICLEMANAGEMENTSYSTEMS **9**

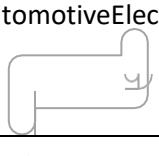
ABS system, its need, layout and working. Electronic control of suspension – Damping control, Electric power steering, Supplementary Restraint System of air bag system – crash sensor, seat belt tightening. Cruise control. Vehicle security systems- alarms, vehicle tracking system. On board diagnostics. Collision avoidance Radar warning system.

.

TOTAL: 45 Hours

TEXTBOOKS:

1. EricChowanietz"AutomobileElectronics"SAEPublications,1994
2. WilliamBRibbens"UnderstandingAutomotiveElectronics",SAEPublications, 1998



REFERENCEBOOKS:

1. RobertBosch "DieselEngineManagement"SAE Publications,2006.
2. RobertBosch,"Gasoline EngineManagement"SAEPublications,2006.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Understandthe fundamentalsofautomotive electronics	**K3**
CO2:	Understandtheroleofvarioussensors,itsconstructionandworking principle	**K3**
CO3:	FamiliarwiththeS.IEngineManagementsystem	**K4**
CO4:	FamiliarwiththeC.IEngineManagementsystem	**K5**
CO5:	FamiliarwiththeVehicleManagement system	**K3**

22PEAU15	METROLOGYANDMEASUREMENTSFOR AUTOMOBILE ENGINEERS	L	T	P	Credits
		3	0	0	3

CourseObjective:

- Knowledgeinusageofsoftwaretomeasureparameterslikespeed,position,velocity, pressure, force, torque, temperature etc

UNITIINTRODUCTIONTOMEASUREMENTSANDSENSORS **9**

Sensors: Functions- Classifications- Main technical requirement and trends Units and standards- Calibration methods- Classification of errors- Error analysis- Limiting error- Probable error- Propagation of error- Odds and uncertainty- principle of transduction- Classification. Static characteristics- mathematical model of transducers- Zero, First and Second order transducers- Dynamic characteristics of first and second order transducers for standard test inputs.

UNITIIVARIABLERESISTANCE,INDUCTANCEANDCAPACITIVESENSOR **11**

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

SpecialSensors

Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor- digital transducers-Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.

UNITIIIAUTOMOTIVEPRESSUREANDFORCE/TORQUESENSOR **9**

PressureSensor:

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

Force/TorqueSensor:

Typical automotive applications- Magneto elastic bearing-pin sensor- Magneto elastic tension/compressive-force sensor – Basic principle of torque measurement – steering- Angle measuring torque sensor.

UNITIVAUTOMOTIVEPOSITIONANDRPM/VELOCITYSENSORS **9**

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

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

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

UNITVMETROLOGY **7**

Basic concept - scientific, industrial and legal metrology - linear and angular measuring instruments, measurement of screw thread - Two, three wire method, measurement with optical flats, laser inter ferometer, coordinate measuring machine.

TOTAL: 45 Hours

TEXTBOOKS:

1. RobertBrandy,"AutomotiveElectronicsandComputerSystem",PrenticeHall, 2001
2. WilliamKimberley,"BoschAutomotiveHandbook",6th Edition,RobertBosch GmbH, 2004

REFERENCEBOOKS:

1. BentleyJ.P,"PrinciplesofMeasurementSystems",4th Edition,AddisionWesley Longman Ltd., U.K, 2004
2. JainR.K."Engineering Metrology"KhannaPublishers,NewDelhi,2012
3. MurthyD.V.S,"Transducersand Instrumentation",PrenticeHallof India,2007

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Selectingsuitablemechanicalmeasuringinstrumentsforbasicandspecial requirement in the industries.	**K3**
CO2:	Calibratingandanalyzingthecharacteristicsofmeasuringinstruments.	**K3**
CO3:	Designingthefitsandtolerancestoimprovetheexisting performance.	**K4**
CO4:	Determineerror andanalyzinguncertaintyinthe measurements.	**K5**
CO5:	Workinquality controlandquality assurancesdivisionsin industries.	**K3**

22PEAU16	AUTOMOTIVESAFETY	L	T	P	Credits
		3	0	0	3

Course Objective:

- Tounderstandthevarious safetyconcepts,systemsand workingofsafety equipment

UNITI INTRODUCTION **9**

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

UNITIISAFETYCONCEPTS **9**

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

UNITIIISAFETYEQUIPMENTS **9**

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

UNITIVCOLLISIONWARNINGANDAVOIDANCE **9**

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

UNITVCOMFORTANDCONVENIENCESYSTEM **9**

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

TOTAL: 45 Hours

TEXT BOOKS:

1. Bosch-“Automotive Handbook”-5thedition -SAEpublication-2000.

2. J.Powloski-“VehicleBodyEngineering”-Businessbookslimited, London-1969.

REFERENCEBOOK:

1. Ronald.K.Jurgen-“AutomotiveElectronicsHandbook”-Secondedition-McGraw-Hill Inc., - 1999.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Familiarwiththeconceptsofsafety.	**K3**
CO2:	Describethevarioussafetyequipment's.	**K3**
CO3:	Describetheelectronicsystemforactivatingair bags.	**K4**
CO4:	FamiliarwiththevariousCollisionwarningsystem.	**K5**
CO5:	Explaintheobjectdetection systemwithbrakingsystem interactions.	**K3**

22PEAU17	OFF ROADVEHICLES	L	T	P	Credits
		3	0	0	3

Course Objective:

- Attheendofthecourse,thestudentswillbeabletounderstandthevarious Offroadvehicleand their systems and features

UNITICLASSIFICATIONANDREQUIREMENTSOFOFFROADVEHICLES 6

Construction layout, capacity and applications of off road vehicle - prime mover, chassis and transmission, Multi-axle vehicles.

UNITIIEARTHMOVINGCONSTRUCTIONALMACHINES 10

Dumpers - safety features, safe warning system for dumper, Design aspects on dumper body, Articulated Dumpers, loaders - single bucket, Multi bucket and rotary types - bulldozers, kinematics for loader and bulldozers with operational linkages, excavators, backhoe loaders, scrappers, motor graders, power shawl, bush cutters, Bush cutters, stumpers, rippers.

UNITYIIIINDUSTRIAL APPLICATIONS 10

Constructional and working details of Jib crane, concrete ready mixers, compactors - vibratory compactors, forklift, utility vehicles, man - lift, scissors, lift trucks, material handlers, power generators.

UNITIVVEHICLESYSTEMSANDITFEATURES 11

Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders. Power steering system. Articulated steering assembly - power and capacity of earth moving machines.

UNITVFARMEQUIPMENTS,MILITARYANDCOMBATVEHICLES 8

Tractors, classification - working attachments, power take off, special implements, paddy harvester, sugarcane harvester, feller bunchers, special features and constructional details of military tankers, AVLB gun carriers and transport vehicles.

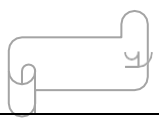
TOTAL: 45 Hours

TEXTBOOKS:

1. Abrosimov.K.Branberg.AandKatayer.K.,"Roadmakingmachinery",MIRPublishers, Moscow, 1971.
2. NakraC.P.,“Farmmachinesandequipments”DhanparaiPublishingCompanyPvt.Ltd.
3. RobertLPeurifoy,“Construction,planning,equipmentandmethods”TataMcGrawHill Publishing company Ltd.
4. Wong.J.T.,"TheoryofGroundVehicles”,JohnWiley&Sons,NewYork,1987.

REFERENCEBOOKS:

1. BartHVanderveen,"TanksandTransportVehicles",FredericWarneandCoLtd., London.Ia.
2. S.Ageikin,“OfftheRoadWheeledandCombinedTractionDevices:TheoryandCalculation”, Ashgate Publishing Co. Ltd. 1988.



3. SchulzErich.J,"DieselequipmentI&II",McGrawHillcompany,London,1982.
4. Satyanarayana.B.,"Constructionplanningandequipment",standardpublishersanddistributors, New Delhi, 1985.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Describethevariousoff-road vehicles.	**K3**
CO2:	Familiarwiththe off-roadvehicle application.	**K3**
CO3:	Describetheoff-roadvehicles systemsad their features	**K4**
CO4:	Describetheconceptof concrete mixtures.	**K5**
CO5:	Clearlyexplainthemilitaryandcombatvehicles.	**K3**

22PEAU18	ADVANCEDPRODUCTIONPROCESSESFOR AUTOMOTIVE COMPONENTS	L	T	P	Credits
		3	0	0	3

Course Objective:

- Tolearntheavailablemanufacturingprocessbasedonquality/time/cost/mechanical properties.

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UNITIPOWDER METALLURGY **9**

Process flow chart – production of metal powers and their raw materials – Manufacture of friction lining materials for clutches and brakes – testing and inspection of PM parts.

UNITIIFORMINGPROCESS **9**

Forging – process flow chart, forging of valves – connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, foot brake linkage, steering knuckles. Extrusion: Basicprocesssteps, extrusionoftransmissionshaft,steeringwormblanks, brakeanchorpins, rear axle drive shaft, axle housing spindles, piston pin and valve tappets. Hydro forming: Process, hydro forming of manifold and comparison with conventional methods – Hydro forming of tail lamphousing stretch forming – process, stretch forming of auto body panels – super plastic alloys for auto body panels.

UNITIII GEARMANUFACTURING **9**

Different methods of gear manufacture – Gear hobbig and gear shaping machines specifications – gear generation – different methods – gear finishing and shaving – Grinding and lapping of hobs and shaping cutters – gear honing – gear broaching.

UNITIVCONCEPT&PROGRAMMINGOF CNCMACHINES **9**

NC, CNC & DNC – types of CNC – constructional features – drives and control systems – feedback devices – manual part programming – steps involved – sample program in lathe &milling.

UNITVRECENTTRENDS INMANUFACTURINGOFAUTO COMPONENTS **9**

Power injection moulding – Shot peen hardening of gears – production of aluminum MMC liners for engine blocks – Plasma spray coated engine blacks and valves – Recent developments in auto body panel forming – Squeeze casting of pistons – aluminumcomposite brake rotors.

TOTAL: 45 Hours

TEXT BOOK:

1. Heldt,P.M.,HighSpeedCombustionEngines, OxfordPublishingCo.,NewYork, 1990

REFERENCE BOOKS:

1. Haslehurst,S.E.,Manufacturing Technology,ELBS,London, 1990
2. Rusinoff,ForgingandFormingofmetals,D.B.TaraporevalaSons&Co.,Pvt.Ltd.,Mumbai, 1995.

3. Subroff, A.M. & Other, Forging Materials & Processes, Reinhold Book Corporation,New York, 1998.
4. HighVelocityFormingofMetals,ASTME,PrenticeHallofIndia(P)Ltd.,New Delhi,1990
5. Groover.M.P.Automaticproductionsystemsandcomputerintegratedmanufacturing prentice – hall, 1990.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Summarizetheproductionmethodsofenginecomponentschassis components	**K 3**
CO2:	Explainthedifferent typesof formingprocessused invarious automobiles.	**K 3**
CO3:	Identifythevariousextrusionprocesses.	**K 4**
CO4:	Describethedifferenttypes ofgear manufacturing process.	**K 3**
CO5:	Teachthedetailprocedureofgearlapping,gearhoningandgearbroaching methods.	**K 3**

22PEAU19	NOISE,VIBRATIONAND HARSHNESS	L	T	P	Credits
		3	0	0	3

Course Objective:

- Toidentify,measure andcontrolthenoise,vibrationand harshness.

UNITIFUNDAMENTALS OFACOUSTICSANDNOISE, VIBRATION 9

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

UNITII EFFECTS OFNOISE,BLAST,VIBRATION,ANDSHOCKON PEOPLE9

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

UNIT III TRANSPORTATION NOISE AND VIBRATION—SOURCES, PREDICTION, AND CONTROL 9

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

UNITIVINTERIORTRANSPORTATIONNOISEANDVIBRATIONSOURCES – PREDICTIONAND CONTROL 9

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

UNIT V NOISE AND VIBRATION TRANSDUCERS, ANALYSIS EQUIPMENT, SIGNAL PROCESSING, AND MEASURING TECHNIQUES 9

General Introduction to Noise and Vibration Transducers, Measuring Equipment, Measurements, SignalAcquisition, and Processing, Acoustical Transducer Principles and Types of Microphones, Vibration Transducer Principles and Types of Vibration Transducers, Sound Level Meters, Noise Dosimeters, Analyzers and Signal Generators, Equipment for Data Acquisition, Noise and Vibration Measurements, Determination of Sound Power Level and Emission Sound Pressure Level, Sound Intensity Measurements, Noise and Vibration DataAnalysis,CalibrationofMeasurementMicrophones,CalibrationofShockandVibration Transducers, Metrology and Trace ability of Vibration and Shock Measurements**.**

TOTAL: 45 Hours

TextBooks:

1. Clarence W. de Silva, "Vibration Monitoring, Testing, and Instrumentation", CRC Press, 2009
2. DavidA.BiesandColinH.Hansen"EngineringNoiseControl:TheoryandPractice"Spon Pres, London, 2009

ReferenceBooks:

1. Alan G. Piersol, Thomas L. Paez "Haris' Shock and Vibration Handbok", McGraw-Hil,New Delhi, 2010
2. ColinHHansen"UnderstandingActiveNoise Cancelation",SponPress,London2003
3. Mathew Harison "VehicleRefinement:ControlingNoiseand VibrationinRoadVehicles", Elsevier Buterworth-Heineman, Burlington, 2004

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Identifythemethodsof vibrationandnoisemeasurement.	**K3**
CO2:	Comparetheeffectofnoise anhumancomfortand environment	**K3**
CO3:	Describetheconcept of mufflers,tire/road noise.	**K4**
CO4:	Describetheinteriortransportationnoiseandvibration sources.	**K5**
CO5:	Describethevarious noiseand vibration measurements.	**K3**

22PEAU20	NEWGENERATIONANDHYBRID VEHICLES	L	T	P	Credits
		3	0	0	3

Course Objective:

- To understand the basic Electrochemistry that occurs in batteries for Hybrid Electric Vehicles.

UNITI INTRODUCTION **9**

Electric and hybrid vehicles, flexible fuel vehicles (FFV), solar powered vehicles, magnetic track vehicles, fuel cells vehicles.

UNITIIPOWERSYSTRMANDNEWGENERATION VEHICLES **9**

Hybrid Vehicle engines, Stratified charge engines, learn burn engines, low heat rejection engines, hydrogen engines, HCCI engine, VCR engine, surface ignition engines, VVTI engines. High energy and power density batteries, fuel cells, solar panels, flexible fuel systems.

UNITIIIVEHICLE OPERATIONAND CONTROL **9**

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

UNITIVVEHICLE AUTOMATEDTRACKS **9**

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

UNITVSUSPENSION,BRAKES,AERODYNAMICSAND SAFETY **9**

Air suspension – Closed loop suspension, compensated suspension, antiskid braking system, retarders, regenerative braking, safety gauge air backs- crash resistance. Aerodynamics for modern vehicles, safety systems, materials and standards.

TOTAL: 45 Hours

TextBooks:

1. Heinz,"ModernVehicleTechnology"SecondEdition,BU.
2. BoschHandBok,SAEPublication,2000.

ReferenceBooks:

1. Lightweightelectricforhybridvehicle design.
2. Advancehybridvehiclepowertransmission, SAE.
3. Noisereduction,BranekL.L.,McGrawHillBokCompany,NewYork, 1993.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	JustifyElectric&hybridvehicles, SolarPoweredandfuelcells vehicles.	**K3**
CO2:	IllustrateHighEnergyandPowerdensitybatteries,SolarPanels and Flexible Fuel systems.	**K3**
CO3:	ExplainSatellitecontrolofvehicleoperationforsafe,GPS andfast ravel.	**K4**
CO4:	Criticizeclosedloop,Compensated,typesofSuspensionandBraking system.	**K5**
CO5:	Stateaerodynamics,safetysystemanditsstandardsformodern vehicles.	**K3**

22PEAU21	AUTOMOTIVEAIR-CONDITIONING	L	T	P	Credits
		3	0	0	3

Course Objective:

- Tostudy thecomponents of theautomotiveair-conditioning and theirfunctions.
- Tofamiliarizewithlatest developmentsinthisfield.

UNITI AIRCONDITIONING FUNDAMENTALS **9**

Basic air conditioning system - location of air conditioning components in a car, schematic layout of a refrigeration system, compressor components, condenser and high pressureservice ports, thermostatic expansion valve, expansion valve calibration, controlling evaporator temperature, evaporator pressure regulator, evaporator temperature regulator.

UNITII AIR CONDITIONER– HEATING SYSTEM **9**

Automotive heaters, manually controlled air conditioner, heater system, automatically controlled air conditioner and heater systems, automatic temperature control, air conditioning protection, engine protection.

UNITIII REFRIGERANT **9**

Containers handling refrigerants, tapping into the refrigerant container, refrigeration system diagnosis, diagnostic procedure, ambient conditions affecting system pressures.

UNITIVAIR ROUTINGANDTEMPERATURE CONTROL **9**

COURSE OBJECTIVEs, evaporator airflow through the recirculation unit, automatic temperaturecontrol,ductsystem,controllingflow,vacuumreserve,testingtheaircontroland handling systems.

UNITV AIR CONDITIONING SERVICE **9**

Air conditioner maintenance and service, servicing heater system removing and replacing components, trouble shooting of air controlling system, compressor service.

TOTAL:45 Hours

TEXT BOOKS:

1. WilliamH.CrouseandDonaldI.Anglin-“AutomotiveAirconditioning”-McGrawHill. -1990.
2. BoyceH.DWiggins -”AutomotiveAirConditioning”-Delmar–2002

REFERENCEBOOKS:

1. MitchellinformationServices,Inc-“MitchellAutomaticHeatingandAirConditioning Systems” - Prentice Hall Ind. - 1989.
2. PaulWeiser-“AutomotiveAir Conditioning”-Reston PublishingCo., Inc., -1990.
3. MacDonald,K.I.,-“AutomotiveAir Conditioning”-TheodoreAudel series-1978
4. Goings.L.F.–“AutomotiveAir Conditioning”-American Technicalservices-1974.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Listand explaintheairconditioning components.	**K3**
CO2:	Clearlyexplaintheair conditioningprotection.	**K3**
CO3:	Familiarwiththehandling refrigerants&diagnosticprocedure.	**K4**
CO4:	Describetheambientconditionsaffectingsystempressures.	**K5**
CO5:	Clearlyexplaintheair conditionermaintenance and service.	**K3**

22PEAU22	AUTOMOTIVETESTING	L	T	P	Credits
		3	0	0	3

Course Objective:

- Tointroducethelearnerswiththeneedforautomotivetestingmethodsandtheir importance.
- Toequipthemwithknowledgeinvarioustestingstandardsand guidelines.

UNITIVEHICLEWINDTUNNELTESTINGANDBODYTESTING **10**

Wind tunnel test requirements - Ground boundary simulation - wind tunnel selection and Reynolds number capability, model details, mounting of model, Test procedure. Body test - Dynamics simulation sled testing - Dolly roll over test - Dolly roll over fixture - vehicle roofstrengthtest - Door system crash test.

UNITIICOLLISIONANDCRASHTESTING **9**

Crash testing: Human Testing, Dummies, Crash worthiness, pole crash testing, near crash testing, vehicle to vehicle impact, side impact testing, crash test sensor, sensor mounting positions, crash test data acquisition, braking distance test.

UNITIIITESTINGOFWHEELSANDBRAKES **10**

Wheels: Dynamic cornering fatigue, dynamic radial fatigue tests-procedures, bending moment and radial load calculations. Impact test -Road hazard impact test for wheel and tyre assemblies test procedures, Failure criteria and performance criteria.

UNITIVENERGYANDFUELCONSUMPTIONTESTING **7**

Engine cooling fan, air conditioning and brake compressors, hydraulic pumps power consumptions, ABS energy consumption. Test Route selection, vehicle test speeds, cargo, weights, driver selection, Tested data, finding and calculations. Test on rough terrain, Pot hole with laden and unladden conditions.

UNITVVEHICLECOMPONENTRELATEDTESTING **9**

Reading - longer texts - close reading, writing - brainstorming - writing short essays - developing an outline - identifying main and subordinate ideas - dialogue writing. Listening - listening to talks - conversations. Speaking - participating in conversations - short group conversations. Language development -modal verbs-present/post perfect tense. Vocabulary development - collocations.

TOTAL: 45 Hours

TEXT BOOKS:

1. Bosch-“Automotive Handbook”-5thedition -SAEpublication-2000.

REFERENCEBOOKS:

1. Beckwith.T.G.andBuck.N.L.“MechanicalMeasurements”,AdditionWesley publishing company Limited, 1995.
2. SAEHand book,Vol 3,SAE, Publications,2000
3. TimGrilles,“AutomotiveService”Delmar publishers,1998

4. W.H.course&D.L.Anglin,"AutomotiveMechanics"TMGpublishingcompany,2004

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Preparethevehiclefortesting accordingto standards	**K3**
CO2:	Testthevehicleinstatic anddynamicconditions.	**K3**
CO3:	Incorporatealltheautomotivetestingregulationswhiletesting vehicle	**K4**
CO4:	Testoneffectivenessandefficiencyofallthe components	**K5**
CO5:	Analyzethe vehicleand report the results.	**K3**

22GEAU01	COMPUTER INTEGRATED MANUFACTURINGSYSTEMS	L	T	P	Credits
		3	0	0	3

Course Objective:

➢ Todevelopanunderstandingofcomputer-integratedmanufacturing(CIM)andits impact on productivity, product cost, and quality.

UNITI COMPUTERAIDED DESIGN 9

Concept of CAD as drafting and designing the facility, desirable features of CAD package, drawing features in CAD – Scaling, rotation, translation, editing, dimensioning, labeling, Zoom, pan, redraw and regenerate, typical CAD command structure, wireframe modeling, surface modeling and solid modeling (concepts only) in relation to popular CAD packages.

UNITII COMPONENTSOF CIM 9

CIM as a concept and technology, CASA/SME model of CIM, CIM II, benefits of CIM, communication matrix in CIM, fundamentals of computer communication in CIM – CIMdata transmission methods – serial, parallel, asynchronous, synchronous, modulation, demodulation, simplex and duplex. Types of communication in CIM – point to point (PTP), star and multiplexing. Computer networking in CIM – the seven-layer OSI model, LAN model, MAP model, network topologies – star, ring and bus, advantages of networks in CIM

UNIT III GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 9

History Of Group Technology – the role of G.T in CAD/CAM Integration – part families- classification and coding – DCLASS and M-CLASS and OPTIZ coding systems – facility design using G.T – benefits of G.T – cellular manufacturing. Process planning - the role of process planning in CAD/CAM Integration – approaches to computer-aided process planning – variant approach and generative approaches – CAPP and CMPP systems.

UNITIVSHOP FLOORCONTROLAND INTRODUCTIONTO FMS 9

Shop floor control – phases – factory data collection system – automatic identification methods – Bar code technology – automated data collection system.

FMS – components of FMS – types – FMS workstation – material handling and storage system –FMS layout- computer control systems – applications and benefits.

UNITVCOMPUTERAIDEDPLANNINGANDCONTROLANDCOMPUTER MONITORING 9

Production planning and control – cost planning and control – inventory management – material requirements planning (MRP) – shop floor control. Lean and Agile Manufacturing. Types of production monitoring systems – structure model of manufacturing – processcontrol and strategies – direct digital control.

TOTAL:45 hours

TextBook:

1. Mikell.P.Groover“Automation,ProductionSystemsandComputerIntegrated Manufacturing”, Pearson Education 2001.

ReferenceBooks:

1. Mikell. P. Groover and Emory Zimmers Jr., “CAD/CAM”, Prentice-Hall of India Pvt. Ltd., 1998.

2. JamesA.ReghandHenryW.Kreabber,“ComputerIntegratedManufacturing”,Pearson Education second edition, 2005.
3. YoramKoren,“ComputerIntegratedManufacturing”,McGrawHill,2005.
4. PNRao,“CAD/CAMPrinciplesandApplications”,TMHPublications, 2007.

WebLinks:

1. https://nptel.ac.in/courses
2. https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Describethefundamentaltheoreticalconceptsgoverningfluidpower	**K3**
CO2:	Abilitytoformulatethemathematicalmodelsofhydraulicandpneumatic circuits.	**K3**
CO3:	Identifythecommonhydraulicandpneumaticcomponents	**K4**
CO4:	Describetheworkingprinciple ofpneumatic cylindersand motors.	**K5**
CO5:	Analyzethepneumaticcircuits byconsideringthe possible failures.	**K3**

22GEAU02	HYDRAULICANDPNEUMATIC SYSTEMS	L	T	P	Credits
		3	0	0	3

Course Objective:

➢ ToDesignandunderstand theelectro-hydraulic andelectro-pneumatic circuits

UNITIFLUID POWERSYSTEMSAND FUNDAMENTALS 12

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – General types of fluids – Fluid power symbols. Basics of Hydraulics-Applications of Pascals Law- Laminar and Turbulent flow – Reynold's number – Darcy's equation – Losses in pipe, valves and fittings.

UNITIIHYDRAULICSYSTEM&COMPONENTS 12

Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance – Variable displacement pumps. Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tandem, Rodless, Telescopic, Cushioning mechanism, Construction of double-acting cylinder, Rotary actuators – Fluid motors, Gear, Vane and Piston motors.

UNITIIIHYDRAULICCONTROLANDCIRCUITS 12

Construction ofControl Components: Director control valve – 3/2 way valve – 4/2 way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram. Accumulators and Intensifiers: Types and sizing of accumulators – intensifiers – Applications of Intensifiers. Circuits for controlling single acting and double acting cylinders, Accumulators circuits – Intensifier circuit.

UNITIVPNEUMATICCONTROLAND CIRCUITS 12

Pneumatic Components: Properties of air – Compressors – Filter, Regulator, and Lubricator Unit– Aircontrolvalves,quickexhaustvalves,andpneumaticactuators. FluidPowerCircuit Design, Speed control circuits, synchronizing circuit, Pneumo hydraulic circuit, Sequential circuit design for simple applications using cascade method.

UNIT V SERVO SYSTEMS, FLUIDICS AND FLUID POWER TROUBLE SHOOTING 12

Servo systems – Hydro Mechanical servo systems, Electro-hydraulic servo systems and proportional valves, Fluidics – Introduction to fluidicdevices, simple circuits, Introduction to Electro-Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

TOTAL: 60 hours

TextBooks:

1. AnthonyEsposito,"FluidPowerwithApplications",PearsonEducation2000.
2. MajumdarS.R.,"OilHydraulics",TataMcGraw-Hill,2000.

ReferenceBooks:

1. MajumdarS.R.,“Pneumaticsystems–Principlesandmaintenance”,TataMcGraw Hill, 1995
2. AnthonyLal,“Oilhydraulicsintheserviceofindustry”,AlliedPublishers, 1982.
3. Harry L. Stevart D.B, “Practical guide to fluid power”, Taraoeala sons and Port Ltd. Broadey, 1976.
4. MichaelJ,Princhesand AshbyJ.G,“PowerHydraulics”,Prentice-Hall,1989.
5. Dudelyt,A.PeaseandJohnT.Pippenger,“Basic FluidPower”,Prentice-Hall,1987.

WebLinks:

1. https://nptel.ac.in/courses
2. https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Describethefundamentaltheoreticalconceptsgoverningfluid power	**K3**
CO2:	Abilitytoformulatethemathematicalmodelsofhydraulicandpneumatic circuits.	**K3**
CO3:	Identifythecommonhydraulicandpneumaticcomponents	**K4**
CO4:	Describetheworkingprincipleofpneumatic cylindersandmotors.	**K5**
CO5:	Analyzethepneumaticcircuits byconsideringthe possible failures.	**K3**

22GEAU03	DESIGNOFMACHINEELEMENTS	L	T	P	Credits
		3	0	0	3

Course Objective:

- Tounderstandtheprincipleinvolvedinevaluatingtheshapeanddimensionsofa component to satisfy functional and strength requirements.
- Tolearntousestandard practicesandstandarddata

UNITISTEADYSTRESSESANDVARIABLESTRESSESINMACHINEMEMBERS 9

Introduction to the design process - factors influencing machine design, selection ofmaterials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and'C'frame-Factorof safety - theories of failure – Design based on strength and stiffness – stress concentration–Design for variableloading.

UNITIISHAFTSANDCOUPLINGS 9

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines - Rigid and flexible couplings.

UNITIIITEMPORARYANDPERMANENTJOINTS 9

Threaded fastners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

UNITIVENERGYSTORINGELEMENTSANDENGINECOMPONENTS 9

Various types of springs, optimization of helical springs - rubber springs -Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

UNITVBEARINGS 9

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Somerfield Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.

TOTAL: 45 Hours

TEXTBOOKS:

1. Bhandari V, "Design ofMachine Elements", 4th Edition, Tata McGraw-Hill Book Co, 2016.
2. Joseph Shigley,CharlesMischke,Richard BudynasandKeithNisbett"Mechanical Engineering Design", 9th Edition, Tata McGraw-Hill,2011

REFERENCEBOOKS:

1. AlfredHall,Halowenko,AandLaughlin,H.,"MachineDesign",TataMcGraw-HillBook Co.(Schaum's Outline), 2010

2. AnselUgural,“MechanicalDesign–AnIntegralApproach",1st Edition,TataMcGraw-Hill Book Co, 2003.
3. P.C.Gope,“MachineDesign–FundamentalandApplication”,PHIlearningprivateltd,New Delhi, 2012.
4. Sundararajamoorthy T.V.Shanmugam.N,“MachineDesign”,Anuradha Publications, Chennai, 2015.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Explaintheinfluenceofsteadyandvariablestressesinmachinecomponent design.	**K3**
CO2:	Applythe conceptsof designto shafts,keys and couplings.	**K3**
CO3:	Applytheconcepts ofdesignto temporaryandpermanent joints.	**K4**
CO4:	Applytheconceptsofdesigntoenergyabsorbingmembers,bearingsand connecting rod.	**K5**
CO5:	Applythe concepts of design to bearings.	**K3**

22GEAU04	WASTEHEATRECOVERYANDCO- GENERATION	L	T	P	Credits
		3	0	0	3

Course Objective:

- Tounderstandthewasteheatrecoverysystems,economicanalysisandenvironmental considerations.

UNITI INTRODUCTION **9**

Source and utilization of waste heat, thermodynamic analysis - Second law and waste heat,Recovery of waste heat engines and other power plants -Heat pump for waste heat recovery.

UNITIIDESIGNOFWASTEHEAT RECOVERYSYSTEMS **9**

Design of waste heat recovery system- Heat exchanger - Theory and design, Organic fluidsystems – Analysis and design.

UNITIIICOGENERATION PRINCIPLES **9**

Cogenerationprinciplesandthermodynamicspowercycleanalysis,combinedforpower generation and process heat.

UNITIVAPPLICATIONS OF COGENERATION **9**

Applicationsinsugarmillsricemills,textilefactories,andotherprocessandengineering industries.

UNITVCOSTANALYSISOFCOGENERATION SYSTEMS **9**

Financialconsiderations,operatingandmaintenancecost,investmentcostsofwasteheat recovery and Cogeneration system, environmental and air quality consideration.

TOTAL: 45 Hours

TextBooks:

1. CharlesH.Butler,“Cogeneration",McGrawHillBookCo.,1984.
2. Goldstick R., et.al, “Principles of Waste Heat Recovery ", The Fairment Press, Inc.,Georgia, 1986

ReferenceBooks:

1. KiangY.H.,“WasteUtilizationTechnology",MaecelDekkerInc.,1981.
2. David Hu and Gerald Hrd, “Waste recycling for Energy Conservation ", John Wiley and Sons, New York, 1981.
3. Sydney Reiter, " Industrial and Commercial Heat Recovery Systems ", Van Nostrand Reinhold, 1985.

4.SpiewakScottA,“CogenerationandSmallPowerProductionManual",theFairment Press, 1987.
5. NelsonE,Hay,“GuidetoNaturalGasCogeneration",TheFairmentPressInc., 1980.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Definetheutilizationof wasteheat,secondlaw andthermodynamicanalysis ofwasteheat.	**K3**
CO2:	Resolvethetheory,design andanalysisofwaste heatrecoverysystems and organicfluid systems	**K3**
CO3:	EvaluatetheCogenerationprinciplesandthermodynamicpower cycle analysis.	**K4**
CO4:	Derivethepowergenerationandprocessheatinwasteheatprocess.	**K5**
CO5:	DeterminetheFinancialConsiderationsofWasteheatRecovery systems.	**K3**

22GEAU05	DESIGNANDANALYSISOF COMPOSITES	L	T	P	Credits
		3	0	0	3

Course Objective:

- Studyaboutlinearelasticanalysisofcompositematerials.
- Tounderstandtheanisotropicmaterialbehavior

UNITICOMPOSITEMATERIALSANDTHEIR APPLICATIONS **9**

Introduction Fibers Matrix materials Material forms and fabrication methods Current applications

UNITIICONCEPTSOFSOLID MECHANICS **9**

Tensors Stress and strain Plane stress and plane strain energy density Generalized Hooke's LawMaterialsymmetryEngineeringconstants3CoordinatetransformationsThermaleffects, Moisture effects Chemical aging, flammability

UNITIII CONCEPTSOF MICROMECHANICS **9**

Effective properties Survey and model comparison from strength of materialsapproximations, continuum mechanics approaches

UNIT IV STRESS-STRAIN FOR AN ORTHOTROPIC LAMINA AND LAMINATE ANALYSIS **9**

Orthotropic properties in plane stress, Deformation due to extension/shear and bending/torsion A, B, D matrices hydrothermal behavior Special laminates Average stress- strain properties

UNITVCONCEPTSOFFAILUREOF LAMINATESAND SHAFTS **9**

Tensile failure of fiber composites Compressive failure of fiber composites Effect of multi axial stresses (failure criteria by Tsai-Wu, Hashin, etc.) Edge effects, Effective stiffness of beams Effective stiffness of shafts.

TOTAL: 45 Hours

TEXT BOOKS:

1. CarlT.Herakovich, MechanicsofFibrousComposites, 1997,
2. Stephen R. Swanson, Introduction to Design and Analysis with Advanced Composite Materials, Prentice-Hall, 1997.

REFERENCEBOOKS:

1. HyerM. W., Stress Analysis of Fiber-Reinforced Composite Materials, McGraw-Hill, 1997
2. GibsonR.F.,PrinciplesofCompositeMaterialMechanics,2ndedition,CRC Press.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	ExplaintheapplicationsofMatrixmaterials.	**K3**
CO2:	ExplaintheMoisture effects.	**K3**
CO3:	Describethepropertiesof micromechanics.	**K4**
CO4:	Describethepropertiesin plane stress.	**K5**
CO5:	Explaintheeffectivestiffnessofshafts.	**K3**

22GEAU06	COMPUTATIONALFLUIDDYNAMICS	L	T	P	Credits
		3	0	0	3

Course Objective:

- Tointroducenumerical modelingandtosolvecomplexproblemsinthefieldofheat transfer and fluid flow.

UNITIGOVERNINGEQUATIONSANDBOUNDARY CONDITIONS 9

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent flow - Turbulence -Kinetic - Energy Equations – mathematical behavior of PDEs on CFD: Elliptic, Parabolic and Hyperbolic equations.

UNITIIDISCRETIZATION ANDSOLUTION METHODOLOGIES 9

Methods of Deriving the Discretization Equations - Taylor Series formulation – Finite difference method – Control volume Formulation – Spectral method. Solutionmethodologies: Direct and iterative methods, Thomas algorithm, Relaxation method, Alternating Direction Implicit method.

UNITIIIHEAT CONDUCTION 9

Finite difference and finite volume formulation of steady/transient one-dimensional conduction equation, Source term linearization, Incorporating boundary conditions, Finite volume formulations for two and three dimensional conduction problem

UNITIVCONVECTIONAND DIFFUSION 9

Finite volume formulation of steady one-dimensional convection and Diffusion problems, Central, upwind, hybrid and power-law schemes - Discretization equations for two dimensional convection and diffusion.

UNITV CALCULATIONOFFLOW FIELD 9

Representation of the pressure - Gradient term and continuity equation - Staggered grid - Momentum equations - Pressure and velocity corrections - Pressure - Correction equation, SIMPLE algorithm and its variants. Turbulence models: mixing length model, two equation (k-e) models.

TOTAL: 45 Hours

TEXT BOOKS:

1. Versteeg,H.K,andMalalasekera,W.,"AnIntroductiontoComputationalFluidDynamics: The Finite Volume Method", Longman, 1998

2. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw- Hill Publishing Company Ltd., 1998.

REFERENCEBOOKS:

1. Patankar,S.V.,"NumericalHeatTransferandFluidFlow",McGraw-Hill,1980.Ane- Books 2004 Indian Edition.
2. Muralidhar, K and Sundarajan .T. "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 1995.
3. Bose,T.K.,"NumericalFluidDynamics",NarosapublishingHouse,1997.
4. Muralidhar, K and Biswas "Advanced Engineering Fluid Mechanics", Narosa Publishing House, New Delhi, 1996.
5. Anderson,J.D.,"Computationalfluiddynamics –thebasicswithapplications",1995.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Demonstratethe abilitytousemodernCFDsoftwaretools	**K3**
CO2:	Demonstratethe abilitytoanalyzetheflowvisualizationandanalysis tools.	**K3**
CO3:	Abilitytosimplify arealfluid-flowsystem intoa simplifiedmodel problem	**K4**
CO4:	Abilitytocommunicate theresults ofthis detailed fluid-flowstudy.	**K5**
CO5:	DescribethemathematicalpropertiesofgoverningNavier-Stokes equations	**K3**

22GEAU07	METROLOGYAND INSTRUMENTATION	L	T	P	Credits
		3	0	0	3

Course Objective:

- This course provides required knowledge, skills and creates self confidence instudents so that they can work on shop floor independently for accurate and precise measurements and manufacturing.

UNITIINTRODUCTIONTOMEASUREMENTSANDSENSORS 9

Sensors: Functions- Classifications- Main technical requirement and trends Units and standards- Calibration methods- Classification of errors- Error analysis- Limiting error- Probable error- Propagation of error- Ods and uncertainty- principle of transduction- Classification. Static characteristics- mathematical model of transducers- Zero, First and Second order transducers- Dynamic characteristics of first and second order transducers for standard test inputs.

UNITIIIVARIABLE RESISTANCEANDINDUCTANCESENSORS 9

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

UNITIIIVARIABLE ANDOTHERSPECIAL SENSORS 9

Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magneto strictive, Hal Effect, semiconductor sensor- digital transducers- Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.

UNITIVAUTOMOTIVEPRESSUREANDFORCE/TORQUESENSOR 9

Pressure Sensor: Typical automotive applications- Thick film pressure sensor-Semiconductor pressure sensor Integrated silicon intake-manifold pressure sensor-Integrated silicon combustion-pressure sensor- Piezo electric sensor-High pressure sensor with metal diaphragm. Force/Torque Sensor: Typical automotive applications- Magneto elastic bearing- pin sensor- Magneto elastic tension/compressive-force sensor according to the cross-ductor principle–Basic principleof torquemeasurement –Stress andAngle measuringtorque sensor

UNITVAUTOMOTIVEPOSITIONANDRPM/VELOCITYSENSORS 9

Position Sensors:- Typical automotive applications- Wiper potentiometers- Short-circuiting ring sensor- Half-differential sensor- Eddy-current pedal-travel sensor- Integrated Hal IC's – Hal acceleration sensor- Knock sensors-RPM and Velocity Sensors: - Inductive rotational sped sensor- Hal effect sensor Temperature Sensors:- Typical automotive applications - Sintered-Ceramic resistors- Thin film resistors-Thick film resistors- Mono crystalline silicon semiconductor resistor- Thermopile sensors Flow Sensors:- Ultrasonic flow sensors-Pitottube air-flow sensor- Hot wire air-mass flow meter- Micro mechanical hot-film air-mas flow meter- Lambda sensor -Imaging sensor-Rain Sensor Introduction to MEMs

TOTAL: 45 Hours

TEXT BOOKS:

1. Doeblin E.O, "Measurement Systems: Aplications and Design", 5th Editon, Tat McGraw- Hil Publishing Co, 2007

2. RobertBrandy,“AutomotiveElectronicsandComputerSystem”,PrenticeHal,2001
3. WiliamKimberley,”BoschAutomotive Handbok”,6thEditon, RobertBoschGmbH, 2004

REFERENCEBOOKS:

1. Bentley J.P,” Principles of Measurement Systems”, 4th Editon, Adision Wesley Longman Ltd., U.K, 2004
2. Patranabis.D,“SensorsandTransducers”,2ndEditon,PrenticeHal IndiaLtd,2003
3. MurthyD.V.S,“Transducersand Instrumentation”,PrenticeHalofIndia,2007

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Identifythemethodsof vibrationandnoisemeasurement.	**K3**
CO2:	Comparetheeffectofnoise anhumancomfortand environment	**K3**
CO3:	Describetheconceptof mufflers,tire/roadnoise.	**K4**
CO4:	Describetheinteriortransportationnoiseandvibration sources.	**K5**
CO5:	Describethevariousnoiseandvibration measurements.	**K3**

22GEAU08	COMPOSITEMATERIALS& STRUCTURES	L	T	P	Credits
		3	0	0	3

Course Objective:

- Tounderstandthefabrication,analysisanddesignofcompositematerials&structures

UNITIINTRODUCTIONTO COMPOSITES **8**

Fundamentals of composites - need for composites – Enhancement of properties - classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites.

UNITII POLYMERMATRIX COMPOSITES **12**

Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – Rovings – Woven fabrics – Non woven random mats – various types of fibres. PMC processes - Hand layup processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding - Resin transfer moulding – Pultrusion – Filament winding – Injection moulding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GRP).

UNITIII METALMATRIX COMPOSITES **9**

Characteristics of MMC, Various types of Metal matrix composites Alloy vs. MMC, Advantages of MMC, Limitations of MMC, Metal Matrix, Reinforcements – particles – fibres. Effect of reinforcement - Volume fraction – Rule of mixtures. Processing of MMC – Powder metallurgy process – diffusion bonding – stir casting – squeeze casting.

UNITIVCERAMIC MATRIX COMPOSITES **9**

Engineeringceramicmaterials–properties–advantages–limitations–Monolithicceramics
- Need for CMC – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride – reinforcements – particles- fibres- whiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).

UNITV ADVANCESIN COMPOSITES **7**

Carbon /carbon composites – Advantages of carbon matrix – limitations of carbon matrix Carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Sol gel technique. Composites for aerospace applications.

TOTAL: 45 Hours

TEXT BOOKS:

1. MathewsF.L.andRawlingsR.D.,"Compositematerials:EngineeringandScience", Chapman and Hall, London, England, 1st edition, 1994.
2. ChawlaK.K.,"Compositematerials",Springer–Verlag,1987

REFERENCEBOOKS:

1. ClyneT.W.andWithersP.J.,"IntroductiontoMetalMatrixComposites",Cambridge University Press, 1993.
2. StrongA.B.,"FundamentalsofCompositeManufacturing",SME,1989.
3. SharmaS.C.,"Compositematerials",NarosaPublications,2000.
4. "ShortTermCourseonAdvancesinCompositeMaterials,CompositeTechnologyCentre, Department of Metallurgy", IIT- Madras, December 2001

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Explainthefundamentalsofcomposites.	**K3**
CO2:	Familiarwiththethermoplasticresins.	**K3**
CO3:	ExplaintheMetalmatrixcompositesAlloy.	**K4**
CO4:	Describethediffusion bonding.	**K5**
CO5:	Describestudyof engineeringceramicmaterials	**K3**

MAPPINGOF PROGRAMOUTCOMES WITHCOURSE OUTCOMES

	PO1	**PO2**	**PO3**	**P O4**	**PO5**	**PO6**	**PO7**	**PO 8**	**PO9**	**PO 10**	**PO 11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	-	-	-	-	3	3	3	3	2	2
CO2	3	3	2	3	-	-	-	-	2	2	2	2	3	2
CO3	3	2	2	2	-	-	-	-	2	2	2	2	2	2
CO4	3	2	3	3	-	-	-	-	3	2	2	3	3	3
CO5	3	3	3	3	-	-	-	-	3	2	3	2	3	3

ASSESSMENT METHODS:

CAT1	**CAT2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
☑	☑	☑	☑	☑	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open booktest**
			☑		☑

		L	T	P	Credits
22GEAU09	DESIGNOFJIGS,FIXTURESANDPRESS TOOLS	3	0	0	3

Course Objective:

- Tounderstandthefunctionsanddesign principlesofJigs,fixturesandpress tools

UNITILOCATING ANDCLAMPING PRINCIPLES **8**

Tool design- Function and advantages of Jigs and fixtures – Basic elements– principles of location – Locating methods and devices – Redundant Location –Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used.

UNITII JIGS AND FIXTURES **10**

Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

UNITIIIPRESSWORKINGTERMINOLOGIESANDCUTTINGDIES **10**

Press Working Terminologies - operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances– PressWorkMaterials–Centerofpressure-Designofvariouselementsofdies– Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots –Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

UNITIV BENDINGFORMING ANDDRAWING DIES **10**

Differencebetweenbending,forminganddrawing –Blankdevelopmentforaboveoperations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads-ironing – Design and development of bending, forming, drawingreversere-drawingandcombinationdies –Blankdevelopmentforax-symmetric,rectangular and elliptic parts – Single and double action dies.

UNITVMISCELLANEOUSTOPICS **7**

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke - Course should be supplemented with visits to industries.

(UseofApproveddesignDataBookpermitted).

TOTAL: 45 Hours

TEXT BOOKS:

1. Joshi, P.H. “Jigs and Fixtures”, Second Edition, Tata McGraw Hill Publishing Co., Ltd.,New Delhi, 2004.
2. Donaldson,LecainandGoold“ToolDesign”,IIIrdEditionTataMcGrawHill,2000.

REFERENCEBOOKS:

1. K.Venkataraman,"DesignofJigsFixtures&PressTools",TataMcGrawHill,NewDelhi, 2005.Kempster, "Jigs and Fixture Design", Hoddes and Stoughton – Third Edition 1974.
2. Joshi,P.H."PressTools"–DesignandConstruction",Wheelspublishing, 1996.
3. Hoffman"JigsandFixtureDesign"–Thomson DelmarLearning,Singapore,2004.
4. ASTMEFundamentalsofToolDesignPrenticeHallof India.
5. DesignData HandBook, PSGCollegeofTechnology, Coimbatore.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Explainthebasics ofJigsand fixtures.	**K3**
CO2:	ExplainthedifferenttypesofFixturesandGauges	**K3**
CO3:	Explaintheconstructionandworkingprinciplesofdifferenttypesofpress and press tools	**K4**
CO4:	DescribetheManufactureand assembleofdifferentpress tools	**K5**
CO5:	Abilitytoclassifyandexplainvarious presstoolsandpresstools operations.	**K3**

22GEAU10	ROBOTICS	L	T	P	Credits
		3	0	0	3

Course Objective:

- Tounderstandthebasicconceptsassociatedwiththedesignandfunctioningand applications of Robots
- Tostudyabout thedrivesandsensors usedin Robots

UNITI FUNDAMENTALSOF ROBOT **7**

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

UNITIIROBOTDRIVESYSTEMSANDEND EFFECTORS **10**

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

UNITIIISENSORSANDMACHINEVISION **10**

Requirements of a sensor, Principles and Applications of the following types of sensors– Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors),Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors. Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis –Data Reduction: Edge detection, Segmentation Feature Extraction and Object Recognition - Algorithms. Applications – Inspection, Identification, Visual Serving and Navigation.

UNITIVROBOTKINEMATICSANDROBOTPROGRAMMING **10**

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs.

UNITVIMPLEMENTATIONANDROBOTECONOMICS **8**

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

TOTAL: 45 Hours

TEXT BOOK:

1. M.P.Groover,"IndustrialRobotics–Technology,ProgrammingandApplications", McGraw-Hill, 2001

REFERENCEBOOKS:

1. Fu.K.S.Gonzalz.R.C.,andLeeC.S.G.,"RoboticsControl,Sensing,Visionand Intelligence", McGraw-Hill Book Co., 1987
2. YoramKoren,"RoboticsforEngineers",McGraw-HillBookCo., 1992
3. Janakiraman.P.A.,"RoboticsandImageProcessing",TataMcGraw-Hill,1995

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Classifytherobotsbasedonjoints andarm configurations.	**K3**
CO2:	ProgramrobottoperformtypicaltasksincludingPickandPlace,Stacking and Welding.	**K3**
CO3:	DesignandselectrobotsforIndustrialandNon-Industrialapplications.	**K4**
CO4:	Describetheautomationandbriefhistoryof robotandapplications.	**K5**
CO5:	DescribetheProgramming methods&various Languagesof robots.	**K3**

22GEAU11	SUPERCHARGING AND SCAVENGING	L	T	P	Credits
		3	0	0	3

Course Objective:

- To make the students understand the need for supercharging and the various types of superchargers used and their performance characteristics and the scavenging methods for two stroke engines.

UNITI SUPERCHARGING **8**

Effects on engine performance – engine modification required Thermodynamics of Mechanical Supercharging and Turbocharging – Turbocharging methods – Engine exhaust manifolds arrangements.

UNITII SUPERCHARGERS **10**

Types of compressors – Positive displacement blowers – Centrifugal compressors – Performancecharacteristiccurves–Suitabilityforengineapplication–Surging–Matchingof supercharger compressor and Engine – Matching of compressor, Turbine, Engine.

UNITIII SCAVENGINGOFTWO STROKE ENGINES **12**

Peculiarities of two stroke cycle engines – Classification of scavenging systems –Mixture control through Reed valve induction – Charging Processes in two stroke cycle engine – Terminologies – Shankey diagram – Relation between scavenging terms –scavenging modeling – Perfect displacement, Perfect mixing – Complex scavenging models.

UNITIVPORTSANDMUFFLERDESIGN **8**

Porting–Designconsiderations –Designof IntakeandExhaustSystems–Tuning.

UNITVEXPERIMENTAL METHODS **7**

Experimental techniques for evaluating scavenging – Firing engine tests – Non firing engine tests – Port flow characteristics – Kadenacy system – Orbital engine combustion system.

TOTAL: 45 Hours

TEXT BOOKS:

1. Watson,N.andJanota,M.S.,Turbochargingthe I.C.Engine,MacMillan Co.,1982.
2. JohnB.Heywood,TwoStrokeCycleEngine,SAEPublications, 1997.

REFERENCEBOOKS:

1. Obert, E.F.,Internal Combustion Engines and Air Pollution, Intext EducationalPublishers, 1980.
2. RichardStone, InternalCombustionEngines,SAE,1992.
4.Schweitzer, P.H.,Scavenging ofTwo StrokeCycleDiesel Engine,MacMillan Co., 1956

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Describetheeffectson Engineperformance andEngine modification.	**K3**
CO2:	StatethetypesofcompressorsblowersanditsPerformanceCharacteristics Curves.	**K3**
CO3:	Definethepeculiaritiesoftwo strokeEngines,anditsScavenging and Chargingprocess.	**K4**
CO4:	EvaluatethedesignofIntakeandExhaust systems.	**K5**
CO5:	DeterminetheExperimentaltechniquesfor evaluatingscavenging.	**K3**

22GEAU12	MECHANICSOFMACHINES	L	T	P	Credits
		3	0	0	3

Course Objective:

- Tounderstandthedifferentmechanisms,themethodofworkingofdifferent mechanisms
- ToimpartonknowledgeontheForcesinvolvedandconsequentvibrationduring working

UNITI KINEMATICOF MECHANICS **9**

Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – kinematics analysis in simple mechanisms – velocity and acceleration polygons – Analytical methods – computer approach – cams – classifications – displacement diagrams - layout of plate cam profiles – derivatives of flowers motion – circular arc and tangent cams.

UNITIIGEARSandGEARTRAINS **9**

Spur gear – law of toothed gearing – involute gearing – Interchangeable gears – Gear tooth action interference and under cutting – nonstandard teeth – gear trains – parallel axis gears trains – epicyclic gear trains – automotive transmission gear trains.

UNITIII FRICTION **9**

Sliding and Rolling Friction angle – friction in threads – Friction Drives – Friction clutches – Belt and rope drives – brakes – Tractive resistance.

UNITIVFORCE ANALYSIS **9**

AppliedandConstrainedForces –Freebodydiagrams–staticEquilibriumconditions–Two, Three and four members – Static Force analysis in simple machine members – Dynamic Force Analysis – Inertia Forces and Inertia Torque – D'Alembert's principle – super position principle – dynamic Force Analysis in simple machine members.

UNITVBALANCINGAND VIBRATION **9**

StaticandDynamicbalancing–Balancingofrevolvingandreciprocatingmasses–Balancing machines – free vibrations – Equations of motion – natural Frequency – Damped Vibration – bending critical speed of simple shaft – Torsional vibration – Forced vibration – harmonic Forcing – Vibration solution.

TOTAL: 45 Hours

TEXT BOOKS:

1. AmbekarA.G.,"MechanismandMachineTheory"PrenticeHalof India, NewDelhi,207
2. ShigleyJ.E.,PenockG.RandUickerJ.J.,"TheoryofMachinesandMechanisms", OxfordUniversity

REFERENCEBOOKS:

1. ThomasBevan,“TheoryofMachines”,CBSPublishersandDistributors,1984.
2. Ghosh.A,andA.K.Malick,“TheoryandMachine”,AfilatedEast-WestPvt.Ltd.,New Delhi, 198.
3. Rao.J.S.andDukipatiR.V.“MechanismsandMachines”,Wiley-EasternLtd.,New Delhi,192.
4. Ramamurthi.V.,"MechanismsofMachine", NarosaPublishingHouse, 202.
5. RobertL.Norton,"DesignofMachinery",McGraw-Hil,204.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	AnalyzethedifferenttypesofmotionsandDisplacementdiagramofCam and Follower.	**K3**
CO2:	DiscussabouttheFrictionalforcesinanInclinedPlanes,Screwthreadsand Clutches.	**K3**
CO3:	AnalyzetheTensions,ForcesandPowerindifferenttypesofBeltandRope drives and Brakes.	**K4**
CO4:	ComparetheDynamicForceanalysis,inertialforceandTorqueinSimple Machine Members.	**K5**
CO5:	EvaluatetheFreevibrations,balancingofrevolvingandreciprocating masses of rotating shaft.	**K3**

22OEAU01	PRINCIPLESOFMANAGEMENTAND PROFESSIONAL ETHICS	L	T	P	Credits
		3	0	0	3

Course Objective:

- To enable thestudents to study the evolution of Management, to study thefunctions andprinciplesofmanagementandtocreateanawarenessonEngineeringEthicsand Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNITI OVERVIEWOF MANAGEMENT **9**

Definition - Management - Role of managers - Evolution of Management thought – Organization and the environmental factors – Trends and Challenges of Management in Global Scenario.

UNITIIPLANNING&ORGANIZING **9**

Nature and purpose of planning and Organizing - Planning process - Types of plans – Managing by objective (MBO) Strategies - Types of strategies - Policies - Decision Making - Types of decision - Decision Making Process - Rational Decision Making Process - Decision Making under different conditions. - Organization structure - Formal and informal groups I organization - Line and Staff authority - Departmentation - Span of control - Centralization and Decentralization - Delegation of authority - Staffing - Selection and Recruitment - Orientation - Career Development - Career stages – Training - Performance Appraisal.

UNITIII DIRECTING &CONTROLLING **9**

Creativity and Innovation - Motivation and Satisfaction - Motivation Theories - Leadership Styles - Leadership theories - Communication - Barriers to effective communication – Organization Culture - Elements and types of culture - Managing cultural diversity. Processof controlling - Types of control - Budgetary and non-budgetary control techniques - Managing Productivity - Cost Control - Purchase Control - Maintenance Control - Quality Control - Planning operations.

UNITIV ENGINEERINGETHICS&HUMANVALUES **9**

Definition -Societiesfor engineers – CodeofEthics – Ethical Issuesinvolved in crossborder research - Ethical and Unethical practices – case studies – situational decision making - Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue –Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNITVSAFETYRESPONSIBILITIESANDRIGHTS **9**

SafetyandRisk–AssessmentofSafetyandRisk–RiskBenefitAnalysisandReducingRisk
- Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination – Global issues - Multinational Corporations – Environmental Ethics– Computer Ethics – Weapons Development – Engineers as Managers – ConsultingEngineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

TOTAL: 45 Hours

TEXT BOOKS:

1. StephenP.RobbinsandMaryCoulter,'Management',PrenticeHallof India,8thedition.
2. CharlesWLHill,StevenLMcShane,'PrinciplesofManagement',McgrawHill Education, 2007.

REFERENCEBOOKS:

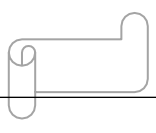
1. Hellriegel,Slocum&Jackson,'Management-ACompetencyBasedApproach', Thomson South Western, 2007.
2. AndrewJ.Dubrin,'EssentialsofManagement',ThomsonSouthwestern,7thedition,2007.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Definemanagement,managersrole andmanagementchallenges	**K3**
CO2:	Explainplanning,organizing,decisionmaking,delegation,staffingand recruitment	**K3**
CO3:	Describethedirectingandcontrolling functions	**K4**
CO4:	Explaintheengineeringethicsandhumanvalues	**K5**
CO5:	Describethesafetyresponsibilitiesand rights	**K3**



22OEAU02	TOTALQUALITY MANAGEMENT	L	T	P	Credits
		3	0	0	3

Course Objective:

- TofacilitatetheunderstandingofQualityManagementprinciplesand process.

UNITI INTRODUCTION **9**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNITII TQM PRINCIPLES **9**

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNITIII TQMTOOLS &TECHNIQUESI **9**

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

UNITIV TQMTOOLS&TECHNIQUESII **9**

Qualitycircles–QualityFunctionDeployment(QFD) –Taguchiqualitylossfunction –TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNITVQUALITY SYSTEMS **9**

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TOTAL: 45 Hours

TEXT BOOK:

1. DaleH.Besterfiled,etcat“TotalQualityManagement”,PearsonEducationAsia, Third Edition, 2006.

REFERENCEBOOKS:

1. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, 6th Edition, South-Western (Thomson Learning), 2005.
2. Suganthi,LandAnandSamuel,“TotalQualityManagement”,PrenticeHall(India) Pvt. Ltd.,2006.
3. Janakiraman,BandGopal,R.K,“TotalQualityManagement–TextandCases”, Prentice Hall (India) Pvt. Ltd.

4. R.Pugazhenthi,A.Baradeswaran,K.Balachandran,andP.Balamurali,"Total Quality Management", sams publications, 2015.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Defineequality,conceptsofqualityandTQM	**K3**
CO2:	Explainindetail abouttheTQM principles	**K3**
CO3:	Describethevarious toolsand techniques ofTQM	**K4**
CO4:	Definequalitycircleandperformance measures	**K5**
CO5:	Listthequalitysystemsimplementedinmanufacturingandservicesectors including IT.	**K3**

22OEAU03	QUALITYCONTROLANDRELIABILITY ENGINEERING	L	T	P	Credits
		3	0	0	3

Course Objective:

- Tobefamiliarwiththevariousqualitycontroltechniquesandcontrolchartsfor variables and attributes

UNITIINTRODUCTION ANDPROCESS CONTROLFOR VARIABLES **9**

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality cost-Variation in process causes of variation – Theory of control chart- uses of control chart – Control chart forchart - process capability – process capability studies□variables – X chart, R chart and simple problems, Six sigma concepts.

UNITIIPROCESS CONTROLFOR ATTRIBUTES **9**

Controlchartforattributes –controlchartfornonconformings–pchartandnpchart –control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

UNITIIIACCEPTANCESAMPLING **9**

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans.

UNITIVLIFETESTING –RELIABILITY **9**

Lifetesting –Objective–failuredataanalysis,Meanfailurerate,meanstimetofailure,mean time between failure, hazard rate – Weibull model, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability –simple problems, Acceptance sampling based on reliability test – O.C Curves.

UNITV QUALITYAND RELIABLITY **9**

Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

Note:*Useofapprovedstatisticaltablepermittedinthe examination.*

TOTAL: 45 Hours

TEXT BOOKS:

1.Douglas.C.Montgomery,"IntroductiontoStatisticalqualitycontrol",Johnwiley,4th edition2001.

2. SrinathL.S.,"ReliabilityEngineering",AffiliatedEastwestpress,1991.

REFERENCEBOOKS:

1. John.S.Oakland.Statisticalprocesscontrol",Elsevier,5thedition,2005
2. Grant,Eugene.L"StatisticalQualityControl",McGraw-Hill,1996
3. MonoharMahajan,"StatisticalQualityControl",DhanpatRai&Sons,2001.
4. GuptaR.C.,"StatisticalQualitycontrol",KhannaPublishers,1997.
5. BesterfieldD.H., "QualityControl",PrenticeHall,1993.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Definequalitycontrol,qualityassurance andcontrol charts.	**K3**
CO2:	Describetheprocess controlchartsforattributes.	**K3**
CO3:	Definesamplingandit types	**K4**
CO4:	Explainlifetesting,reliability, availabilityand maintainability	**K5**
CO5:	Describethereliabilitydesignandtechniques.	**K3**

22OEAU04	SUPPLYCHAINMANAGEMENT	L	T	P	Credits
		3	0	0	3

Course Objective:

- Tobefamiliar withthevarious conceptsandfunctions ofsupplychain management

UNITI INTRODUCTION **9**

DefinitionofLogisticsandSCM:Evolution,Scope,Importance&DecisionPhases –Drivers of SC Performance and Obstacles.

UNITIILOGISTICS MANAGEMENT **9**

Factors–ModesofTransportation-DesignoptionsforTransportationNetworks-Routing and Scheduling– Inbound and outbound logistics- Reverse Logistics – 3PL- Integrated Logistics Concepts- Integrated Logistics Model – Activities - Measuring logistics cost and performance – Warehouse Management- Case Analysis.

UNITIII SUPPLY CHAINNETWORK DESIGN **9**

Distribution in SupplyChain – Factors in Distribution network design –Design options-NetworkDesigninSupplyChain–FrameworkfornetworkDecisions-Managingcycle inventory and safety.

UNITIVSOURCING,ANDPRICING IN SUPPLY CHAIN **9**

SupplierselectionandContracts-Designcollaboration-Procurementprocess.Revenue management in supply chain.

UNITVCOORDINATIONAND TECHNOLOGYINSUPPLY CHAIN **9**

Supplychaincoordination-Bullwhipeffect–Effectoflackofco-ordinationandobstacles– IT andSCM-supplychainITframe work,E Business&SCM,MetricsforSCperformance – Case Analysis

TOTAL: 45 Hours

TEXTBOOKS:

1. SupplyChainManagement,Strategy,Planning,andoperation–SunilChopraandPeter Meindl- PHI, Second edition, 2007
2. Logistics,DavidJ.Bloomberg,StephenLemayandJoeB.Hanna,PHI2002

REFERENCEBOOKS:

1. LogisticsandSupplyChainManagement–StrategiesforReducingCostandImproving Service. Martin Christopher, Pearson Education Asia, Second Edition.
2. Modelingthesupplychain,JeremyF.Shapiro,ThomsonDuxbury,2002.

3. HandbookofSupplychainmanagement,JamesB.Ayers,St.LuclePress,2000.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Definelogisticsandsupplychain management	**K3**
CO2:	Describethemodesoftransportationand warehousemanagement	**K3**
CO3:	Explainthesupplychainnetworkdesign,managingcycleinventoryand safety	**K4**
CO4:	Describethesourcing andpricing in theSCM	**K5**
CO5:	Explainin detailabout coordination and technologyin theSCM	**K3**

22OEAU05	OPERATIONS RESEARCH	L	T	P	Credits
		3	0	0	3

Course Objective:

➢ Tobefamiliarwiththeoptimizationtechniquesunderlimitedresourcesfortheengineering.

UNITI LINEAR MODELS **9**

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

UNITIITRANSPORTATIONMODELSANDNETWORKMODELS **9**

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route– Minimal spanning tree – Maximum flow models –Project network – CPMand PERT networks – Critical path scheduling – Sequencing models.

UNITIIIINVENTORYMODELS **9**

Inventorymodels –Economicorderquantitymodels –Quantitydiscountmodels –Stochastic inventory models – Multi product models – Inventory control models in practice.

UNITIV QUEUEING MODELS **9**

Queueing models - Queueing systems and structures – Notation parameter – Single serverand multi-server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNITVDECISION MODELS **9**

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

TOTAL: 45 Hours

TEXTBOOKS:

1. TahaH.A.,"OperationsResearch",SixthEdition,PrenticeHallof India,2003

REFERENCEBOOKS:

1. ShennoyG.V.andSrivastavaU.K.,"OperationResearchforManagement",Wiley Eastern,1994.
2. BazaraM.J.,JarvisandSheraliH.,"LinearProgrammingandNetworkFlows",John Wiley,1990.
3. PhilipD.T.andRavindranA.,"OperationsResearch",JohnWiley,1992.
4. HillierandLibeberman,"OperationsResearch",HoldenDay,1986

5. BudnickF.S.,“PrinciplesofOperationsResearchforManagement”,RichardDIrwin, 1990.
6. TulsianandPasdeyV.,“QuantitativeTechniques”,Pearson Asia,2002.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Definelinearprogramming,simplexalgorithmandsensitivityanalysis	**K3**
CO2:	Explainthetransportationassignment modelsandnetworkmodels	**K3**
CO3:	Describethevarious inventory models	**K4**
CO4:	Explainthequeuingmodels, systemsand structures.	**K5**
CO5:	Describethedecision modelsandgame theory	**K3**

22OEAU06	ENERGYAUDITANDENERGY CONSERVATION METHODS	L	T	P	Credits
		3	0	0	3

Course Objective:

- Thiscourseprovidestheknowledgeaboutenergyauditandenergyconservation methods in I.C. Engines.

UNITI ENERGYANDENVIRONMENT **9**

Introduction - fossil fuels reserves - world energy consumption - greenhouse effect, global warming - Renewable energy sources - environmental aspects utilization - energy prizes - energy policies.

UNITII ENERGY CONSERVATION **9**

Energyconservationschemes-industrialenergyuse-energysurveyingandauditing-energy index –Energy cost - cost index - energy conservation in engineering and process industry, in thermal Systems, in buildings and non-conventional energy resources scheme

UNIT III ENERGY TECHNOLOGIES **9**

Fuels and consumption - boilers - furnaces - waste heat recovery systems - heat pumps and Refrigerators - storage systems - insulated pipe work systems - heat exchangers.

UNITIV ENERGYMANAGEMENT **9**

Energy management principles - energy resource management - energy management informationSystems-instrumentationandmeasurement-computerizedenergymanagement - energyAuditing.

UNITVECONOMICSAND FINANCE **9**

Costing techniques - cost optimization - optimal target investment schedule - financial appraisal and Profitability - project management.

TOTAL: 45 Hours

TEXT BOOKS:

1. MurphyW.R.andMcKay.“EnergyManagement, Butterworths,London,1982.
2. TrivediP.R.,JulkaB.R., “EnergyManagement”,Commonwealthpublishers,1997.

REFERENCEBOOKS:

1. David Merick, Richard Marshal, “Energy, present and future options”, Vol. I and II, John Wiley and Sons, 1981.
2. ChaigierN.A.“EnergyConsumptionandEnvironment",McGraw-Hill, 1981.
3. IkkenP.A.SwartR.Jand Zwerves.S,“ClimateandEnergy",1989.
4. RayD.A.“IndustrialEnergyConservation",PergamaonPress,1980.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Describetheenergysources,utilizationandpolicies	**K3**
CO2:	Explaintheenergyconservationinindustriesandbuildings	**K3**
CO3:	Describethevarious energydeveloping systems	**K4**
CO4:	Explaintheenergy managementand auditing	**K5**
CO5:	Definethe costeconomicsandoptimization	**K3**

22OEAU07	ENTREPRENEURSHIPDEVELOPMENT	L	T	P	Credits
		3	0	0	3

Course Objective:

- To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

UNITI ENTREPRENEURSHIP **9**

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

UNITII MOTIVATION **9**

MajorMotivesInfluencinganEntrepreneur –AchievementMotivationTraining,Self-Rating, BusinessGames, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, objective.

UNITIII 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 FeasibilityAssessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNITIVFINANCINGANDACCOUNTING **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.

UNITV 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 Hours

TEXT BOOKS:

1. Khanka.S.S.,"EntrepreneurialDevelopment"S.Chand&Co.Ltd.,RamNagar,New Delhi, 2013.
2. DonaldFKuratko,"Entrepreneurship–Theory,ProcessandPractice",9thEdition,Cengage Learning, 2014.

REFERENCEBOOKS:

1. HisrichRD, PetersM P, "Entrepreneurship"8thEdition, Tata McGraw-Hill, 2013.

2. Mathew J Manimala, "Enterprenuership theory at cross roads: paradigms and praxis" 2nd Edition Dream tech, 2005.
3. RajeevRoy,"Entrepreneurship"2ndEdition,OxfordUniversityPress,2011.
4. EDII"FaultyandExternalExperts–AHandBookforNewEntrepreneursPublishers: Entrepreneurship Development",InstituteofIndia,Ahmadabad, 1986.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Defineentrepreneur andittypes	**K3**
CO2:	Explainmotivation,self-ratingandstressmanagement	**K3**
CO3:	Describethesmallenterpriseandsteps involvedinsettingup a business	**K4**
CO4:	Definethesourcesoffinance,loans andtaxation	**K5**
CO5:	Describethegovernmentpoliciesforsmallscaleindustries.	**K3**

22OEAU08	VALUEANALYSISANDVALUE ENGINEERING	L	T	P	Credits
		3	0	0	3

Course Objective:

- Toprovide thebasicconceptsand featuresofvalueanalysis andvalueengineering.

UNITI CONCEPTS **9**

Introduction – status of VEin India and origin country – impact of VEapplication – types of values – types of function – function identification on product – functionmatrix – function analysis – elements ofcosts–calculationofcosts–costallocationtofunction–evaluationofworthinVEmethodology.

UNITII TECHNIQUES **9**

General techniques: brain storming – godson feasibility ranking – morphological analysis – ABC analysis – probability approach – make or buy.

UNITIIIANALYSIS **9**

Function – cost-worth analysis – function analysis – system techniques – function analysis matrix – customer oriented FAST diagram – fire alarm – Langrange plan – evaluation methods – matrix in evaluation – break even analysis.

UNITIVVALUEENGINEERINGINJOBPLAN **9**

Orientation phase – information phase – functional analysis – creative phase – evaluation phase – recommendation phase – implementation phase – audit phase.

UNITVCASESTUDIES **9**

Water treatment plant – engineering management, pump component, motor component, wet grinder, automobile, hospital.

TOTAL: 45 Hours

TEXTBOOKS:

1. MukhophadhyayaAK,"ValueEngineering",SagePublicationsPvt.Ltd.,NewDelhi,2003.
2. RichardJPark,"ValueEngineering–APlanforInventions",St.LuciePress,London,1998.

REFERENCEBOOKS:

1. LarryWZimmesman.PE,"VE–APracticalApproachforOwnersDesignersand Contractors", CBS Publishers, New Delhi, 1992.
2. ArthusEMudge,"ValueEngineering",McGrawHillInc.,NewYork,1971.
3. ArmyMaterielCommandUS,"ValueEngineering(EngineeringDesignHandbook)",University Press of the Pacific, 2006

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Definevalueengineeringandit types.	**K3**
CO2:	Explainbrainstorming,morphologicalandABCanalysis	**K3**
CO3:	Describethecostworth andfunctionanalysis, evaluationmethodsand break evenanalysis	**K4**
CO4:	Describethevalue engineering inthedifferentwork phase.	**K5**
CO5:	Illustratethevariouscase studiesforvalueengineeringand analysis	**K3**

22OEAU09	INDUSTRIALMARKETINGANDMARKET RESEARCH	L	T	P	Credits
		3	0	0	3

Course Objective:

- Tobefamiliarwiththenewerconceptsofmarketingconceptslikestrategicmarketing segmentation, pricing, advertisement and strategic formulation.

UNITIINDUSTRIALMARKETING **9**

Nature of Industrial Marketing: Industrial Marketing Vs Consumer Marketing Relational approach to Industrial Marketing- The Nature of Industrial Demand &Industrial Customer. Types of Industrial Products: Major Equipment; Accessory Equipment; Raw and Processed Materials; Component Parts and Sub- Assemblies; Operating Supplies; Standardized and Non-standardized parts, Industrial services.

UNITII PRICING **9**

Pricing for Industrial Products – Pricing COURSE OBJECTIVE - Price Decision Analysis – Breakeven analysis – net pricing – discount pricing – trade discounts – geographic pricing – factory pricing – freight allowance pricing – Terms of Sale – Outright purchase – Hire- purchase – Leasing.

UNITIIIMARKETRESEARCH **9**

Introduction to Market Research, Types of Research – Basic & Applied, Nature, Scope, objective, Importance & Limitations of Market Research. Sources and collection of Marketing Data. Secondary data – Advantages &Limitations, Sources – Govt. & Non Govt. Primary Data – Advantages &Limitations, Sources, Methods of Collection Primary Data – Observation, Mail, Personal Interview, Telephonic Interview, Internet Interviewing.

UNITIVTECHNIQUES **9**

Market Research Techniques. National readership survey, Retail Store Audit, Consumer Panels, Test Marketing, Research in Advertising Decisions, Marketing Audit, Data Base Marketing, Focus Group Interviews. Sampling, Questionnaire & Scaling Techniques. ProbabilityandNonProbabilitySampling,Samplingmethods,SampleDesign,Questionnaire design and drafting. Scaling techniques like Nominal, Ordinal, Interval, Ratio, Perceptual Map, Semantic Differential, Likert, Rating& Ranking Scales.

UNITVIMPLEMENTATION **9**

Setting up & Implementation of Marketing Research Project, Steps in formulating Market Research Projects, One project for consumer durables and one for nondurables to be discussed.

TOTAL:45Hours

TEXT BOOKS:

1. RalphS.Alexander,JamesS.Cross,RichardM.Hill,"IndustrialMarketing", Homewood, 1967.
2. RajendraNargundkar,"MarketingResearch",TataMcGrawHill, 2008.

REFERENCEBOOKS:

1. Robert R. Reeder; Edward G. Brierty; Betty H. Reeder**,** "Industrial Marketing – Analysis, Planning and Control",Prentice Hall, 1991**.**
2. GhoshPK,"IndustrialMarketing",OxfordUniversityPress, India.
3. RamanujMajumdar,"MarketingResearch-Text,ApplicationsandCaseStudies".
4. DonaldR.Cooper,"BusinessresearchMethods",McGraw-Hill,2005.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Defineindustrialmarketing,industrialdemandand customer.	**K3**
CO2:	Explaintheproductpricing,pricedecision,discounts,purchase and leasing.	**K3**
CO3:	Explainthemarketresearchandittypes,sourcesandcollectionofmarketing data.	**K4**
CO4:	Describeindetailaboutthemarketresearchtechniques	**K5**
CO5:	DescribetheSettingupandImplementationofMarketingResearchProject	**K3**

22OEAU10	DISASTER MANAGEMENT	L	T	P	Credits
		3	0	0	3

Course Objective:

- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction

UNITIINTRODUCTIONTODISASTERS **9**

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

UNITIIAPPROACHESTODISASTERRISKREDUCTION(DRR) **9**

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

UNITIIIINTER-RELATIONSHIPBETWEENDISASTERSANDDEVELOPMENT **9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenariosin the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNITIVDISASTERMANAGEMENT:APPLICATIONSANDCASESTUDIESANDFIELD WORKS **9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment,Floods:FluvialandPluvialFlooding:CaseStudies;ForestFire:CaseStudies,ManMade disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

UNITVDISASTERRISKMANAGEMENTININDIA **9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, RiskAssessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

TOTAL:45Hours

TEXTBOOKS:

1. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
2. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.
3. Singhal J.P. "DisasterManagement", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423

4. TusharBhattacharya,"DisasterScienceandManagement",McGrawHillIndiaEducationPvt. Ltd., 2012.

REFERENCEBOOKS:

1. Govt.ofIndia:DisasterManagementAct,GovernmentofIndia,NewDelhi,2005
2. GovernmentofIndia,NationalDisasterManagementPolicy,2009.

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Differentiatethetypesofdisasters,causesandtheirimpactonenvironmentand society	**K3**
CO2:	Assessvulnerabilityandvariousmethodsofriskreductionmeasuresaswellas mitigation.	**K3**
CO3:	ExplainDisasterdamageassessmentandmanagement.	**K4**
CO4:	DescribeManagement:ApplicationsAndCaseStudiesAndFieldWorks	**K5**
CO5:	ExplainDisasterRiskManagementInIndia	**K3**

22OEAU11	NEWPRODUCT DEVELOPMENT	L	T	P	Credits
		3	0	0	3

Course Objective:

- Tounderstandtothebasicconceptsofengineeringdesignandproductdevelopmentwith focus on the front end processes.

UNITI INTRODUCTION **9**

Need for developing products – the importance of engineering design – types of design –the design process – relevance of product lifecycle issues in design –designing to codes and standards- societal considerations in engineering design –generic product development process – various phases of product development-planning for products –establishing markets- market segments- relevance of market research

UNITIICUSTOMERNEEDS **9**

Identifying customer needs –voice of customer –customer populations- hierarchy of human needs-need gathering methods – affinity diagrams – needs importance- establishing engineering characteristics-competitive benchmarking- quality function deployment- house of quality- product design specification-case studies

UNITIIICREATIVETHINKING **9**

Creative thinking –creativity and problem solving- creative thinking methods- generating design concepts-systematic methods for designing –functional decomposition – physical decomposition – functional representation –morphological methods-TRIZ- axiomatic design

UNITIVDECISIONMAKINGANDPRODUCTARCHITECTURE **9**

Decision making –decision theory –utility theory –decision trees –concept evaluation methods –Pugh concept selection method- weighted decision matrix –analytic hierarchy process – introduction to embodiment design –product architecture – types of modular architecture –steps in developingproduct architecture

UNITVDESIGNANDCOSTANALYSIS **9**

Industrial design – human factors design –user friendly design – design for serviceability – design for environment–prototypingandtesting–costevaluation–categoriesofcost–overheadcosts–activity basedcosting–methodsofdevelopingcostestimates–manufacturingcost–valueanalysisincosting

TOTAL:45Hours

TEXTBOOKS

1. AnitaGoyal,KarlTUlrich,StevenDEppinger,"ProductDesignandDevelopment",Tata McGraw-Hill Education, 4th Edition, 2009
2. KevinOtto,KristinWood,"ProductDesign",PearsonEducation,IndianReprint2015,

REFERENCEBOOKS:

1. CliveL.Dym,PatrickLittle,"EngineeringDesign:AProject-basedIntroduction",3rdEdition, John Wiley & Sons, 2009,

2. GeorgeE.Dieter,LindaC.Schmidt,“EngineeringDesign”,McGraw-HillInternationalEdition, 4th Edition, 2009

3. YousefHaik,T.M.M.Shahin,“EngineeringDesignProcess”,2ndEditionReprint,Cengage Learning, 2010

Weblinks:

- https://nptel.ac.in/courses
- https://swayam.gov.in

COURSEOUTCOMES:

CO1:	Understandtheneedfordevelopingnew products	**K3**
CO2:	Attaintheknowledgeofcreativethinkingtodevelopnewproducts	**K3**
CO3:	Familiarwithdecisionmakingonnewproductdevelopment	**K4**
CO4:	Gaintheknowledgeonnewproductdesignandcostanalysis	**K5**
CO5:	Familiarwiththeconceptgenerationandselectiontools	**K3**

22HSPD01	PERSONALITYDEVELOPMENTI	L	T	P	Credits
		2	0	0	2

COURSEOBJECTIVES:

- Tonurtureanddevelopwinningpersonalitiesandeventuallyleadingthemtobecome dynamic and socially responsible leaders

UNITISOFTSKILLSI **6**

IntroductiontoPersonalityDevelopment–Meaning–Featuresofpersonality–Dimensionsof Personality Determinants of Personality–Features and Traits– Components of self-concept– Barriers–Self analysis

UNITIISOFTSKILLSII **6**

Importance of Soft Skills – First impression–Work Place requirements–DisciplineCleanlinessHygiene–generalAppearance—BuildingConfidence—ConceptofThinkingand Usage –Value of Time–Focus & Commitment.

UNITIIISOFT SKILLSIN ACTION **6**

Grooming–Attire–Understandingothers–Stability&MaturityDevelopment –Strengths– Weakness – Opportunities–threats – Merits of SWOT Analysis – Components – how to convert weakness into strengths – Goalsettings

UNITIV SELF AWARENESSAND SELFESTEEM **6**

Definitions–ComponentsofSelf-awareness–DevelopingSelf-awareness–Self-esteem– meaning –Steps to improve self-esteem.

UNITV SELF MOTIVATION **6**

Motivation–Meaning–Techniquesofself-motivation–Motivation&goalsetting– Motivation and emotion – Motivation at work.

TOTAL:30 h

TEXT BOOKS:

1. PersonalityDevelopmentAndSoftSkillsBarunKMitra,Oxford Publication
2. SevenhabitsofHighlyEffectivepeople–StephenR.covey

REFERENCEBOOKS:

1. Emotion,motivationandSelf-regulation–NathanC.Hall,McGillUniversity,Canada Thomas Goetz, University of Konstanz, Germany http://www.emeraldgrouppublishing.com.
2. PsychologyofSelf-esteem–NathanielBranden,Nash(1stedition),Jossey–Bass(32 nd anniversary edition)

Weblinks:

1. http://www.stevepavlina.com/ –PersonalDevelopmentforSmartPeople
2. http://www.scotthyoung.com/blog/ –Get themostout ofyourlife!
3. http://zenhabits.net/–Smile,breathe andgoslowly

4. http://www.craigharper.com.au/–atell-it-like-it-isAussie Coach
5. http://www.personaldevelopment.ie/–Daretodiscoveryourself
6. http://www.thechangeblog.com/–acommunityblogonpersonalchange
7. http://ripplerevolution.com/blog/–work forpositivechangewith Curt Rosengren
8. http://www.manifestyourpotential...–FindYourGiftsandTalents,DiscoverYour Dream Job, Career or Business
9. http://www.drphil.com/ –Hetellsitlikeitistohelpyou“GetReal”
10. http://www.oprah.com/ –LiveYourBestLife

COURSEOUTCOMES:

CO1:	Discussthefeatures,dimensionsanddeterminantsofpersonality	**K2**
CO2:	Makeagood firstimpression inprofessional and other situations	**K3**
CO3:	Demonstrateconfidence,punctualityandcommitmentasanengineer	**K3**
CO4:	Setgoals fordevelopment usingSWOTanalysis	**K5**
CO5:	Developself-awarenessandimproveselfesteem	**K3**

22HSPD02	PERSONALITYDEVELOPMENTII	L	T	P	Credits
		2	0	0	2

COURSEOBJECTIVES:

- Tonurtureanddevelopwinningpersonalitiesandeventuallyleadingthemtobecome dynamic and socially responsible leaders

UNITI SOFT SKILLS III **6**

BasicEtiquette–Emailetiquette–Businessetiquette–Telephoneetiquette–Meeting etiquette – Adjustment of Role & Leadership – Team Management & Development

UNITIIQUANTITATIVE APTITUDE I **6**

Percentage–ProfitLoss–Discount–RatioProportion–Time&Work–Time,Speed& Distance. Problems relating to ages– Permutation & Combination–Probability

UNITIIIQUANTITATIVE APTITUDEII **6**

Mensuration–ClocksandCalendars–Boats–SimpleInterest–CompoundInterest– Fractions and Decimals – Square roots – Functions.

UNITIVANALYTICALPROBLEMS **6**

Introduction – Linear Sequencing – Seating Arrangements – Distribution/Double Line Up – Selection – Ordering and Sequencing – Binary Logic – Venn Diagrams –Directions.

UNITV LOGICAL PROBLEMS **6**

IntroductiontoLogicalproblems–CauseandEffect–CourseofAction–Statementand Assumption – Letter and Symbol series – Analogies.

TOTAL: 30 h

TEXT BOOKS:

T1.K.R.DhanalakshmiandNSRaghunathan,PersonalityEnrichment,Margham Publications, 2012

T2.R.S. Agarwal,QuantitativeAptitudeforCompetitiveExaminations,S.Chand Publishers, 2017

REFERENCEBOOKS:

R1.D. P. Sabharwal, Personality Development Handbook, Fingerprint publishing, 2021 R2.A.K Gupta, Logical andAnalytical Reasoning (English), Ramesh Publishing House, 2022

Weblinks:

1. http://www.stevepavlina.com/–PersonalDevelopmentforSmartPeople
2. http://www.scotthyoung.com/blog/–Get themostout ofyourlife!
3. http://zenhabits.net/–Smile,breatheandgoslowly
4. http://www.craigharper.com.au/–atell-it-like-it-isAussieCoach
5. http://www.personaldevelopment.ie/–Daretodiscoveryourself

6. http://www.thechangeblog.com/–acommunityblogonpersonalchange
7. http://ripplerevolution.com/blog/–work forpositivechangewith Curt Rosengren
8. http://www.manifestyourpotential...–FindYourGiftsandTalents,DiscoverYour Dream Job, Career or Business
9. http://www.drphil.com/–Hetells itlikeitis tohelpyou “Get Real”
10. http://www.oprah.com/ –LiveYourBestLife

COURSEOUTCOMES:

CO1:	Discussthebasic,email,business,telephoneandmeetingetiquettes.	**K2**
CO2:	Solve problems on ratio proportion related to profit and loss, discounts, time and work, Time, speed and distance.	**K3**
CO3:	Workwithfractions,decimalsandsquare roots.	**K3**
CO4:	Analyzethe cause, effectandcourseofactioninlogicalproblems.	**K4**
CO5:	Solveproblemson theletter andsymbol series.	**K3**

22HSPD03	PERSONALITYDEVELOPMENT III	L	T	P	Credits
		2	0	0	2

COURSEOBJECTIVE:

- Toenhancethecommunication,interpersonal,groupskills.

UNITI VERBALAPPTITUDE I **6**

Phonetics / Neutral Accent / Pronunciation – Speech Mechanism / Mouth & Face Exercise – Vowels & Consonants – Sounds – Syllable and Syllable Stress/ Word Stress – SentenceStress & Intonation Articulation Exercise – Rate of Speech / Flow of Speech / Idiomatic Phrases.

UNITII VERBALAPTITUDE II **6**

Singular/plural – present tense / past tense – genders Prepositions – conjunctions – Choice of words –simple sentences – compound sentences – summarizingphrases Synonyms – Antonyms – Analogies –Similar Words.

UNIT III SOFT SKILLS **6**

Attitude–Meaning–Featuresof attitude– Formation –PersonalityFactors –Typesof attitude – change in attitude – developing Positive attitude.

UNITIV TIME MANAGEMENT **6**

Definition – Meaning–Importance, Value of time as an important resource – comparison of Time and Money – Circle of influence and circle of control – Definition of URGENT and IMPORTANT – Time Wasters and how to reduce – Procrastination – meaning and impact –4 Quadrants.

UNITV TEAM BUILDING **6**

Meaning – Aspects of team building – Process of team building – Types of Teams – Team Ethics and Understanding – Team trust and commitment.

TOTAL: 30 h

TEXT BOOKS:

T1.BN Ghosh,ManagingSoftSkillsand Personality,McgrawHill Publications
T2.ShejwalkarandGhanekar,PrinciplesandPracticesofManagement,McGrawHill Latest.
T3.RobertaRoesch,Timemanagementfor Busypeople, TataMcGraw–Hill Edition

REFERENCEBOOKS:

R3.D.P.Sabharwal,PersonalityDevelopmentHandbook,Fingerprintpublishing,2021 R4.DrV M Selvaraj, Personality Development, Bhavani Publications

Weblinks:

1. http://www.stevepavlina.com/–PersonalDevelopmentforSmartPeople
2. http://www.scotthyoung.com/blog/ –Get themostout ofyourlife!

3. http://zenhabits.net/–Smile,breatheandgo slowly
4. http://www.craigharper.com.au/–atell-it-like-it-isAussie Coach
5. http://www.personaldevelopment.ie/–Daretodiscoveryourself
6. http://www.thechangeblog.com/–acommunityblogonpersonalchange
7. http://ripplerevolution.com/blog/–work forpositivechangewith Curt Rosengren
8. http://www.manifestyourpotential...–FindYourGiftsandTalents,DiscoverYourDream Job, Career or Business
9. http://www.drphil.com/ –Hetellsitlikeitistohelpyou“GetReal”
10. http://www.oprah.com/ –LiveYourBestLife

COURSEOUTCOMES:

CO1:	Articulatebyunderstandingtherateandflowof speech.	**K3**
CO2:	Choosewordsandphrasesappropriatelyforanyverbal communication.	**K3**
CO3:	Developapositiveattitudeinhandlingdiverse situations.	**K4**
CO4:	Prioritizeimportantandurgenttasksusingthefourquadrantsmethod.	**K4**
CO5:	Practiceteamethicsandunderstandingwhenworkingwith teams.	**K3**

22HSPD04	PERSONALITYDEVELOPMENT IV	L	T	P	Credits
		2	0	0	2

COURSEOBJECTIVES:

- Toenhancethesoft skills andpreparethem towardsthe skills neededfortheir career.

UNITI SOFT SKILLS **6**

Assertiveness – Meaning – Importance of assertiveness – Characteristics of Assertive communication –Merits – forms of assertion – Causes of misunderstanding

UNITIICOMMUNICATIONSKILLS **6**

Meaning – Elements of Communication – Functions of Communication – Principles of Communication Formal and Informal Communication – Barriers in Communication – Characteristics of good – communication – Feedback – Communication systems.

UNITIIIPRESENTATIONSKILLS **6**

Meaning – Importance of Presentation – Concept of 5 W'sand one H – understanding the audience – Types of presentations – How to make effective presentation.

UNITIVPRESENTATIONSKILLSII **6**

Use of slide, PPT's and visuals – Rules for slide presentation – precautions – seminars and conferences – Steps to eliminate Stage fear.

UNITVCHANGE MANAGEMENT **6**

Definition – Necessity – Resistance towards Change – 10 Principles of Change Management – Leaders approach – Effective Change management.

TOTAL: 30 h

TEXT BOOKS:

T1.LaClair, J. and Rao, R. Helping Employees Embrace Change, McKinsey Quarterly,2002, Number 4.

T2.SpencerJohnson,WhoMovedMyCheese,Vermilion,Firstedition

T3.Adair,John,EffectiveCommunication, London:Pan MacmillanLtd., 2003.

REFERENCEBOOKS:

R1.Bovee, Courtland L, John V. Thill & Barbara E. Schatzman. Business Communication Today, Tenth Edition. New Jersey: Prentice Hall, 2010.

Weblinks:

1. http://www.stevepavlina.com/–PersonalDevelopmentforSmartPeople
2. http://www.scotthyoung.com/blog/–Get themostout ofyourlife!
11. http://zenhabits.net/–Smile,breatheandgoslowly
12. http://www.craigharper.com.au/–atell-it-like-it-isAussieCoach
13. http://www.personaldevelopment.ie/ –Daretodiscoveryourself
14. http://www.thechangeblog.com/–acommunityblogonpersonalchange
15. http://ripplerevolution.com/blog/–work forpositivechangewith Curt Rosengren
16. http://www.manifestyourpotential..... FindYour GiftsandTalents,Discover Your DreamJob,Careeror Business
17. http://www.drphil.com/–Hetells itlikeit istohelpyou"Get Real"

18.http://www.oprah.com/–LiveYourBest Life

COURSEOUTCOMES:

CO1:	Beassertiveintheircommunication.	**K3**
CO2:	Differentiatetheprinciplesofformalandinformalcommunication.	**K4**
CO3:	Makeaneffectivepresentationby understandingtheaudience.	**K3**
CO4:	Practicethe rulesofpresentationusingslides,PPT'sand visuals.	**K3**
CO5:	Discusstheprinciplesof change management.	**K2**

ANNEXURE II

B.E Automobile Engineering

SEMESTER – I

65 subjects

Category	Code	Course	Interdisciplinary	Activities/Content with direct on Employability / Competency/ Entrepreneurship / Skill development
HSC	22CGMA11	Mathematics - I (CALCULUS AND LINEAR ALGEBRA)	**Interdisciplinary**	**Skill development**
BSC	22CBAE12	ELECTROMAGNETISM	**Interdisciplinary**	**Skill development**
BSC	22CBAE11	ENGLISH	**Interdisciplinary**	**Skill development**
ESC	22CBAE14	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	**Interdisciplinary**	**Employability**
ESC	22CBAE15	ENGINEERING GRAPHICS AND DESIGN	**Interdisciplinary**	**Employability**
HSC	22PBAE11	PRACTICAL - ENGINEERING ENGLISH	**Interdisciplinary**	**Skill development**
BSC	22PBAE12	PRACTICAL - ENGINEERING PHYSICS	**Interdisciplinary**	**Employability**
ESC	22PBAE13	PRACTICAL - BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	**Interdisciplinary**	**Entrepreneurship**
MC	22CBAE16	CONSTITUTION OF INDIA	**Interdisciplinary**	**Skill development**

SEMESTER – II

Category	Code	Course	Interdisciplinary	Activities/Content with direct on Employability / Competency/ Entrepreneurship / Skill development
BSC	22GCCH21	CHEMISTRY	**Interdisciplinary**	**Skill development**
BSC	22GCMA22	Mathematics - II (CALCULUS, ORDINARY DIFFERENTIAL EQUATIONS AND COMPLEX	**Interdisciplinary**	**Skill development**

		VARIABLE)		
ESC	22CBME23	ENGINEERING MECHANICS	**Interdisciplinary**	**Employability**
ESC	22CBCE22	PROGRAMMING FOR PROBLEM SOLVING	**Interdisciplinary**	**Skill development**
ESC	22PBCE21	PRACTICAL - PROGRAMMING FOR PROBLEM SOLVING	**Interdisciplinary**	**Skill development**
BSC	22GPCH21	PRACTICAL - CHEMISTRY	**Interdisciplinary**	**Competency**
ESC	22PBME21	PRACTICAL - WORKSHOP AND MANUFACTURING PRACTICES	**Interdisciplinary**	**Employability**
MC	22GCHV21	UNIVERSAL HUMAN VALUES	**Interdisciplinary**	**Skill development**

SEMESTER – III

Category	**Code**	**Course**	**Interdisciplinary**	**Activities/Content with direct on Employability / Competency/ Entrepreneurship / Skill development**
BSC	22BSAU07	MATHEMATICS III (FOURIER SERIES AND TRANSFORMS)	**Interdisciplinary**	**Skill development**
ESC	22ESAU08	ELECTRICALDRIVES ANDCONTROL	**Interdisciplinary**	**Skill development**
PCC	22PCAU01	ENGINEERING THERMODYNAMICS	**Interdisciplinary**	**Employability**
PCC	22PCAU02	AUTOMOTIVEENGINES	**Interdisciplinary**	**Employability**
PCC	22PCAU03	FLUIDMECHANICSAND MACHINERY	**Interdisciplinary**	**Skill development**
PCC	22PCAU15	AUTOMOTIVE ENGINE COMPONENTS LABORATORY	**Interdisciplinary**	**Entrepreneurship**
PCC	22PCAU05	ELECTRONICSAND MICROPROCESSORS LABORATORY	**Interdisciplinary**	**Employability Competency**
HSC	22HSPD01	PERSONALITY DEVELOPMENT-I	**Interdisciplinary**	**Skill development**
MC	22MCAU03	BASICLIFESKILLS	**Interdisciplinary**	**Skill development**

SEMESTER – IV

Category	Code	Course	Interdisciplinary	Activities/Content with direct on Employability / Competency/ Entrepreneurship / Skill development
BSC	22BSAU08	MATHEMATICS–IV (STATISTICAL AND NUMERICAL METHODS)	**Interdisciplinary**	**Skill development**
PCC	22PCAU06	ENGINEERING METALLURGY	**Interdisciplinary**	**Employability**
PCC	22PCAU07	AUTOMOTIVE FUELS AND LUBRICANTS	-	**Employability**
PCC	22PCAU08	AUTOMOTIVE CHASSIS	-	**Employability**
PCC	22PCAU09	HEATANDMASS TRANSFER	**Interdisciplinary**	**Skill development**
PCC	22PCAU10	AUTOMOTIVE CHASSIS COMPONENTS LABORATORY	-	**Employability**
PCC	22PCAU11	STRENGTHOF MATERIALS LABORATORY	**Interdisciplinary**	**Employability**
HSC	22HSPD02	PERSONALITY DEVELOPMENT-II	**Interdisciplinary**	**Skill development**
BSC	22BSAU09	ENVIRONMENTALSCIENCEAND ENGINEERING	**Interdisciplinary**	**Employability**
MC	22MCAU04	GENDERINSTITUTION ANDSOCIETY	**Interdisciplinary**	**Skill development**

SEMESTER – V

Category	Code	Course	Interdisciplinary	Activities/Content with direct on Employability / Competency/ Entrepreneurship / Skill development
PCC	22PCAU12	AUTOMOTIVE TRANSMISSION	-	**Employability**
PCC	22PCAU13	VEHICLEDESIGN DATA CHARACTERISTICS	-	**Employability**
PEC	22PEAU03	AUTOMOTIVE POLLUTION AND CONTROL (PROFESSIONAL ELECTIVE-I)	**Interdisciplinary**	**Employability**
OEC	22GEAU01	COMPUTER INTEGRATED MANUFACTURING SYSTEMS OPENELECTIVE-I(TECHNICAL)	**Interdisciplinary**	**Employability**
PCC	22PCAU14	MANUFACTURING PROCESS OF AUTOMOTIVE COMPONENTS	-	**Entrepreneurship**
PCC	22PCAU15	AUTOMOTIVE ENGINECOMPONENTS DESIGN LABORATORY	**Interdisciplinary**	**Employability**
PCC	22PCAU16	PERFORMANCEAND EMISSION TESTING LABORATORY	**Interdisciplinary**	**Employability**
HSC	22HSPD03	PERSONALITY DEVELOPMENT-III	**Interdisciplinary**	**Skill development**
PCC	22PCAU17	INDUSTRIALTRAINING/MINI PROJECT/ MOOC COURSE (NPTEL/SWAYAM/COURSEERA/ MATHWORKS)-MINIMUM4WEEKS	**Interdisciplinary**	**Skill development**

SEMESTER – VI

Category	Code	COURSE	Interdisciplinary	Activities/Content with direct on Employability / Competency/ Entrepreneurship / Skill development
PCC	22PCAU18	TWOAND THREE WHEELERS	-	**Employability**
PCC	22PCAU19	AUTOMOTIVE CHASSIS COMPONENTS DESIGN	-	**Employability**
PEC	22PEAU07	ALTERNATIVE FUELS AND ENERGY SYSTEMS (PROFESSIONALELECTIVE- II)	**Interdisciplinary**	**Employability**
PEC	22PEAU21	AUTOMOTIVE AIR CONDITIONING (PROFESSIONALELECTIVE BLENDED)	-	**Entrepreneurship**
OEC	22GEAU02	OPENELECTIVE-II(TECHNICAL) HYDRAULIC AND PNEUMATIC SYSTEMS	**Interdisciplinary**	**Competency**
PCC	22PCAU20	AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS	**Interdisciplinary**	**Competency**
PCC	22PCAU21	MECHATRONICSLABORATORY	**Interdisciplinary**	**Employability**
HSC	22HSPD04	PERSONALITY DEVELOPMENT-IV	**Interdisciplinary**	**Skill development**
PCC	22PCAU22	SUMMERINTERNSHIP(4WEEKS)	-	**Employability**

SEMESTER – VII

Category	Code	Course	Interdisciplinary	Activities/Content with direct on Employability / Competency/ Entrepreneurship / Skill development
PCC	22PCAU23	VEHICLEMAINTENANCE	-	**Employability**

OEC	22GEAU07	METROLOGY AND INSTRUMENTATION OPENELECTIVE-III(TECHNICAL)	**Interdisciplinary**	**Employability Competency**
OEC	22OEAU02	TOTAL QUALITY MANAGEMENT OPENELECTIVE-I(MANAGEMENT)	**Interdisciplinary**	**Employability**
PEC	22PEAU04	PROFESSIONAL ELECTIVE- III (SIMULATION OF IC ENGINE PROCESSES)	-	**Employability**
PEC	22PEAU05	VEHICLE BODY ENGINEERING (PROFESSIONAL ELECTIVE)	-	**Entrepreneurship**
PCC	22PCAU24	VEHICLEMAINTENANCE & RECONDITIONINGLABORATORY	-	**Employability**
Project	22EEAU01	PROJECTPHASEI	-	**Employability**

SEMESTER – VIII

Category	**Code**	**Course**	**% of Revision**	**Interdisciplinary**	**Activities/Content with direct on Employability / Competency/ Entrepreneurship / Skill development**
DSE	22PEAU11	MODERN AUTOMOBILE ACCESSORIES (PROFESSIONAL ELECTIVE- IV)	-	-	**Employability**
DSE	22GEAU11	SUPERCHARGING AND SCAVENGING OPENELECTIVE-IV (TECHNICAL)	-	**Interdisciplinary**	**Employability**
DSE	22OEAU09	INDUSTRIAL MARKETING AND MARKET MANAGEMENT(OPENELECTIVE-II(MANAGEMENT)	-	**Interdisciplinary**	**Employability**
DSE	22EEAU02	PROJECTPHASEII	-	-	**Employability**

ANNEXURE - III
COURSES INTEGRATED CROSS CUTTING ISSUES
B.E AUTOMOBILE ENGINEERING

Sl. No	Name of the Programme	Course code	Name of the Course	Institution Integrates Cross Cutting Issues						
				Gender	Environment and Sustainability	Human Values	Health Determinants	Right to Health	Emerging Demographic Changes	Professional Ethics
1	B.E Automobile Engineering	22CGMA11	MATHEMATICS- I (CALCULUS AND LINEAR ALGEBRA)						✓	
2		22CBAE12	ELECTRO MAGNETISM						✓	
3		22CBAE11	ENGLISH						✓	
4		22CBAE14	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING						✓	
5		22CBAE15	ENGINEERING GRAPHICS AND DESIGN						✓	
6		22PBAE11	PRACTICAL - ENGINEERING ENGLISH						✓	
7		22PBAE12	PRACTICAL - ENGINEERING PHYSICS						✓	
8		22PBAE13	PRACTICAL - BASIC ELECTRICAL AND ELECTRONICS ENGINEERING						✓	
9		22CBAE16	CONSTITUTION OF INDIA							✓
10		22GCCH21	CHEMISTRY		✓					
11		22GCMA22	MATHEMATICS - II (CALCULUS, ORDINARY DIFFERENTIAL EQUATIONS AND						✓	

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			COMPLEX VARIABLE)							
12		22CBME23	ENGINEERING MECHANICS						✓	
13		22CBCE22	PROGRAMMING FOR PROBLEM SOLVING						✓	
14		22PBCE21	PRACTICAL - PROGRAMMING FOR PROBLEM SOLVING						✓	
15		22GPCH21	PRACTICAL - CHEMISTRY		✓					
16		22PBME21	PRACTICAL - WORKSHOP AND MANUFACTURING PRACTICES						✓	
17		22GCHV21	UNIVERSAL HUMAN VALUES			✓				
18		22BSAU07	MATHEMATICS III (FOURIER SERIES AND TRANSFORMS)						✓	
19		22ESAU08	ELECTRICALDRIVES ANDCONTROL						✓	
20		22PCAU01	ENGINEERING THERMODYNAMICS						✓	
21		22PCAU02	AUTOMOTIVE ENGINES						✓	
22		22PCAU03	FLUIDMECHANICSAND MACHINERY						✓	
23		22PCAU15	AUTOMOTIVE ENGINE COMPONENTS LABORATORY						✓	
24		22PCAU05	ELECTRONICS AND MICROPROCESSORS LABORATORY						✓	
25		22HSPD01	PERSONALITY DEVELOPMENT-I			✓				

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26		22MCAU03	BASICLIFE SKILLS			✓				
27		22BSAU08	MATHEMATICS–IV (STATISTICAL AND NUMERICAL METHODS)						✓	
28		22PCAU06	ENGINEERING METALLURGY						✓	
29		22PCAU07	AUTOMOTIVE FUELS AND LUBRICANTS						✓	
30		22PCAU08	AUTOMOTIVE CHASSIS						✓	
31		22PCAU09	HEATANDMASS TRANSFER						✓	
32		22PCAU10	AUTOMOTIVE CHASSISCOMPONENTS LABORATORY						✓	
33		22PCAU11	STRENGTHOF MATERIALS LABORATORY						✓	
34		22HSPD02	PERSONALITY DEVELOPMENT-II			✓				
35		22BSAU09	ENVIRONMENTALSCIENCEAND ENGINEERING		✓				✓	
36		22MCAU04	GENDERINSTITUTION ANDSOCIETY	✓		✓				
37		22PCAU12	AUTOMOTIVE TRANSMISSION		✓				✓	
38		22PCAU13	VEHICLEDESIGN DATA CHARACTERISTICS		✓				✓	
39		22PEAU03	PROFESSIONAL ELECTIVE-I (AUTOMOTIVE POLLUTION CONTROL)		✓				✓	

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40		22GEAU01	OPENELECTIVE-(COMPUTER INTEGRATED MANUFACTURII SYSTEMS)						✓	
41		22PCAU14	MANUFACTURING PROCESS OF AUTOMOTIVE COMPONENTS						✓	
42		22PCAU15	AUTOMOTIVE ENGINECOMPONENTS DESIGN LABORATORY						✓	
43		22PCAU16	PERFORMANCEAND EMISSION TESTING LABORATORY		✓				✓	
44		22HSPD03	PERSONALITYDELOPMENT-III			✓				
45		22PCAU17	INDUSTRIALTRAINING/MINI PROJECT/ MOOC COURSE (NPTEL/SWAYAM/COURSEERA/MATHWORKS)-MINIMUM4WEEKS						✓	
46		22PCAU18	TWOAND THREE WHEELERS						✓	
47		22PCAU19	AUTOMOTIVE CHASSIS COMPONENTS DESIGN						✓	
48		22PEAU07	PROFESSIONALELECTIVE- II (ALTERNATIVE FUELS AND ENERGY SYSTEMS)						✓	
49		22PEAU21	PROFESSIONALELECTIVE						✓	

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			BLENDED (AUTOMOTIVE AIR-CONDITIONING)							
50		22GEAU02	HYDRAULIC AND PNEUMATIC SYSTEMS OPENELECTIVE-II(TECHNICAL)						✓	
51		22PCAU20	AUTOMOTIVEELECTRICAL AND ELECTRONICS SYSTEMS						✓	
52		22PCAU21	MECHATRONICSLABORATORY						✓	
53		22HSPD04	PERSONALITYDELOPMENT-IV			✓				
54		22PCAU22	SUMMERINTERNSHIP(4WEEKS)						✓	
55		22PCAU23	VEHICLEMAINTANCE						✓	
56		22GEAU07	METROLOGY AND INSTRUMENTATION OPENELECTIVE-III(TECHNICAL)						✓	
57		22OEAU02	TOTAL QUALITY MANAGEMENT OPENELECTIVE-I(MANAGEMENT)			✓				✓
58		22PEAU04	PROFESSIONAL ELECTIVE-III (SIMULATION OF IC ENGINE						✓	

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			PROCESSES)							
59		22PEAU05	VEHICLE BODY ENGINEERING (PROFESSIONAL ELECTIVE)						✓	
60		22PCAU24	VEHICLEMAINTENANCE& RECONDITIONINGLABORATORY						✓	
61		22EEAU01	PROJECTPHASE I						✓	
62		22PEAU11	MODERN AUTOMOBILE ACCESSORIES (PROFESSIONAL ELECTIVE-IV)						✓	
63		22GEAU11	SUPERCHARGIN AND SCAVENGI OPENELECTIVE-(TECHNICAL)						✓	
64		22OEAU09	INDUSTRIAL MARKETING AN MARKET MANAGEMENT (OPENELECTIVE II(MANAGEMEN						✓	
65		22EEAU02	PROJECT PHASE II						✓	