



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with "A" Grade by NAAC

Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 600 119.

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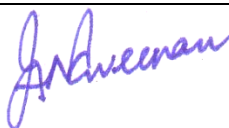


SCHOOL OF MECHANICAL ENGINEERING

DEPARTMENT OF AUTOMOBILE ENGINEERING

BOARD OF STUDIES MEETING HELD ON 21.12.2020

Members present:

External Members	Signature	Internal Members	Signature
Dr.G.Sathiyaseelan General Manager- Ashok Leyland- External Member		Dr.S.Prakash Dean/School of Mechanical Engineering	
Mr.A.J.Naveenan Lawrence Chief training officer TVS Training and services Ltd Chennai		Dr.V.K.Bupesh Raja, Head/Automobile Engineering	
Er.Dinesh Procurement Consultant Altron Deutschland S.A.S.&Co.KG, U.K (Alumni)		Dr.A.Karthikeyan Professor/ Automobile Engineering	



Minutes of the Board of Studies meeting

Board of Studies meeting for the Department of Automobile Engineering held on 21st December 2020 through virtual mode (zoom) with the following agenda:

Inclusion of new contents in the course titled "Vehicle body Engineering" in B.E-Automobile Engineering Curriculum

Welcome Address

Dr.S.Prakash welcomed the members of BoS and placed the agenda for the deliberations of the members. The following decisions were made as per the items of the circulated agenda.

Agenda : Inclusion of new contents in the course titled "Vehicle Body Engineering" in B.E-Automobile Engineering Curriculum

The topics "Quality management system and Failure mode effect analysis" were included in the syllabus of the course "Vehicle body Engineering" as suggested by ISO Auditor.

BoS members accepted the changes and approved the syllabus.

The revised syllabus of the course is enclosed in Annexure-1



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Vote of Thanks

Dr.V.K.Bupesh Raja thanked the expert members for accepting the invitation for attending the BoS meeting in a short notice. He thanked them for their valuable suggestions on the agenda items presented. He also thanked Dr.S.Prakash, Dean/Chair and Dr.A.Karthikeyan, Professor for their contribution towards the conduct of this BoS meeting.

Dean/CHAIR

- Yellow colour indicates contents added in the syllabus

ANNEXURE-1

SAUA1504	VEHICLE BODY ENGINEERING	L	T	P	Credits	TotalMarks
		3	0	0	3	100

COURSE OBJECTIVE

- To develop knowledge in design of vehicle body to give maximum comfort for the passengers
- To develop skills in the areas of car body design, bus body design, active and passive safety.
- To understand different types of bodies and ergonomics of the vehicle

UNIT1 CAR BODY DETAILS

9Hrs.

Types of car bodies, visibility: regulations, driver's visibility, tests for visibility, methods of improving visibility and space incars safety: safety design, safety equipment for cars, car body construction - front assembly, roof assembly, under floor, bonnet; design criteria, prototype making, initial tests, crash tests on full scale model

UNIT2 VEHICLE AERODYNAMICS

9Hrs.

Objectives, vehicle drag and its types; various types of forces and moments, effects of forces and moments, side wind effects on forces and moments, various body optimization techniques for minimum drag, wind tunnel testing: flow visualization techniques, scale model testing, component balance to measure forces and moments, aerodynamic study for heavy vehicles, effects of different cabin to trailer body, pressure distribution, effects of a cab to trailer body roof height.

UNIT3 BUSBODY AND COMMERCIAL VEHICLE DETAILS

9Hrs.

Types: mini bus, single decker, double-decker, two level and articulated bus. Bus body layout; floor height, engine location, entrance and exit location, seating dimensions, constructional details: frame construction, double skin construction, types of metal sections used, regulations, conventional and integral type construction. commercial vehicle: types of body; flatplatform, drop side, fixed side, tipper body, tanker body, light commercial vehicle body types, dimensions of driver's seatrelationtocontrols,driverscabdesign.

UNIT4 INTERIOR ERGONOMICS

9Hrs.

Introduction, seating dimensions, interior ergonomics, seat comfort, driver seat design, dash board instruments, electronicdisplays, commercial vehicle cabin ergonomics, mechanical package layout, goods vehicle layout. Vehicle stability: Introduction, longitudinal, lateral stability, vehicle on a curvilinear path, critical speed for toppling and skidding, effect of operating factors on lateral stability, steering geometry and stabilization of steerable wheels, mass distribution and engine location on stability.

UNIT5 BODY MATERIALS, TRIM AND MECHANISMS

9Hrs.

Steel sheet, timber, plastic, glass, GRP, properties of materials; corrosion, anticorrosion methods, selection of paint and painting process, adhesives, insulation, body trim items, body mechanisms.

Max.45Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 -Discuss the different types of car body design and its safety features.

CO2 - Select suitable body optimization techniques to minimize drag and able to describe the wind tunnel testing procedure.

CO3 -Classify the various types of bus body construction and able to identify

the Body layout.

CO4 -Describe the different types of commercial vehicles and its design.

CO5 -Explain the various types of materials and painting techniques used in automobiles.

CO6 -Acquire knowledge about the corrosion coating methods

TEXT/REFERENCEBOOKS

1. PowloskiJ, "Vehicle Body Engineering", Business BooksLtd.,London1989.
2. John Fenton, "Vehicle body layout and analysis", Mechanical Engg. Publication ltd, London,1982.
3. KohliP.L, "Automotive Chassis & Body", Papyrus Publishing House, New Delhi, 2010.
4. Wolf-Heinrich Hucho, "Aerodynamics of Road Vehicles" SAE International,USA,1998.
5. Robinson A., LiveseyW.A, "The Repair of Vehicle Bodies", Butterworth-Heinemann Ltd,1989
6. John Fenton, "Vehicle Body Layout & Analysis", Hutchinson, London,1998

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100

Exam Duration: 3Hrs.

PART A:10 Questions of 2 marks each–No choice

20Marks

PART B:2 Questions from each unit with internal choice, each carrying12 marks

80Marks

SAUA1505	VEHICLE BODY ENGINEERING	L	T	P	Credits	TotalMarks
		3	0	0	3	100

COURSE OBJECTIVE

- To develop knowledge in design of vehicle body to give maximum comfort for the passengers
- To develop skills in the areas of car body design, bus body design, active and passive safety.
- To understand different types of bodies and ergonomics of the vehicle

UNIT1 CAR BODY DETAILS

9Hrs.

Types of car bodies, visibility: regulations, driver's visibility, tests for visibility, methods of improving visibility and space in cars. safety: safety design, safety equipment for cars, car body construction - front assembly, roof assembly, under floor, bonnet; design criteria, prototype making, initial tests, crash tests on full scale model

UNIT2 VEHICLE AERODYNAMICS

9Hrs.

Objectives, vehicle drag and its types; various types of forces and moments, effects of forces and moments, side wind effects on forces and moments, various body optimization techniques for minimum drag, wind tunnel testing: flow visualization techniques, scale model testing, component balance to measure forces and moments, aerodynamic study for heavy vehicles, effects of different cabin to trailer body, pressure distribution, effects of a cab to trailer body roof height.

UNIT3 BUS BODY AND COMMERCIAL VEHICLE DETAILS

9Hrs.

Types: mini bus, single decker, double-decker, two level and articulated bus. Bus body layout; floor height, engine location, entrance and exit location, seating dimensions, constructional details: frame construction, double skin construction, types of metal sections used, regulations, conventional and integral type construction. commercial vehicle: types of body; flat platform, drop side, fixed side, tipper body, tanker body, light commercial vehicle body types, dimensions of driver's seat relation to controls, drivers cab design.

UNIT4 INTERIOR ERGONOMICS

9Hrs.

Introduction, seating dimensions, interior ergonomics, seat comfort, driver seat design, dash board instruments, electronic displays, commercial vehicle cabin ergonomics, mechanical package layout, goods vehicle layout. Vehicle stability: Introduction, longitudinal, lateral stability, vehicle on a curvilinear path, critical speed for toppling and skidding, effect of operating factors on lateral stability, steering geometry and stabilization of steerable wheels, mass distribution and engine location on stability.

UNIT5 BODY MATERIALS, TRIM AND MECHANISMS

9Hrs.

Steel sheet, timber, plastic, glass, GRP, properties of materials; corrosion, anti-corrosion methods, selection of paint and painting process, adhesives, insulation, body trim items, body mechanisms. IATF 16949:2016 - Quality management system for organizations in the automotive industry, Core tools including FMEA (Failure mode and effects analysis)

Max.45Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 -Discuss the different types of car body design and its safety features.
CO2 - Select suitable body optimization techniques to minimize drag and able to describe the wind tunnel testing procedure.
CO3 -Classify the various types of bus body construction and able to identify the Body layout.
CO4 -Describe the different types of commercial vehicles and its design.
CO5 -Explain the various types of materials and painting techniques used in automobiles.
CO6 -Acquire knowledge about the corrosion coating methods

TEXT/REFERENCEBOOKS

1. PowloskiJ, "Vehicle Body Engineering", Business BooksLtd.,London1989.
2. John Fenton, "Vehicle body layout and analysis", Mechanical Engg. Publication Ltd, London,1982.
3. KohliP.L, "Automotive Chassis & Body", Papyrus Publishing House, New Delhi, 2010.
4. Wolf-Heinrich Hucho, "Aerodynamics of Road Vehicles" SAE International,USA,1998.
5. Robinson A., LiveseyW.A, "The Repair of Vehicle Bodies", Butterworth-Heinemann Ltd,1989
6. John Fenton, "Vehicle Body Layout & Analysis", Hutchinson, London,1998
7. AIAG & VDA FMEA Handbook, Edition 1, 2019

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100

Exam Duration: 3Hrs.

PART A:10 Questions of 2 marks each–No choice

20Marks

PART B:2 Questions from each unit with internal choice, each carrying12 marks

80Marks



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SCHOOL OF MECHANICAL ENGINEERING

DEPARTMENT OF AUTOMOBILE ENGINEERING

BOARD OF STUDIES MEETING HELD ON 27.06.2020

Members present:

External Members	Signature	Internal Members	Signature
Dr.G.Sathiyaseelan General Manager- Ashok Leyland- External Member		Dr.S.Prakash Dean/School of Mechanical Engineering	
Mr.A.J.Naveenan Lawrence Chief training officer TVS Training and services Ltd Chennai		Dr.V.K.Bupesh Raja, Head/Automobile Engineering	
Er. Dinesh Deenadayalu (Alumni) Procurement Consultant Altron Deutschland S.A.S.& Co.KG, U.K		Dr.A.Karthikeyan Professor/ Automobile Engineering	



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Minutes of the Board of Studies meeting

Board of Studies meeting for the Department of Automobile Engineering held on 27th June 2020 through virtual mode (zoom) with the following agenda:

1. Introduction of a new course titled "Engineering Economics and Cost Analysis" as an Open elective in B.E-Automobile Engineering Curriculum
2. Introduction of a new course titled "Industry 4.0" in B.E-Automobile Engineering Curriculum

Welcome Address

Dr.S.Prakash welcomed the members of BoS and placed the agenda for the deliberations of the members. The following decisions were made as per the items of the circulated agenda.

Agenda1: Introduction of a new course titled "Engineering Economics and Cost Analysis" as an Open elective in B.E-Automobile Engineering Curriculum

As suggested by the ISO auditor a new course was introduced as an open elective titled "Engineering Economics and Cost Analysis" as this course is very much important in executing the final year project and in the Industry.

This initiative was appreciated by BoS members and after discussion about the contents of the syllabus; the course was approved for inclusion as an open elective in the Curriculum.

The syllabus of the course was enclosed in Annexure-1



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Agenda 2: Introduction of a new course titled "Industry 4.0" in 4th Semester of B.E-Automobile Engineering Curriculum

BoS external members stressed the importance of Industry 4.0 in the automobile industries and as per their advice the new course titled "Industry 4.0" was included in the curriculum.

BoS members approved the introduction of the new course titled "Industry 4.0" as a core course in 4th semester after careful discussion of the contents in the syllabus

The syllabus of the course was enclosed in Annexure-1

Vote of Thanks

Dr.V.K.Bupesh Raja thanked the expert members for accepting the invitation for attending the BoS meeting in a short notice. He thanked them for their valuable suggestions on the agenda items presented. He also thanked Dr.S.Prakash , Dean and Dr.A.Karthikeyan, Professor for their contribution towards the conduct of this BoS meeting.

Dean/CHAIR

ANNEXURE-1

SMEA4004	ENGINEERING ECONOMICS AND COST ANALYSIS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

To learn about the basics of economics and cost analysis related to engineering so as to take economically sound decisions.

UNIT 1 INTRODUCTION

9 HRS

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics - Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis- V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning.

UNIT 2 VALUE ENGINEERING

9 HRS

Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT 3 CASH FLOW

9 HRS

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT 4 REPLACEMENT AND MAINTENANCE ANALYSIS

9 HRS

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely – Case study based on replacement and maintenance in automobile components.

UNIT 5 DEPRECIATION

9 HRS

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

- Mini project on Production of Automobile parts / vehicle for studying about Engineering Economics and cost analysis

Max. 45 HRS

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand different cost, selection of materials in engineering economics.
- CO2 - Understand the major capabilities and limitations of cash flow analysis
- CO3 - Recognise, formulate, analyse and solve cash flow models in practical situations
- CO4 - Develop the ability to account for time value of money using engineering economy factors
- CO5 - Implications and importance of considering taxes, depreciation, and inflation
- CO6 - Apply engineering economic techniques on solving engineering problems

TEXT BOOK

1. PanneerSelvam, R, Engineering Economics, Prentice Hall of India Ltd, New Delhi, 2013.
2. Suma Damodaran, “ Managerial economics”, Oxford university press 2006.

REFERENCES

- 1.Chan S.Park, “Contemporary Engineering Economics”, Prentice Hall of India, 2002.
2. Donald.G. Newman, Jerome.P.Lavelle, “Engineering Economics and analysis” Engg. Press, Texas, 2002
- 3.Degarmo, E.P., Sullivan, W.G and Canada, J.R, “Engineering Economy”, Macmillan, New York, 1984
4. Grant.E.L.,Ireson.W.G., and Leavenworth, R.S, “Principles of Engineering Economy”, Ronald Press, New York,1976.
5. Smith, G.W., “Engineering Economy”, Iowa State Press, Iowa, 1973.

SAIC4001	INDUSTRY4.0	L	T	P	Credits	TotalMarks
		2	-	2	2	100

UNIT1 ADVANCED TECHNOLOGY AND ADVANCED MATERIALS

7Hrs.

Advanced electro-optical sensing technology-active, passive multi-spectral and hyper spectral imaging; electronic beam steering; vacuum technology, surface and coating technology, health care technology, Nanotechnology- Nanomechanics, Nano opto electronics; energy storage technology-next generation Li-based Batteries, Hydrogen storage, solar photovoltaic's, Flexible electronics. Intellectual Property Rights-case studies governing/pertaining to Materials/Technology.

UNIT2 TRANSFORMING TECHNOLOGIES IN BIO ENGINEERING

7Hrs.

Establishment of smart biotechnology factory, Artificial intelligence in Bioprocess technology, Omics – Big data analysis through automation, 3D bio printing for tissue engineering. Simulation tools, RSM and Box model. Cyber physical system based telemedicine, diagnosis and therapeutics through real time biosensors. Bionanotechnology. Intellectual Property rights(IPR):Case Studies.

UNIT3 ADVANCEMENTS IN SUSTAINABLE BUILT ENVIRONMENT

7Hrs.

Introduction – Technological developments in Architectural, Engineering and Construction (AEC) - Building Information Modelling (BIM) using Cloud computing technology and Internet of things (IoT) – Unmanned Aerial Vehicles, sensors – Additive manufacturing in construction – Concrete 3D printing- Materials used - Lightweight and functionally graded structures - Net Zero Energy buildings, Biowaste, Biofiltration pond, Ecosan systems- Recent developments in Waste water Management, Air pollution control, waste disposal - Integration of energy, water and environmental systems for a sustainable development- Emerging Technologies: Robot Highway- Vertical farming - Intellectual Property rights: Case studies.

UNIT4 SMART MANUFACTURING

8Hrs.

Smart factories and interconnection, Smart Manufacturing – automation systems, Additive Manufacturing, Smart grids, Micro Electro Mechanical Systems (MEMS), Stealth technology, Metal Finishing, Self propelled vehicles, e mobility, Green fuels, drones – unmanned aerial vehicles(UAVs), aerodynamics. Robotic Automation and Collaborative Robots – Augmented reality and haptics, engineering cybernetics and artificial intelligence (AI), Disruptive Technologies – Frugal Innovations – Emerging Technologies - Autonomous Robots, Swam Robot, Modular Robotics, Space craft, Intellectual Property Rights(IPR):Case Studies.

UNIT5 SMART WORLD

8Hrs.

Smart Sensors and IIOT, Smart grid, Hybrid renewable energy systems, Electronics in Smart city, Integration of Sensors in Robots and Artificial Intelligence, 5G Technology, Communication protocols, Human-Machine Interaction, Virtual Reality, Quantum Computing: Changing trends in transistor technology: Processor, Emerging Trends: Deep Space, Swarm Robots, Cyborg, Geofencing, Pervasive Computing, Intellectual Property Rights-Case Studies.

UNIT6 CYBER PHYSICAL SYSTEMS

8Hrs.

Introduction to Cyber Physical Systems(CPS), Architecture of CPS, Data science and technology for CPS, Prototypes of CPS, Emerging applications in CPS including social space, crowd sourcing, health care and human computer interactions, Industrial Artificial Intelligence, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Transportation, Intellectual Property Rights(IPR):Case Studies.

Max.45Hrs.

TEXT/REFERENCE BOOKS

1. William D. Callister, "Materials Science and Engineering, An Introduction, John Wiley and Sons Inc .Singapore, 2001.
2. V. Raghavan, "Physical Metallurgy: Principle and Practice, Prentice Hall India Pvt Ltd, 2006.
3. Flavio Craveiro, Jose Pinto Duarte, Helena Bartolo and Paulo Jorge Bartolo, "Additive manufacturing as an enabling technology for digital construction: A perspective on Construction 4.0", Automation in Construction, Vol. 103, pp. 251-267, 2019.
3. Klaus Schwab, "Fourth Industrial Revolution", Random House USA Inc, New York, USA, 2017.
4. Oliver Grunow, "SMART FACTORY AND INDUSTRY 4.0. The current state of Application Technologies", Study lab Publications, 2016.
5. Alasdair Gilchrist, "INDUSTRY 4.0: Industrial Internet of Things", Apress, 2016.
6. Sang C. Suh, U. John Tanik, John N. Carbone, Abdullah Eroglu, "Applied Cyber-Physical Systems", Springer Publications, New York, 2013.



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SCHOOL OF MECHANICAL ENGINEERING

DEPARTMENT OF AUTOMOBILE ENGINEERING

BOARD OF STUDIES MEETING HELD ON 29.10.2018

Members present:

External Members	Signature	Internal Members	Signature
Dr.G.Sathiyaseelan General Manager- Ashok Leyland- External Member		Dr.S.Prakash Dean/School of Mechanical Engineering	
Mr.A.J.Naveenan Lawrence Chief training officer TVS Training and services Ltd Chennai		Dr.V.K.Bupesh Raja, Head/Automobile Engineering	
Er.Dinesh Procurement Consultant Altron Deutschland S.A.S.&Co.KG, U.K (Alumni)		Dr.A.Karthikeyan Professor/ Automobile Engineering	



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Minutes of the Board of Studies meeting

Board of Studies meeting for the Department of Automobile Engineering held on 29th october 2018 with the following agenda:

1. Discussion on New Curriculum Structure for 2019 Regulations
2. Inclusions or exclusions of courses in the revised B.E Automobile Engineering.
3. Inclusions or exclusions of contents of the courses in the revised B.E Automobile Engineering.

Welcome Address

Dr.V.K.Bupesh Raja welcomed the members of BoS and placed the agenda for the deliberations of the members. The following decisions were made as per the items of the circulated agenda.

Agenda1: Discussion on New Curriculum Structure for 2019 Regulations

With reference to the regulation 2015, the following discussions are made for the new curriculum design – Regulations 2019

- No Credit for Environmental Sciences and Engineering course to be provided in the R2019 Curriculum. The total credits for Humanities and Social Sciences category subjects will be increased from six (6) to Nine (9).
- The total credits may be limited to 26 for Basic Science Course Category
- The total credits may be limited to 24 for Engineering Science Course Category
- The total Credits may be limited to 54 for Professional Core course category



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- Two more courses (3 credits each) can be included in the Professional Elective Course Category
- Three (3) Credits to be provided for Mathematics 1 to Mathematics 4 courses. Total credits for Mathematics courses are 12.
- Reduce the credits for Project and Professional Training from 25 to 15.
- Project work to be started in the 7th semester, so Project credit of 10 should be split as 3 (for 7th sem) and 7 (for the 8th sem). This will facilitate projects to turn into publications and patents.
- Three Credits (3) for Professional Training and Two Credits (2) for Placement Training (Mandatory for all Students).
- All Lab Courses / Component credits to be increased from 1.5 to 2 Credits.
- The total credits should be in the range of 160 to 165 as per the new guidelines
- No Credit for Induction Programme / Indian Constitution / Essence of Indian tradition
- Comply with AICTE Norms

Agenda 2: Inclusions or exclusions of courses in the revised B.E Automobile Engineering Syllabus

Dr.G.Sathiyaseelan emphasized the need to introduce two separate courses namely Automotive Petrol Engines and Automotive Diesel Engines instead of Automotive Engines course in the syllabus in order to impart in-depth knowledge on engines.

Dr.G.Sathiyaseelan also suggested shifting of Hybrid and Electric Vehicles course from elective to core course category since it is an emerging technology and shall be useful for placement.

As per the inputs received from Alumni, Finite element analysis course is introduced as core course as some foreign universities made it mandatory for admission to master degree.

As prescribed by AICTE the credits in the new curriculum are reduced from 195 to



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165. In this context as per the suggestions received from faculty members, the following courses were ratified without any lacuna in contents of curriculum

- i. Strength of materials, and Fluid mechanics and machinery course contents are consolidated into a single course titled Solid and Fluid mechanics.
- ii. Engineering thermodynamics and Thermal Engineering course contents are consolidated into a single course titled Applied Thermodynamics.
- iii. Kinematics of Machines and Dynamics of machines course contents are consolidated into a single course titled Mechanics of machines.

As suggested by Mr.A.J.Naveenan Lawrence the laboratory course titled "Fuels, lubricants and Engine testing lab" is reframed into two individual lab courses namely, Fuels and lubricants lab and Thermal Engineering lab. This shall facilitate in-depth understanding of the core concepts

Agenda3: Inclusions or exclusions of contents of the courses in the B.E- Automobile Engineering Syllabus

Mr.A.J.Naveenan Lawrence emphasized to include Alternate fuels topics in the syllabus of the course titled "Fuels and lubricants"

Dr.G.Sathiyaseelan suggested modifying the syllabus of the course titled "Vehicle dynamics" so as to include the major topics vertical, Lateral and longitudinal dynamics.

Dr.G.Sathiyaseelan also suggested modifying the syllabus of the course titled "Heat and mass transfer" so as to include the topics relevant to engine heat transfer. Further he suggested reframing the title of the course as "Heat transfer applied to I.C engines".(Annexure-1)

Vote of Thanks

Dr.S.Prakash thanked the expert members for accepting the invitation for attending the BOS meeting in a short notice. He thanked them for their valuable suggestions on the agenda items presented. He also thanked Dr.V.K.Bupesh Raja, Professor and HoD, Dr.A.Karthikeyan, Professor for their contribution towards the conduct of this BOS meeting.

- Red colour indicates deleted contents and Yellow colour indicates added contents.

Annexure-1

SAU1201	FUELS AND LUBRICANTS	L	T	P	Credits	Total Marks
		3	0	0	3	100

OBJECTIVES:

- To understand the manufacturing, properties and testing of fuels and lubricants used in automotive applications

UNIT 1: MANUFACTURE OF FUELS AND LUBRICANTS

8 hrs.

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, distillation curve

UNIT 2: THEORY OF LUBRICATION

7 hrs.

Engine friction: introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elastic hydrodynamic lubrication, **boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system.**

UNIT 3: LUBRICANTS

10 hrs.

Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, additives and additive mechanism, synthetic lubricants, classification of lubricating oils, properties of lubricating oils, tests on lubricants, grease, classification, properties, test used in grease.

UNIT 4: PROPERTIES AND RATING OF FUELS

10 hrs.

Types of fuels, liquid and gaseous fuels, heating value of fuels, higher and lower heating values, chemical structure of hydro-carbons SI engine fuels, volatility characteristics, desirable characteristics of SI engine fuels, knock rating and additives,

UNIT 5: COMBUSTION & ANALYSIS

10 hrs.

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

TOTAL: 45 hrs

On completion of the course, student will be able to

C01: Recall the structure of petroleum and explain the petroleum refining process and manufacture of lubricants in detail.

C02: Explain the properties of fuels and their effect on engine performance

C03: Explain the qualities of fuels and various additives used to enhance performance of fuels and

C04: Explain the theory of lubrication and effect of engine variables on friction

C05: Explain the requirements and various properties of lubricants and compare different types of Lubricants.

C06: Derive theoretically correct air required for combustion of liquid and Gaseous fuels

REFERENCE BOOKS:

1. Ganesan. V. "Internal Combustion Engines", Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. Mathur D.S., Sharma. R.P. "A course in internal combustion engines", Dhanpatrai publication, 2003.
3. Obert. E.F. "Internal Combustion Engineering and Air Pollution", International book Co., 1988.
4. Brame. J.S.S. and King. J.G. "Fuels – Solids, Liquids, Gaseous", Edward Arnold, London, 1955.
5. Francis. W "Fuels and Fuel Technology", Published by Pergamon Press Inc, 1980.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 10 questions of 2 marks each - No choice

PART B: 2 questions from each unit of internal choice; each carrying 16 marks

Exam Duration : 3 Hrs.

20 Marks

80 Marks

SAUA1303	FUELS AND LUBRICANTS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the refining process of petroleum.
- To develop understanding about various types of fuels, lubricants and their properties
- To understand the importance of Alternate fuels available.

UNIT 1 MANUFACTURE OF FUELS AND LUBRICANTS

9 Hrs.

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

UNIT 2 FUELS FOR I.C. ENGINES

9 Hrs.

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

UNIT 3 COMBUSTION OF FUELS

9 Hrs.

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

UNIT 4 LUBRICANTS

9 Hrs.

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

UNIT 5 ALTERNATE FUELS

9 Hrs.

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

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Recall the structure of petroleum and explain the petroleum refining process and manufacture of lubricants in detail.
- CO2 - Explain the properties of fuels and their effect on engine performance
- CO3 - Explain the qualities of fuels and various additives used to enhance performance of fuels and Derive theoretically correct air required for combustion of liquid and Gaseous fuels
- CO4 - Explain the theory of lubrication and effect of engine variables on friction
- CO5 - Explain the requirements and various properties of lubricants and compare different types of Lubricants
- CO6 - Summarize the alternate fuels for SI and CI engines and alternate source vehicles

TEXT / REFERENCE BOOKS

1. Ganesan V., "Internal Combustion Engines", Tata McGraw Hill Publishing Co., New Delhi, 2012.
2. Mathur D.S., Sharma. R.P. "A course in internal combustion engines", Dhanpatrai publication, 2014.
3. Srivastava S.P., Jenő Hancsók "Fuels and Fuel-Additives" Wiley; 1st Edition, 2014.
4. Srivastava S.P., "Developments in Lubricant Technology", Wiley Blackwell, 1 Edition, 2014.
5. Gupta O.P., "Elements of Fuel & Combustion Technology", Khanna Book Publishing; 1st Edition, 2018.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

SAU1304	VEHICLE DYNAMICS	L	T	P	Credits	Total Marks
		3	1	0	4	100

OBJECTIVE

- To understand basic principles of vibration and dynamic analysis of vehicles

UNIT 1: INTRODUCTION

12 hrs

Classification of vibrations- mechanical vibrating systems, single degree of freedom, two degree of freedom, multi degree of freedom, free, forced and damped vibrations, modeling and simulation studies, model of an automobile, magnification factor, transmissibility, vibration absorber.

UNIT 2: APPLIED NUMERICAL METHODS

12 hrs

Close-coupled and far-coupled systems, determination of mass & stiffness matrices -eigen value problems- -orthogonality of mode shapes, modal analysis, approximate methods for determining fundamental frequency, Dunkley's lower bound, Rayleigh upper bound, Holzer method for closed coupled system and branched system.

UNIT 3: SUSPENSION SYSTEM

12 hrs

Vehicle dynamics and suspension requirements, natural spring frequencies, force acting on a semi-elliptic suspension, design of laminated spring, design of coil spring and torsion bar, spring characteristics, mechanics of an independent suspension system, roll axis and the vehicle under the action of side forces, coupled front and rear suspension effects, relative pitch and bounce frequencies, anti-roll rates, roll angles in cornering, attitudes changes due to brakes, traction and independent suspension.

UNIT 4: PERFORMANCE OF AUTOMOBILES

12 hrs

Forces and couples on the wheels, tractive and braking properties of tires, cornering properties of tires, slip angle, cornering force, camber thrust, deformation of wheel and ground, power of propulsion, road performance curves, resistances- air, rolling and grade, determination of center of gravity of vehicle, load distribution, stability on a curved track slope and a banked road, calculation of tractive effort and reactions for different drives.

UNIT 5: WHEELS AND TYRES

12 hrs

Automobile wheels, pneumatic tires, tire- construction, properties, characteristics, tread, bite, operation and inflation pressure, wheel balancing, tire, dynamics, ride characteristics power consumed by a tire, over steer, under steer, steady state cornering, effect of braking, driving torques on steering, effect of camber, transient effects in cornering

TOTAL: 60 hrs

REFERENCE BOOKS:

- Giri N.K – Automotive Mechanics, Khanna Publishers, 2002.
- Rao J.S and Gupta. K “Theory and Practice of Mechanical Vibrations”, Wiley Eastern Ltd., New Delhi - 2002.
- Ellis.J.R - “Vehicle Dynamics”- Business Books Ltd., London- 1991
- Giles.J.G.Steering - “Suspension and Tyres”,- Illiffe Books Ltd., London- 1998
- Wong J.Y. Theory of Ground Vehicles, 4th edition, Wiley
- Thomas D. Gillespie, “Fundamental of Vehicle Dynamics, Society of Automotive Engineers”, USA 1992.
- Rajesh Rajamani, “Vehicle Dynamics and Control”, Springer, 2012.

Course Outcomes:

On completion of the course, students will be able to

- CO1:** Understand vibration modes and its problems related to Automobile Engineering.
- CO2:** Understand how passenger comforts is achieved along with vehicle stability.
- CO3:** Design and conduct experiments on tires on different road conditions.
- CO4:** Demonstrate the ability to design a system, component or process to meet the stability needs of vehicles
- CO5:** Understand the concepts in lateral and longitudinal dynamics of automobiles.
- CO6:** Understand the methods of predicting vehicle performance.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration : 3 Hrs.

PART A: 10 questions of 2 marks each-No choice

20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 16 marks

80 Marks

SAU1304	VEHICLE DYNAMICS	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- To familiarize with dynamic analysis of vehicles.
- To demonstrate the ability to design a system, component or process to meet the desired needs within realistic constraints.
- To acquire the capability to identify, formulate and solve complex engineering problems related to Automobile Engineering.

UNIT 1 CONCEPT OF VIBRATION

9 Hrs.

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

UNIT 2 VERTICAL DYNAMICS

9 Hrs.

Human response to vibration, Sources of Vibration. Design and analysis of Passive, Semi-active and Active suspension using Quarter car, half car and full car model. Influence of suspension stiffness, suspension damping, and tire stiffness. Control law for LQR, H-Infinite, Skyhook damping. Air suspension system and their properties.

UNIT 3 TIRES

9 Hrs.

Tire forces and moments, Tire structure, Longitudinal and Lateral force at various slip angles, rolling resistance, Tractive and cornering property of tire. Performance of tire on wet surface. Ride property of tires. Magic formulae tire model, Estimation of tire-road friction. Test on Various road surfaces. Tire vibration.

UNIT 4 LATERAL DYNAMICS

9 Hrs.

Steady-state handling characteristics. Steady state response to steering input. Testing of handling characteristics. Transient response characteristics, Direction control of vehicles. Roll center, Roll axis, Vehicle underside forces. Stability of vehicle on banked road, during turn. Effect of suspension on cornering.

UNIT 5 LONGITUDINAL DYNAMICS AND CONTROL

9 Hrs.

Aerodynamic forces and moments. Equation of motion. Tire forces, rolling resistance, Load distribution for three wheeler and four wheeler. Calculation of Maximum acceleration, Reaction forces for Different drives. Braking and Driving torque. Prediction of Vehicle performance. ABS, stability control, Traction control.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, students will be able to

- CO1 - Understand vibration modes and its problems related to Automobile Engineering.
- CO2 - Able to understand how passenger comfort is achieved along with vehicle stability.
- CO3 - Ability to design and conduct experiments on tires on different road conditions.
- CO4 - Demonstrate the ability to design a system, component or process to meet the stability needs of vehicles
- CO5 - Understand the concepts in lateral and longitudinal dynamics of automobiles.
- CO6 - Understand the methods of predicting vehicle performance.

TEXTBOOKS/ REFERENCES

1. Singiresu S. Rao, "Mechanical Vibrations", 6th Edition, Prentice Hall, 2017.
2. Dieter Schramm, "Vehicle Dynamics- Modeling and Simulation", Springer, 2016.
3. Wong. J. Y., "Theory of Ground Vehicles", 5th Edition, Wiley-Interscience, 2013.
4. Hans B Pacejka, "Tire and Vehicle Dynamics", 3rd Edition, SAE International, 2012.
5. John C. Dixon, "Tires, Suspension, and Handling", 4th Edition, Society of Automotive Engineers Inc, 2013.
6. Jan Zuijdijk, "Vehicle dynamics and damping", Author House, 2013.
7. Michael Blundell & Damian Harty, "The Multibody Systems Approach to Vehicle Dynamics", 2nd Edition, Elsevier Limited, 2014
8. NakhaieJazar. G., "Vehicle Dynamics: Theory and Application", 2nd edition, Springer, 2014.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 10 questions of 2 marks each - No choice

PART B : 2 questions from each unit of internal choice; each carrying 16 marks

Exam Duration : 3 Hrs.

20 Marks

80 Marks

SME1309	HEAT AND MASS TRANSFER (Common to Mech & Auto)	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OUTCOMES:

On completion of the course, student will be able to

- CO1: Analyse the conduction heat transfer characteristics for both simple and composite geometries.
- CO2: Evaluate the physical problems related to free and forced convection situation.
- CO3: Design and analyze the heat exchangers with LMTD and NTU procedures.
- CO4: Apply the laws of radiation to the different surfaces and Evaluate the radiation properties and shape factor.
- CO5: Analyze the similarity in governing equations of mass transfer.
- CO6: Evaluate the convective mass transfer correlations.

UNIT 1 CONDUCTION

12 Hrs

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – General Differential equation of Heat Conduction – Fourier Law of Conduction – Cartesian – Cylindrical – Polar Coordinates– One Dimensional Steady State Heat Conduction – Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems-critical thickness of insulation – Conduction with Internal Heat Generation – Systems with Variable Thermal Conductivity - Extended Surfaces- Fins–Classification – **Unsteady Heat Conduction – Lumped Analysis – Infinite and Semi Infinite Solids – Heislerand Grober Charts. Finite difference method for multi dimensional heat conduction**

UNIT 2 CONVECTION

12 Hrs

Basic Concepts – Convective Heat Transfer Coefficients – Boundary Layer Concept – Forced Convection –External Flow– Flow over Plates, Cylinders Spheres and Bank of tubes – Internal Flow – Laminar and Turbulent Flow Solutions – Analogies between momentum and heat transfer- Reynolds analogy-Chilton colburn analogy (Modified Reynolds analogy)- Free Convection – Flow over Vertical Plate – Vertical Tubes - Horizontal Plate, Inclined Plate, Cylinders and Spheres.

UNIT 3 PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS

12 Hrs.

Film and Drop wise Condensation - Nusselt's theory of condensation- Regimes of pool boiling and flow boiling, Nucleate Boiling - correlations in boiling and condensation. Heat Exchanger Types – Overall Heat Transfer Coefficient – Fouling Factors – Analysis – LMTD method, – NTU method. - Introduction of TEMA Standards.

UNIT 4 RADIATION

12 Hrs

Basic Concepts, Laws of Radiation- Wiens Displacement Law – Hemispherical Emissive Power - Stefan Boltzman Law, Kirchoff Law – Black Body Radiation – Grey body radiation – Shape Factor – Electrical Analogy – Radiation Shields-Solar radiation.

UNIT 5 Mass Transfer

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

Max.60 Hrs.

TEXT/ REFERENCE BOOKS

1. Yunus A. Cengel, "Heat Transfer A Practical Approach", Tata Mc Graw Hill, 2004
2. Rajput R.K., "Heat and Mass transfer", S.Chand & Co, 1983.
3. Frank P. Incropera and David P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley & Sons, 1998.
4. Kothandaraman C.P., "Fundamentals of Heat and Mass Transfer", New Age International (P) Ltd., 1998
5. Sachdeva R.C., "Fundamentals of Heat and Mass Transfer", New Age International (P) Ltd., 2010
6. Ozisik N.M., "Heat Transfer", McGraw Hill Book Company, 1988.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 2 Questions each from CO1-CO4, 1 question each from CO5 and CO6 – No choice

20 Marks

PART B: 4 Questions each with internal choice from CO1-CO4, 1 question from CO5 and CO6 with internal choice, each carrying 16 marks

80 Marks

SAUA1503	HEAT TRANSFER APPLIED TO I.C ENGINES	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- Impart the knowledge of fundamentals of heat transfer
- Deep understanding on the governing equations for convection heat transfer and the dimensionless parameters
- Understand the temperature distribution and heat transfer rate in engine components
- Familiarize with cooling system and measurement of heat transfer rate in IC engines

UNIT1 CONDUCTION

9 Hrs.

Fourier law of conduction, general equation in Cartesian, cylindrical, spherical co-ordinates – 1 Dimensional steady state conduction in solids across plane wall - composite wall - composite cylinder - composite sphere with convection boundaries, overall heat transfer co-efficient, critical thickness of insulation, conduction with generation, thermal contact resistance, variable conductivity.

UNIT 2 CONVECTION

9 Hrs.

Forced convection - external flow over a plate; cylinder, sphere & non circular ducts- internal flow through pipes- annular spaces & non circular conducts. Natural convection from vertical inclined & horizontal surfaces.

UNIT 3 RADIATION

9 Hrs.

Electromagnetic spectrum, black body emission, emissive power, laws of radiation, radiation shape factor, electrical analogy, radiation shields gas radiation.

UNIT 4 HEAT TRANSFER AND COOLING IN IC ENGINES

9 Hrs.

Temperature distribution in cylinder, piston – engine heat transfer and energy balance – parameters- Extended Surfaces- Fins-Heat Exchanger Types - Overall Heat Transfer Coefficient - Fouling Factors - Analysis - LMTD method, - NTU method - Classification -cooling system-need for cooling system-power required to cool the engine-characteristics of efficient cooling system-types of cooling system.

UNIT 5 MEASUREMENT OF HEAT TRANSFER RATES IN IC ENGINES

9 Hrs.

Measurement methods-SI engine measurement-CI engine measurement –evaluation of heat transfer correlations-boundary layer behavior-components temperature distribution - effect of engine variables-temperature measurement.

Max.45 Hrs.

COURSE OUTCOMES

- On completion of the course, student will be able to
- CO1 - Understand the basic modes of heat transfer
 - CO2 - Compute temperature distribution in steady-state heat conduction.
 - CO3 - Understand principles of forced and free convection heat transfer processes.
 - CO4 - Understand the principles of radiation heat transfer.
 - CO5 - Understand the cooling systems in IC engines.
 - CO6 - Estimate the temperature distribution and heat transfer rate in IC engine.

TEXT / REFERENCE BOOK

1. Heywood J.B "Internal Combustion Engine Fundamentals", McGraw-Hill Book CO., USA - 1995.
2. Rajput.R.K, Heat and Mass transfer – S.Chand& Co, 2016.
3. Kothandaraman C.P. Fundamentals of Heat and Mass Transfer - New Age International (P) Ltd., 1998.
4. Sachdeva R.C. Fundamentals of Heat and Mass Transfer - New Age Internationals (P) Ltd.
5. Ozisik N.M., Heat Transfer - McGraw Hill Book Company, 1988.
6. Holman J.P. Heat Transfer – McGraw Hill Book Company, 1989.
7. Incropera and Dewite, Heat Transfer - John Wiley.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each – No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks