



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 Mechanical Engineering

Minutes of Board of Studies Meeting held on 24th October 2018

The following members were present in the meeting:

1. Dr.L.Vijayaraghavan, Professor- IIT Madras - External Member
2. Er.James Michael Amulu, Director- SAP - External Member
3. Dr.G.Arunkumar, Professor and Head- Mechanical Engineering - Internal Member
4. Dr.S.P.Venkatesan, Associate Professor- Mechanical Engineering - Internal Member
5. Dr.G.Senthilkumar, Associate Professor- Mechanical Engineering - Internal Member
6. Mr.M.Purusothaman, Assistant Professor- Mechanical Engineering - Internal Member
7. Mr.R.Devaraj, Associate Professor- Mechanical Engineering - Internal Member
8. Mr.Abhishek Singh Chauhan, Alumni- Internal Member.

At the outset, the Chair Person welcomed the members of BoS and placed the agenda for the deliberations of the members. The following deliberations were made as per the items of the circulated agenda.

1. Agenda item # 1 Modifications of the course syllabus proposed in Design of Transmission Systems for 2015 batch Bachelors of Engineering- Mechanical Engineering students

Head of the department informed that the department teams have been working on the modification of curriculum and in this direction the following changes were made on Design of Transmission Systems.

- (a). Inclusion of the following topics in Unit V: Basic concept of FEM- steps involved in FEM, shape function, mathematical modeling of one dimensional element- stepped bar, tapered bar-simple problems. Variational Formulation

School of Mechanical Engineering

and approximation- the Rayleigh-Ritz method, method of weighted residuals-
simple problems

Resolutions: The External members considered the revision made and discussed regarding the revision. Dr. G.Arunkumar pointed that the Inclusion of topics was necessary. These topics are necessary as per the industrial standard. Then the members approved the modification in curriculum for consideration. The matter regarding the implementation of scheme from academic year 2018-19 batch onwards.

2. Agenda item # 2 Addition of new Courses for Bachelors of Engineering- Mechanical Engineering

The Head of the department highlighted the feedback from the Alumni for the inclusion of elective courses to focus on emerging technologies and asked the suggestion the suggestions from Dr.L.Vijayaraghavan and Er.James Michael Amulu They suggested the Design of Machine Tool Structure, Waste Heat Utilization and Management courses. Based on their suggestion, Department proposed the following courses for the incorporation of the following courses.

Course 1: SME1611 - Design of Machine Tool Structure

Course 2: SME1612 - Waste Heat Utilization and Management

Resolutions: The BOS resolved to recommend for approval of the suggested courses for inclusion in B.E Mechanical Engineering Programme.

3. Skilling in professional domains to promote industry ready competency among learners. Necessary certification courses to improve the domain knowledge.

Head pointed the workshop offered by the department such Finite Element Modelling and Analysis Using ANSYS Training on design and construction of Go-kart Vehicle









Resolutions: The BoS recommended the same to promote the industry ready competency among the students.

4. Any other points with the permission of Chair -Academic flexibilities with extra credits acquired through either advanced study of same courses or with procuring additional credits from additional courses as per student's choice - suggestion. Universal Human values was introduced as a mandate course

Head ask the suggestion to the External members for students undergoing specialization.

Resolutions: The BoS recommended that advanced courses/NPTEL courses and can be selected for the specialization. Also recommend that the students can opt these courses at the end of the third semester subject to the condition prescribed by the Board of Management time to time.

With the above discussion, the Head expressed his deep sense of gratitude to all members for an academic vibrant discussion on various matters. Since there was no other agenda, the meeting ended with the Vote of thanks.

Member	Designation	Signature
Dr.L.Vijayaraghavan	Professor	
Er.James Michael Amulu	Director	
Dr.A.Krishnamoorthy	Professor and Head	
Dr.S.P.Venkatesan,	Associate Professor	
Mr.R.Devaraj	Associate Professor	
Dr.G.Senthilkumar	Assistant Professor	
Mr.M.Purusothaman	Assistant Professor	
Mr. Abhishek Singh Chauhan	Alumni- Internal Member	

1. Modifications of the course syllabus proposed in Design of Transmission Systems -SME1307

SMEX1019	DESIGN OF TRANSMISSION SYSTEMS (Common to Mechanical – Mechanical and Production)	L	T	P	Credits	Total Marks
		3	1	0		

UNIT I DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS 10 hrs.

Selection and design of – Flat belts and pulleys- V belts and pulleys –Chain drives and sprockets

UNIT II DESIGN OF SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 10 hrs.

Gear Terminology-Speed ratios – Selection and design of spur gear- material selection- service factor- module calculation for endurance strength- Force analysis -Tooth stresses (fillet bending stress and contact stress) — Parallel axis Helical Gears – Equivalent number of teeth- Forces. Estimating the size of the helical gears and stresses – Dynamic effects- Fatigue strength

UNIT III DESIGN OF BEVEL AND WORM GEARS 10 hrs.

Straight bevel gear: Tooth terminology- Design of pair of straight bevel gears – Tooth forces and stresses.Worm Gear: Merits and demerits- Terminology. Thermal capacity, Design of the worm and gear – Forces and stresses, efficiency

UNIT IV DESIGN OF GEAR BOXES 10 hrs.

Geometric progression – Standard step ratio – Ray diagram, kinematics layout -Design of sliding mesh gear box -Constant mesh gear box. – Design of multi speed gear box.

UNIT V DESIGN OF CLUTCHES AND BRAKES 10 hrs.

Design of plate clutches – Axial clutches-Cone clutches-Internal expanding rim clutches – Design of brakes – Internal and external shoe brakes.

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

TEXT / REFERENCES BOOKS:

1. Juvinall R.C., K.M. Marshek , “Fundamentals of Machine component Design”, Third Edition, John Wiley & Sons, 2002.
2. Bhandari V.B., “Design of Machine Elements”, Tata McGraw-Hill Publishing Company Ltd., 1994.
3. Maitra G.M., Prasad L.V., “Hand book of Mechanical Design”, II Edition, Tata McGraw-Hill, 1985.
4. Shigley J.E. and Mischke C.R., “Mechanical Engineering Design”, McGraw-Hill International Editions, 1989.
5. Norton R.L., “Design of Machinery”, McGraw-Hill Book co, 2004.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80

Exam Duration : 3 hrs.

PART A : 2 Questions from each unit, each carrying 2 marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

MECHANICAL ENGINEERING

SME1307	DESIGN OF TRANSMISSION SYSTEMS (Common to Mech & M&P)	L	T	P	Credits	Total Marks
		3	1	0	4	100

(Use of PSG Design Data Book is permitted in the END SEMESTERination)

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Adapt the standards, safety aspects, the use of design handbook and procedures involved during the design of transmission systems.

CO2: Propose the appropriate type of flexible drive and its key specifications for the stated power transmission application.

CO3: Suggest the suitable gear with nomenclature for the stated power transmission application by considering strength and wear.

CO4: Recommend a suitable kinematic layout required to meet the specified multi-speed gear box system.

CO5: Formulate the mathematical model for the given one dimensional structural problem using the finite element method.

CO6: Use FEA solver to interpret the given one dimensional structural problem.

UNIT I DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE DRIVES 12 Hrs.

Selection and design of – Flat belts and pulleys- V belts and pulleys –Chain and sprockets drive.

UNIT II DESIGN OF SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 12 Hrs.

Gear Terminology-Speed ratios – Selection and design of spur gear- material selection- service factor- module calculation for endurance strength- Force analysis -Tooth stresses (fillet bending stress and contact stress) — Parallel axis Helical Gears --Forces

UNIT III DESIGN OF BEVEL AND WORM GEARS 12 Hrs.

Straight bevel gear: Tooth terminology- Design of pair of straight bevel gears – Tooth forces and stresses
Worm Gear: Merits and demerits- Terminology. Design of the worm and gear – Forces and stresses, efficiency

UNIT IV DESIGN OF GEAR BOXES 12 Hrs.

Geometric progression – Standard step ratio – Ray diagram, kinematics layout -Design of sliding mesh gear box -Constant mesh gear box. – Design of multi speed gear box.

UNIT V INTRODUCTION TO FINITE ELEMENT METHOD 12 Hrs

Basic concept of FEM- steps involved in FEM, shape function, mathematical modeling of one dimensional element- stepped bar, tapered bar-simple problems. Variational formulation and approximation- the Rayleigh-Ritz method, method of weighted residuals- simple problems

Max.60 Hrs

REFERENCE BOOKS:

1. J.E.Shigley and C.R.Mischke, "Mechanical Engineering Design", McGraw-Hill International Editions, 1989.
2. Design of Machine Elements by V.B. Bhandari, TMH publishing Co. Ltd., New Delhi.
3. R.C.Juvinall, K.M. Marshek , "Fundamentals of Machine component Design", Third Edition, John Wiley & Sons, 2002.
4. V.B.Bhandari, "Design of Machine Elements", Tata McGraw-Hill Publishing Company Ltd., 1994.
5. J.N Reddy. "An Introduction to the Finite Element Method" , Mc Graw Hill, International Edition, 1993.
6. S.S Rao., "Finite Element Method in Engineering" , Pergamum Press, 1989.
7. Chandrupatla & Belagundu, "Finite Elements in Engineering", Prentice Hall of India Private Ltd., 1997

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

 - Modifications of the course syllabus proposed in Design of Transmission Systems -SME1307

2. Addition of new Courses for Bachelors of Engineering– Mechanical Engineering

SME1611	DESIGN OF MACHINE TOOL STRUCTURE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES:**On completion of the course, student will be able to**

1. Understand machining process, needs of machine tools.
2. Modern machine tool development, calculation of basic needs of a machine tool.
3. Materials selection for the machine tool.
4. Designing the beds for the machine tool with rigid and stability.
5. Slide ways design calculations
6. Spindle design calculations.

UNIT 1 INTRODUCTION

9 Hrs.

Classification of machining processes, machine tools machine tool- construction factors performance criteria trends in modern machine tool calculation of cutting forces and power requirements for turning, milling, boring and grinding force distribution on different parts of drilling, milling and grinding machine tools.

UNIT 2 STRENGTH AND RIGIDITY OF MACHINE TOOL STRUCTURES

9 Hrs.

Basic principles of design comparison of materials used in machine tool construction dependence of process capability on rigidity static compliance design of lathe beds materials typical construction torsional modulus of regangular and box sections methods of increasing rigidities.

UNIT 3 SLIDEWAYS

9 Hrs.

Slide ways types materials constructions clearance adjustments Hydrostatically lubricated slide ways slide way design pressure distribution antifriction ways design construction.

UNIT 4 SPINDLES AND SPINDLE SUPPORTS

9 Hrs.

Spindle units materials spindle design spindle bearings types of materials constructions.

UNIT 5 MACHINE TOOL DYNAMICS

9 Hrs.

Dynamic system elastic system working processes- vibration in machine tools self excited vibration and dynamic stability basic principles of chatter effects of vibration vibration elimination damping

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 2 Questions each from C01-C04, 1 question each from C05 and C06 – No choice**20 Marks****PART B:** 4 Questions each with internal choice from C01-C04, 1 question from C05 and C06 with internal choice, each carrying 16 marks**80 Marks**

SME1612	WASTE HEAT UTILIZATION AND MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES:**On completion of the course, student will be able to**

1. Understand the fundamentals of cogeneration technology and its related thermodynamic cycles.
2. Understand the industrial applications of cogeneration.
3. Understand the waste heat recovery systems, their applications and the factors affecting their performance.
4. Explain the use of waste heat recovery systems on the boilers.
5. Select a suitable waste heat recovery system for an industrial application.
6. Enumerate and evaluate the techno economics of cogeneration.

UNIT 1 COGENERATION

9 Hrs.

Introduction, Principles of Thermodynamics, Combined Cycles, Topping, Bottoming, Organic Rankine Cycles, Advantages of Cogeneration Technology

UNIT 2 APPLICATION & TECHNO ECONOMICS OF COGENERATION

9 Hrs.

Cogeneration Application in various process industries. Sizing of waste heat boilers, Performance calculations, Part load characteristics selection of Cogeneration Technologies, Financial considerations, operating cost and Investments, Costs of Cogeneration

UNIT 3 WASTE HEAT RECOVERY

9 Hrs.

Introduction - Principles of Thermodynamics and Second Law, Sources of waste heat and its potential applications, Waste heat survey and measurements, Data collection, Limitations and affecting factors Heat recovery equipment and systems

UNIT 4 WASTE HEAT RECOVERY SYSTEMS & WASTE HEAT BOILERS

9 Hrs.

Waste heat recovery systems: Recuperators, Regenerators, Economizers: Waste heat boilers: Classification, Location, Service Conditions, Design Considerations, Unfired combined Cycle, Supplementary fired combined cycle, fired combined cycle, Thermic fluid heaters

UNIT 5 APPLICATIONS & TECHNO ECONOMICS OF WASTE HEAT RECOVERY SYSTEMS

9Hrs

Applications in industries, selection of waste heat recovery technologies - financial considerations - operations and investment costs of waste heat recovery

Max. 45 Hrs

TEXT / REFERENCE BOOKS

1. Charles H. Butler, Cogeneration, McGraw Hill Book Co., 1984.
2. Horlock JH, Cogeneration - Heat and Power, Thermodynamics and Economics, Oxford, 1987.
3. Institute of Fuel, London, Waste Heat Recovery, Chapman & Hall Publishers, London, 1963.
4. Sengupta Subrata, Lee SS EDS, Waste Heat Utilization and Management, Hemisphere, Washington, 1983.
5. De Nevers, Noel., Air Pollution Control Engineering, McGrawHill, New York, 1995.

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**



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SCHOOL OF MECHANICAL ENGINEERING

Department of Mechanical Engineering

Minutes of Board of Studies meeting held on 3rd March 2018

The following members were present in the meeting:

1. Dr.L.Vijayaraghavan, Professor- IIT Madras - External Member
2. Er.James Michael Amulu, Director- SAP - External Member
3. Dr.G.Arunkumar, Professor and Head- Mechanical Engineering - Internal Member
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7. Mr.M.Purusothaman, Assistant Professor- Mechanical Engineering - Internal Member
8. Mr.Abhishek Singh Chauhan, Alumni- Internal Member

At the outset, the Chair Person welcomed the members of BoS and placed the agenda for the deliberations of the members. The following deliberations were made as per the items of the circulated agenda.

1. Agenda item # 1 Addition of new Course for Bachelors of Engineering- Mechanical Engineering

The Head of the department highlighted the feedback from the Alumni for the incorporation of elective courses focussed on emerging technologies and asked suggestion from Dr.L.Vijayaraghavan and Er.James Michael Amulu. They suggested few courses like Product Design as the inclusions will help students later in their career. Based on their suggestion, Department proposed the following course for the inclusion in the syllabus from July 2019 onwards.

Course 1: Product Design



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Resolutions: Dr. L. Vijayaraghavan and Mr. James Michael Amulu highlighted to include Product Design and Mechatronics Lab also suggested to incorporate as core Courses. The BOS recommended for approval of the suggested courses for inclusion in B.E Mechanical Engineering programme with effect from July 2019.

2. Agenda item # 2: To add Skills in professional domains to promote industry-ready competency among learners. Suggestions for Necessary certification courses for improvement in the domain knowledge.

Head highlighted the value added courses offered by the department such as Drafting and Modelling using Solidworks and Non Destructive Testing.

Resolutions: The BoS recommended for the same to promote the industry-ready Competency among the students.

3. Any other points with the permission of Chair :

Academic flexibilities with extra credits acquired through either advanced study of same courses or with procuring additional credits from additional courses as per student's choice - suggestion. Universal Human values to be introduced as a mandate course

Head asked the suggestion to the External members for students opted various specialization.

Resolutions: The BoS recommended advanced courses/NPTEL courses and can be selected based on the specialization. Also recommend that the students can opt these courses at the end of the fourth semester subject to the condition prescribed by the Board of Management from time to time.

With the above discussion, the Head expressed his deep sense of gratitude to all members for an academic vibrant discussion on various matters. Since there was no other agenda, the meeting ended with the Vote of thanks to the Chair.



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Member	Designation	Signature
Dr.L.Vijayaraghavan	Professor	
Er.James Michael Amulu	Director	
Dr.A.Krishnamoorthy	Professor and Head	
Dr.S.P.Venkatesan,	Associate Professor	
Mr.R.Devaraj	Associate Professor	
Dr.G.Senthilkumar	Assistant Professor	
Mr.M.Purusothaman	Assistant Professor	
Mr. Abhishek Singh Chauhan	Alumni- Internal Member	

1. Addition of new Course for Bachelors of Engineering– MechanicalEngineering

SME 1310	PRODUCT DESIGN (Mech)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Refine the product design ideas generated using different idea generation methods for a new product development case study.

CO2: Choose the most suitable product design from the alternatives based on the aesthetics, economy, performance,safety, reliability and ease of manufacturing.

CO3: Suggest the appropriate computer applications for each phase of the product development and design process.

CO4: Adapt the general design principles, guidelines, standards, and practices during the product design anddevelopment.

CO5: Recommend the suggestions to reduce the environmental impact of the given product design case study using DFE assessment methods and guidelines.

CO6: Evaluate the industrial design aspects of the given product design for the given case study.

UNIT I INTRODUCTION

9 Hrs

Definition of a product - Types of product- levels of product- New product development product-market mix-New product development (NPD) process- Idea generation methods-Creativity-Creative attitude, creative design process-Morphological analysis- analysis of interconnected decision areas, brain storming, synectics. Product life cycle- The challenges of product development- product analysis- product characteristics

UNIT II BASIC CONCEPTS

9 Hrs

Product design- definition-Design by evolution- design by innovation-design by imitation -factors affecting product design. Standards of performance and environmental factors.decision making and iteration - Morphology of design (different phases).

-role of aesthetics in design. Introduction to optimization in design- economic factors in design-design for safety and reliability.

UNIT III ROLE OF COMPUTERS IN PRODUCT DESIGN

9 Hrs

Geometric Modeling – types – Wire frame surface and solid modeling – Boundary Representation, constructive solid geometry – Graphics standards – assembly modeling – use of software packages Modeling and simulation-the role of models in engineering design- Design for manufacturing, Rapid proto typing (RP) - application of RP in product design.

UNIT IV DESIGN FOR MANUFACTURE AND ENVIRONMENT

9 Hrs

General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances - mGeometric tolerances - Assembly limits – Datum features - Tolerance stacks.

Design for the Environment - Introduction – Environmental objectives – Global issues – Regional and local issues – Basic DFE methods – Design guide lines.

UNIT V INDUSTRIAL DESIGN

9 Hrs

Need for industrial design-impact in design process - investigation of customer needs - conceptualization - refinement- management of the industrial design process - technology driven products - user – driven products Integrating CAE, CAD, CAM tools

Max.45 Hrs

REFERENCE BOOKS:

1. Product Design and Development, Karl T.Ulrich and Steven D.Eppinger, Tata McGraw –Hill edition.
- 2.An Introduction to Engineering Design methods Vijay Gupta
- 3.Chitale A K and Gupta R C, “Product Design and Manufacturing”, Prentice Hall of India, 2005.
- 4.Bralla, Design for Manufacture handbook, McGraw hill, 1999.
5. Boothroyd, G, Hertz and Nike, Product Design for Manufacture, Marcel Dekker, 1994.
6. Dickson, John. R, and Corroda Poly, Engineering Design and Design for Manufacture and Structural Approach, Field Stone Publisher, USA, 1995.
7. Fixel, J. Design for the Environment McGraw hill, 1996.
8. Graedel T. Allen By. B, Design for the Environment Angle Wood Cliff,Prentice Hall. Reason Pub., 1996.
- 9.Kevien Otto and Kristin Wood, Product Design. Pearson Publication, 2004.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3
Hrs.****PART A:** 2 Questions each from C01-C04, 1 question each from C05 and C06 – No choice**20 Marks****PART B:** 4 Questions each with internal choice from C01-C04, 1 question from C05 and C06 with internal choice, each carrying 16 marks**80 Marks**