



School of Mechanical Engineering

Department of Mechanical Engineering

Minutes of meeting of Board of Studies Virtual meet held on 8th June 2021

The following Members are participated 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. Dr. J.Jayaprabhakar, Associate Professor- Mechanical Engineering- Internal Member
7. Dr.S.Ganesan, Associate Professor – Mechanical Engineering- Internal Member
8. Ms. Sanjana Kallat, Alumni- Internal Member.

The Chair Person welcomed the members of BoS and placed the agenda for the thoughts 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 received from the Alumni for the incursion of new course to focus on emerging technologies and the suggestion from Dr.L.Vijayaraghavan and Er.James Michael Amulu suggested Lean Enterprises and Advanced Manufacturing Technology. Based on BOS members suggestion, Department proposed the following new elective courses for the incorporation from 2019 batch onwards.

Course 1: Lean Enterprises and Advanced Manufacturing Technology



Resolutions:

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

Agenda item # 2 Modifications proposed for 2019 batch Bachelors of Engineering– Mechanical Engineering course syllabus:

Head of the department informed that the need of revising the syllabus of SME1205– CAD/CAM, as per the recent advancements in the field and the following modifications have been considered.

Inclusion of the following topics in Unit I: NC, DNC and CNC machine tools. NC Programming: point to point and continuous path machining approaches, G Codes, M Codes, Canned cycles, Manual NC programming for turning and milling operations. Use of computer applications in inspection, rapid prototyping, material handling and other manufacturing related tasks.

Inclusion of the following topics in Unit V: Computer Aided Process Planning (CAPP): Traditional process planning, Benefits of CAPP, Variant and Generative approaches. Computer integrated production system (CIPS): Traditional production planning, Benefits of CIPS, Master production Schedule, Material Requirement Planning, Inventory Management, Capacity planning, Shop floor control.

Resolutions: The External members considered the revision as necessary as it broadly involved in manufacturing sector. The changes mentioned under inclusion had been approved by all and modification in curriculum had been reflected. Also it was decided to implement for 2019 batch onwards.

3. Agenda item # 3 Addition of Skill in the professional domains in order to promote industry ready competency among learners. Necessity of introduction of certification courses from competent Government authorities for improving the domain knowledge and thus improving core placement counts.

Head pointed out that the workshop offered by the Department such as trends in Mechanical Engineering and Computational Fluid Dynamics.

Resolutions: The BoS members appreciated the same and suggested to follow in future also for making the industry ready competency among the students.

4. Agenda item # 4 Any other points with the permission of Chair -Academic flexibilities with extra credits acquired through either advanced study of some courses or with accumulation of additional credits from additional courses as per students' choice.



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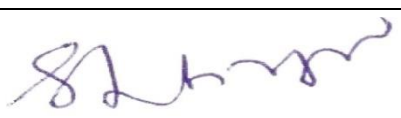
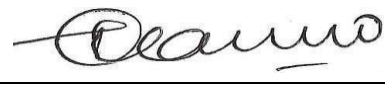
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Head asked for the suggestions from the External members for students pursuing different specialization.

Resolutions: The BoS recommended that NPTEL courses. It can be selected based on the student's specialization. Also recommend that the students can select the courses at the end of the fourth 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 to the Chair.

Member	Designation	Signature
Dr.L.Vijayaraghavan	Professor	
Er.James Michael Amulu	Director	
Dr.G.Arunkumar	Professor and Head	
Dr.S.P.Venkatesan,	Associate Professor	
Dr.G.Senthilkumar	Associate Professor	
Dr. J.Jayaprabakar	Associate Professor	
Dr.S.Ganesan	Associate Professor	
Ms. Sanjana Kallat	Alumni Member	



Addition of new Courses for Bachelors of Engineering– Mechanical Engineering

SMEA3022	Lean Enterprises and Advanced Manufacturing Technology	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To make the students understand how the philosophy and core methods of lean manufacturing are applied to any business.
- To make the students understand the value chain and to map the current state of material and information flow through the value chain and to understand where the added value is for the customer.
- To help the students to identify waste and its root cause in the value stream.
- To help the students to develop a future state vision of lean systems

UNIT 1 INTRODUCTION TO LEAN MANUFACTURING

9 Hrs.

Definition and concept of lean manufacturing; Principles of lean manufacturing Just in time Types of pull systems - Toyota Production systems Benefits of lean manufacturing Theory of constraints Reduction of wastes.

UNIT 2 LEAN MANUFACTURING TOOLS-I

9 Hrs.

Basic tools of lean manufacturing: 5S, Total Productive Maintenance, Key Performance Indicator, Overall Equipment Effectiveness, Plan Do Check Act, Root Cause Analysis, Poka Yoke, Work Cell, Bottleneck analysis, continuous flow.

UNIT 3 LEAN MANUFACTURING TOOLS II

9 Hrs.

Secondary tools of lean manufacturing: Gemba, Heijunka, HoshinKanri, Jidoka, Load leveling, Mind maps, 5 whys, SMDE, Six Big Losses, Standardized work, Visual factory, Zero quality control.

UNIT 4 STRATEGIC ISSUES AND LEAN IMPLEMENTATION

9 Hrs.

Strategic issues: - Actions - Issues - Focus - Leadership - Management of teams Training. Focused factory concept Availability, Variability, Lean implementation strategies, causes for failures, sustaining lean, and constraint management.

UNIT 5 PROCESS MAPPING , VALUE STREAM MAPPING AND LEAN ACCOUNTING

9 Hrs.

Process mapping Need for process map- Types- Detailed instructions - common mistakes in mapping - limits facilitation; Value stream mapping: - Overview - Where to use When to use-Step by step approach How to use Present and future states - VSM symbols. Lean accounting definition, Need for lean accounting, benefits of lean accounting, volume adjusted costing, Target costing.

Max. 45 Hrs.



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COURSE OUTCOMES

On completion of the course, student will be able to

- C01 - Identify key requirements and concepts in lean manufacturing.
- C02 - Apply the tools in lean manufacturing to analyze a manufacturing system and plan for its improvements.
- C03 - Find the common pitfalls encountered during lean implementation and initiate a continuous improvement change program in a manufacturing organization.
- C04 - Map the value chain and predict the value addition
- C05 - Apply lean accounting principles towards financial management of all streamlined operations in a lean manufacturing setup..
- C06 - Apply knowledge of facility planning, cellular manufacturing and group technology in a typical lean manufacturing setup.

TEXT / REFERENCE BOOKS

1. Golam Kibria, B. Bhattacharyya, J. Paulo Davim, Non-traditional micro machining processes: Fundamentals and applications, Springer International publishing, 2017.
2. V.K.Jain, Micro manufacturing processes, CRC press Taylor & Francis group, 2013. (ebook).
3. H. El-Hofy, Fundamentals of Machining Processes: conventional and non-conventional, 2nd edition, CRC press, Taylor & Francis group, 2014.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 2 Questions each from C01-C04, 1 question each from C05 and C06 – No choice

PART B: 4 Questions each with internal choice from C01-C04, 1 question from C05 and C06 with internal choice, each carrying 16 marks

Exam Duration: 3 Hrs.

20 Marks

80 Marks



Modifications proposed for 2019 batch Bachelors of Engineering– Mechanical Engineering

SME1205	CAD/CAM (Common to Mech & M&P)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Suggest the appropriate computer aids for the phases of design and development for the stated industrial application.
- CO2 - Sketch the 3D model of a given part drawing step by step using a 3D modeling representation technique.
- CO3 - Interpret how the synthetic curves are generated using the parametric representations in a CAD environment.
- CO4 - Interpret how the homogeneous and concatenated transformation matrices are applied for the geometric and viewing transformation operations in a CAD environment.
- CO5 - Suggest the appropriate computer aids for the phases of manufacturing and control activities for the stated industrial application.
- CO6 - Propose an appropriate factory data collection method for a specified industrial data collection problem.

UNIT 1 INTRODUCTION TO CAD/CAM

9 hrs.

The design process, Morphology of design, Product cycle Computer Aided Design, Application of computers for design, Benefits of CAD. Basic concepts of CAD - principles of computer graphics. CAD/CAM data base development and data base management systems. Programming and interface hardware computer aided process monitoring - adaptive control, on-line search strategies. Design for Manufacturability - Computer Aided Manufacturing.

UNIT 2 COMPUTER AIDED DRAFTING AND SOLID MODELING

9 hrs.

Concept of CAD as drafting and designing facility, desirable features of CAD package, Graphic software: coordinate representation- graphic functions, software standards. Graphical Kernel system (GKS) Initial graphics exchange system (IGES) - Graphic packages. Geometric Modeling - Wire frame, Surface and Solid models - Constructive Solid Geometry (CSG) and Boundary Representation (B-REP) Techniques - Features of Solid Modeling Packages.

UNIT 3 CURVES & SURFACES AND 2D & 3D TRANSFORMATION

9 Hrs.

Analytic curves and surfaces, 2D homogenous transformations- translation, rotation, reflection, scaling, shearing and combined transformation. 3D homogenous transformation - translation, rotation, reflection, scaling, shearing and combined transformation. 3D viewing transformation panning, rotation, reflection, shearing and zooming Representation of curves - Hermite curve- Bezier curve- B-spline curves-rational curves. Techniques for surface modeling surface patch- Coons and bicubic patches.

UNIT 4 COMPUTER AIDED MANUFACTURING

9 Hrs.

Manufacturing process data system integration of process data. Manufacturing Planning and Control - CAD/CAM Integration - Principles of Computer Integrated Manufacturing - Hierarchical



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computer structures and networking Structure of manufacturing process Process control strategies.
General configuration of an adaptive control system.

UNIT 5 COMPUTER AIDED PROCESS PLANNING AND SHOP FLOOR CONTROL 9 Hrs.

Process Planning - Computer Aided Process Planning - Retrieval and Generative approaches. Benefits of CAPP. Computer Integrated Production Management System - Master Production Schedule - Material Requirement Planning - Inventory Management - Manufacturing and Design Data Base - Capacity Planning - Shop Floor Control - Functions - Order release - Order Scheduling - Order progress - Factory data collection.

Max.45 Hrs.

TEXT / REFERENCE BOOKS

1. M.E. Mortenson, Geometric modeling, John Wiley & Sons, 2006
2. D.F. Roger and J.A. Adams, Mathematical elements of computer graphics, McGraw Hill, 2001
3. M.P. Groover, "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall, 2007.
4. P. Radhakrishnan, S. Subramanyan, V. Raju, "CAD/CAM/CIM", New Age International Publishers(P) Ltd., 2006.
5. Ibrahim Zeid:CAD/CAM Theory and practice;tatamcgraw hill corporation co.ltd,1991.
6. Hearn, Donald and M.Pauline Baker, "computer Graphics ", Prentice Hall 1997
7. Groover M.P. and Zimmers E.W., "CAD/CAM, Computer Aided Design and Manufacturing", Prentice Hall of India, 2006.

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**

SMEA1501	CAD / CAM	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To provide the fundamental information about computer graphics, elements of CAD/CAM and basic understanding about transformations, clipping, windowing and hidden line removal.
- To provide understanding of various wireframe, surface and solid modelling techniques used for generating computer models.
- To provide the details on how computer applications are used directly and indirectly for the manufacturing applications.

UNIT 1 FUNDAMENTALS OF CAD/CAM

9 Hrs.

Introduction: Elements of CAD, Elements of CAM, CAD/CAM integration, Advantages and applications. Computer graphics: Input and output devices, CAD/CAM databases, Requirements of Computer graphics packages. Transformations: Geometric transformation versus viewing transformation, Basic transformation matrices, such as translation, rotation and scaling.

UNIT 2 GEOMETRIC MODELLING - I

9 Hrs.

Wireframe modelling of analytical curves, such as line, circle and conics, and synthetic curves, such as Hermite cubic spline, Bezier curve and B-Spline curve. Surface modelling of analytical surfaces, such as plane surface, ruled surface, surface of revolution and tabulated cylinder, and synthetic surfaces, such as Hermite cubic surface, Bezier surface and B-Spline surface.

UNIT 3 GEOMETRIC MODELING - II

9 Hrs.

Solid modelling techniques: Constructive solid geometry (CSG) representation and Boundary representation. Assembly modelling: Assembly of part drawing, Approaches, Interferences of positions and orientation. Graphics standards: Product data exchange, File format of DXF, IGES and STEP files. Capabilities of modelling & analysis packages.

UNIT 4 COMPUTER AIDED MANUFACTURING - I

9 Hrs.

NC, DNC and CNC machine tools. NC Programming: point to point and continuous path machining approaches, G Codes, M Codes, Canned cycles, Manual NC programming for turning and milling operations. Use of computer applications in inspection, rapid prototyping, material handling and other manufacturing related tasks.

UNIT 5 COMPUTER AIDED MANUFACTURING - II

9 Hrs.

Computer Aided Process Planning (CAPP): Traditional process planning, Benefits of CAPP, Variant and Generative approaches. Computer integrated production system (CIPS): Traditional production planning, Benefits of CIPS, Master production Schedule, Material Requirement Planning, Inventory Management, Capacity planning, Shop floor control.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Interpret how the basic transformation operations are applied for the geometric and viewing transformations in a CAD environment.
- CO2 - Interpret how the analytic and synthetic curves are generated using the parametric representations in a CAD environment.
- CO3 - Interpret how the analytic and synthetic surfaces are generated using the parametric

representations in a CAD environment.

- CO4 - Sketch the 3D model of a given part drawing step by step using a 3D modeling representation technique.
- CO5 - Write the manual NC programming using the FANUC standard NC code library for the given part drawing.
- CO6 - Suggest the appropriate computer aids for the phases of manufacturing and control activities for the stated industrial application.

TEXT / REFERENCE BOOKS

1. Ibrahim Zeid and R. Sivasubramanian, "CAD/CAM : Theory and Practice: Special Indian Edition", 2nd Edition, McGraw Hill Education, 2009.
2. M. Groover and E. Zimmers, "CAD/CAM Computer-Aided Design and Manufacturing", 1st Edition, Pearson Education, 2003.
3. Donald D. Hearn and M. Pauline Baker, "Computer Graphics, C Version", 2nd Edition, Pearson Education, 2014.
4. John F. Hughes, Andries van Dam, Morgan McGuire, David F. Sklar, James D. Foley, Steven K. Feiner and Kurt Akeley, "Computer Graphics: Principles and Practice", 3rd Edition, Pearson Education India, 2013.
5. Mikell P Groover, "Automation, Production Systems, and Computer-Integrated Manufacturing", 4th Edition, Pearson Education, 2014.
6. Mike Mattson, "CNC Programming: Principles and Applications", 1st Edition, Delmar, 2013.
7. M. Adithan and B.S. Pable, "CNC Machines", 3rd Edition, New Age International Publishers, 2018.

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



→ Modifications proposed for 2019 batch Bachelors of Engineering- Mechanical Engineering course syllabus



SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY
SCHOOL OF MECHANICAL ENGINEERING

Department of Mechanical Engineering

Minutes of Board of Studies Virtual meeting held on 18th November 2021

Due to the pandemic the virtual meeting has been planned as per the Government guidelines.

The following members were participated 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. Dr. J. Jayaprabakar, Associate Professor- Mechanical Engineering- Internal Member
7. Dr. S. Ganesan, Associate Professor – Mechanical Engineering – Internal Member
8. Ms. Sanjana Kallat, Alumni- Internal Member.

At the outset, the Chair Person Dr.G.Arunkumar greeted the members of BoS and discussed the agenda for the consolidated views of the members. The following recommendations were made as per the items of the circulated agenda.

1.Agenda item # 1 Addition of a few new Course for Bachelors of Engineering- Mechanical Engineering and Master of Engineering- Computer Aided Engineering

The Head of the department highlighted the feedback received from the Alumni and Industrial experts and requested for the necessary new elective courses introduction on emerging technologies. Dr.L.Vijayaraghavan and Er.James Michael Amulu suggested to focus on Micro and Nano Machining as the Industries look for the enhanced skills in the manufacturing industries.

Based on the feedback, the following courses had been coined and were decided to be offered as elective courses from January 2022 onwards.

Course 1: Micro and Nano Machining



Resolutions: The BOS approved the suggested courses for inclusion in B.E. Mechanical Engineering programme curriculum. Dr. L. Vijayaraghavan and Mr. James Michael Amulu highlighted the importance of Micro and Nano Machining for the ease of manufacturing in Industries and unanimously the syllabi developed by the team members were approved.

2. Agenda item # 2. Need of skills up in the professional domains to promote industry ready competency among learners. Necessary certification courses suggestion were taken for consideration to improve the domain knowledge.

Dr Ganesan also suggested the knowledge and skill on CNC programming and Applications will increase the employment opportunity in core Engineering fields. The members reviewed the requirements and suggested to plan workshop on CNC programming and Applications

Resolutions: The BoS recommended and approved the agenda for enhancement of industry ready competency among learners.

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 students' choice

Internal members suggested the students' enrollment in NPTEL courses for completeness in learning . Dr L Vijayaraghavan pointed out that the completeness of learning fulfilled with the blend of curricular courses and NPTEL courses.

Resolutions: The BoS recommended and approved for introduction of advanced courses/NPTEL courses and it can be selected based on the specialization. Also the team recommended that creating awareness was necessary among the students and the students could select any of these courses at the end of the fourth semester.



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With the above discussion, the Head expressed his deep sense of gratitude to all members for an academic active discussion on the discussed contents. The members were thanked by the HoD and the meeting was smoothly completed.

Member	Designation	Signature
Dr.L.Vijayaraghavan	Professor	
Er.James Michael Amulu	Director	
Dr.G.Arunkumar	Professor and Head	
Dr.S.P.Venkatesan,	Associate Professor	
Dr.G.Senthilkumar	Associate Professor	
Dr. J.Jayaprabakar	Associate Professor	
Dr.S.Ganesan	Associate Professor	
Ms. Sanjana Kallat	Alumni Member	



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Addition of a new Course for Bachelors of Engineering

SMEA3023	Micro and Nano Machining	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To acquaint the basic concepts and applications of micro and nano machining processes
- To encourage the students for developing the models (experimental/theoretical) of micro and nano machining processes.

UNIT 1 INTRODUCTION

9 Hrs.

Classification and types of machining processes, Fundamentals of Micro and Nano machining processes, Nano materials and their applications in various industrial applications Advanced Mechanical Micro-Nano Machining processes.

UNIT 2 TRADITIONAL MICRO AND NANO MACHINING PROCESSES

9 Hrs.

Theory of micromachining, Operating principles and process parameters of Micro turning, Micromilling, Micro-grinding, Applications and Limitations of micro machining. Abrasive Flow Nano finishing, Magnetic Abrasive Nano finishing.

UNIT 3 ADVANCED MECHANICAL MICRO-NANO MACHINING PROCESSES

9 Hrs.

Introduction - Classification of advanced Mechanical Micro - Nano Machining processes, Operating principles and process parameters of Abrasive Jet Micromachining (AJM), Water jet micro machining (WJM), Abrasive Water Jet Machining (AWJM), Ultrasonic Micromachining.

UNIT 4 ADVANCED MICRO-NANO MACHINING PROCESSES

9 Hrs.

Operating principles and process parameters of Electric Discharge Micromachining, Electric Discharge Grinding and Electric Discharge Diamond Grinding, Wire Electric Discharge Micromachining. Operating principles and process parameters of Electrochemical Micromachining, Electrochemical Micro Grinding, Electro stream Micro drilling, Electro-chemical Micro deburring.

UNIT 5 HIGH ENERGY MICRO-NANO MACHINING PROCESSES

9 Hrs.

Operating principles and process parameters of Laser Beam Micromachining (LBM), Electron Beam Micromachining (EBM), Focused Ion Beam Machining (IBM).

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Classify the appropriate micro and nano machining process using material removal mechanism.
- CO2 - Recognize the traditional micro and nano machining process
- CO3 - Demonstrate the material removal mechanism of various Advanced Micro-Nano machining Processes
- CO4 - Extend the mechanism of High Energy Micro-Nano machining Processes and their process
- CO5 - Select suitable Advanced Electro-chemical, Micro-Nano Machining Processes relevant to the desired product.
- CO6 - Utilize various micro and nano finishing processes.

TEXT / REFERENCE BOOKS

- Golam Kibria, B. Bhattacharyya, J. Paulo Davim, Non-traditional micro machining processes: Fundamentals and applications, Springer International publishing, 2017.
- V.K.Jain, Micro manufacturing processes, CRC press Taylor & Francis group, 2013. (ebook).
- H. El-Hofy, Fundamentals of Machining Processes: conventional and non-conventional, 2nd edition, CRC press, Taylor & Francis group, 2014.



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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 Virtual meeting held on 21th December 2020.

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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6. Dr. J.Jayaprabhakar, Associate Professor- Mechanical Engineering- Internal Member
7. Dr.S.Ganesan, Associate Professor – Mechanical Engineering- Internal Member
8. Ms. Sanjana Kallat, 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 # 2 Addition of new Courses for Bachelors of Engineering– Mechanical Engineering

The Head of the department highlighted the feedback from the Alumni for the incorporation of elective courses in January 2021 to focus on emerging technologies and the feedback from Dr.L.Vijayaraghavan is to focus on Design of Heat Exchangers and Er.James Michael Amulu is to focus on Universal Human Values. Based on the feedback, Department proposed the following courses for the incorporation of the following courses.

Course 1: Design of Heat Exchangers

Course 2: Universal Human Values



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Resolutions:

The BOS resolved to recommend for approval of the suggested courses for inclusion in B.E Programme of Mechanical Engineering. Dr.L.Vijayaragahavan highlighted the importance of Design of Heat Exchangers and Er.James Michael Amulu highlighted the importance of Universal human Values and suggested to incorporate in core Courses.

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 Six Sigma and Advanced Machining process

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 to the Chair.



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Member	Designation	Signature
Dr.L.Vijayaraghavan	Professor	
Er.James Michael Amulu	Director	
Dr.G.Arunkumar	Professor and Head	
Dr.S.P.Venkatesan,	Associate Professor	
Dr.G.Senthilkumar	Associate Professor	
Dr. J.Jayaprabakar	Associate Professor	
Dr.S.Ganesan	Associate Professor	
Ms. Sanjana Kallat	Alumni Member	



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SMEA3020	DESIGN OF HEAT EXCHANGERS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To learn the thermal and stress analysis on various parts of the heat exchangers
- To analyze the sizing and rating of the heat exchangers for various applications

UNIT I INTRODUCTION

9 Hrs.

Types of heat exchangers, shell and tube heat exchangers — regenerators and recuperators - Temperature distribution and its implications - Parts description, Classification as per Tubular Exchanger Manufacturers Association (TEMA)

UNIT II PROCESS DESIGN OF HEAT EXCHANGERS

9 Hrs.

Heat transfer correlations, Overall heat transfer coefficient, analysis of heat exchangers – LMTD and effectiveness method. Sizing of finned tube heat exchangers, U tube heat exchangers, Design of shell and tube heat exchangers, fouling factors, pressure drop calculations.

UNIT III STRESS ANALYSIS

9 Hrs.

Stress in tubes - header sheets and pressure vessels - thermal stresses, shear stresses - types of failures, buckling of tubes, flow induced vibration.

UNIT IV COMPACT AND PLATE HEAT EXCHANGER

9 Hrs.

Types- Merits and Demerits- Design of compact heat exchangers, plate heat exchangers, performance influencing parameters, limitations.

UNIT V CONDENSERS AND COOLING TOWERS

9 Hrs.

Design of surface and evaporative condensers – cooling tower – performance characteristics.

Course Outcomes:

Max. 45 Hours

On completion of the course, student will be able to

CO1: Classify Heat Exchangers based on TEMA.

CO2: Perform Heat transfer analysis by LMTD and NTU Methods.

CO3: Calculate stresses in heat exchanger tubes.

CO4: Design compact heat exchangers according to applications

CO5: Evaluate the performance characteristics of heat exchanger types

CO6: Design condensers and cooling towers according to need and applications..

TEXT BOOKS/ REFERENCES BOOKS

1. SadikKakac and Hongtan Liu, "Heat Exchangers Selection", Rating and Thermal Design, CRC Press, 2002.
2. Shah, R. K., Dušan P. Sekulić, "Fundamentals of heat exchanger design", John Wiley & Sons, 2003.
3. Robert W. Serth, "Process heat transfer principles and applications", Academic press, Elsevier, 2007.
4. Sarit Kumar Das, "Process heat transfer", Alpha Science International, 2005
5. John E. Hesselgreaves, "Compact heat exchangers: selection, design, and operation", Elsevier science Ltd, 2001.



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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

SAIC4003	UNIVERSAL HUMAN VALUES	L	T	P	Credits	Total Marks
		2	1	0	3	100

COURSE OBJECTIVES

- To develop a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence
- To understand (or developing clarity) the harmony in the human being, family, society and nature/existence
- To strengthen self-reflection
- To develop commitment and courage to act

MODULE 1 COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self- exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

MODULE 2 UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
 8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
 9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
 10. Understanding the characteristics and activities of 'I' and harmony in 'I'
 11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
 12. Programs to ensure Sanyam and Health.
- Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

MODULE 3 UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN-HUMAN RELATIONSHIP

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient

values in relationship

16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

MODULE 4 UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

MODULE 5 IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. 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
28. Sum up.

Practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

Total: 28 Lectures and 14 Practice Sessions

COURSE OUTCOMES

On completion of the course, the student are expected

- CO1: To become more aware of themselves, and their surroundings (family, society, nature)
- CO2: They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind
- CO3: To have better critical ability
- CO4: To become sensitive to their commitment towards what they have understood (human values, human relationship and human society)
- CO5: To apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction

TEXT /REFERENCE BOOKS

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. The Story of Stuff (Book).
5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
6. Small is Beautiful - E. F Schumacher.
7. Slow is Beautiful - Cecile Andrews
8. Economy of Permanence - J C Kumarappa
9. Bharat Mein Angreji Raj - PanditSunderlal
10. Rediscovering India - by Dharampal
11. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
12. India Wins Freedom - Maulana Abdul Kalam Azad
13. Vivekananda - Romain Rolland (English)
14. Gandhi - Romain Rolland (English)

ASSESSMENT:

Assessment by faculty mentor: 10 marks

Self-assessment:: 10 marks

by peers: 10 marks

Socially relevant project/Group

Activities/Assignments: 20 marks Semester End Examination: 50 marks



SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
SCHOOL OF MECHANICAL ENGINEERING

Department of Mechanical Engineering

Minutes of Board of Studies Virtual meeting held on 16th April 2021.

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. Dr. J.Jayaprabhakar, Associate Professor- Mechanical Engineering- Internal Member
7. Dr.S.Ganesan, Associate Professor – Mechanical Engineering – Internal Member
8. Ms. Sanjana Kallat, 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 proposed for 2020 batch Bachelors of Engineering- Mechanical Engineering students in SMEA1402 – Mechanics of Machines.

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 SMEA1402– Mechanics of Machines.

- (a) Removal of the following topics in Unit V- Gears, Path of contact, arc of contact and contact ratio– Gear trains Interchangeable gears – Gear tooth action – interference and undercutting – Gear trains – Epicyclic gear train – tabular method of finding velocity ratio.
- (b) Inclusion of the following topics in Unit V: Effects of Gyroscopic Effects, Effect of precession motion on the stability of moving vehicles such as motor car, motor cycle (Demonstration of models in video)

Resolutions: The External members considered the revision made and discussed regarding the revision. Dr. G.Arunkumar pointed that the removal of topics was necessary. These topics are covered in Design of Transmission system. Then the members approved the



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modification in curriculum for consideration. The matter regarding the implementation of scheme from academic year 2020-21 batch onwards.

2. Agenda item # 2 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 focus on emerging technologies and the feedback from Dr.L.Vijayaraghavan and Er.James Michael Amulu are to focus on Industry 4.0 Design and Manufacturing & Quality Control and Reliability Engineering. Based on the feedback, Department proposed the following courses for the incorporation of the following courses from July 2020 onwards.

Course 1: Industry 4.0 Design and Manufacturing

Course 2: Quality Control and Reliability Engineering

Resolutions: The BOS resolved to recommend for approval of the suggested courses for inclusion in B.E Programme of Mechanical Engineering. Dr.L.Vijayaraghavan and Mr.James Michael Amulu highlighted the importance of Industry 4.0 Design and Manufacturing & Quality Control and Reliability Engineering also suggested to incorporate in core Courses.

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 as **Patent filing and Non Destructive Testing.**

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 to be introduced as a mandate course

Head asked 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 fourth semester subject to the condition prescribed by the Board of Management time to time.



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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.

Member	Designation	Signature
Dr.L.Vijayaraghavan	Professor	
Er.James Michael Amulu	Director	
Dr.G.Arunkumar	Professor and Head	
Dr.S.P.Venkatesan,	Associate Professor	
Dr.G.Senthilkumar	Associate Professor	
Dr. J.Jayaprabakar	Associate Professor	
Dr.S.Ganesan	Associate Professor	
Ms. Sanjana Kallat	Alumni Member	



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1. Agenda item # 1 Modifications proposed for SMEA1402 – Mechanics of Machines Course.

S.No	Existing Syllabus R2019	Corrected Syllabus
1	UNIT V GEARS, GOVERNORS AND GYROSCOPES 9 Hrs Spur gear terminology – law of toothed gearing – Involute gearing – Path of contact arc of contact and contact ratio Interchangeable gears – Gear tooth action – interference and undercutting – Gear trains – Epicyclic gear train – tabular method of finding velocity ratio. Governors – Types Centrifugal governors – Porter Characteristics – Sensitivity – Stability – Hunting – Isochronisms – equilibrium speed Controlling - Force- Gyroscopes - Gyroscopic couple - Gyroscopic stabilization - Gyroscopic effects in Aeroplanes	UNIT V GOVERNORS AND GYROSCOPES 9 Hrs Gyroscopes and gyroscopic effects-Effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships gyroscopic couple, (Demonstration of models in video). Governors - types and applications - Watt, porter and proell governors - spring loaded governors -Hartnell and Hartung with auxiliary springs. Sensitiveness- isochronisms and hunting.

SMEA1402	MECHANICS OF MACHINES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Provide the insights of the fundamentals of Mechanisms and Cams.
- Understand the basics of Flywheels, Balancing of Rotating and Reciprocating unbalance systems.
- Enhance knowledge of Single degree - Free and Damped Vibrations.
- Provide the detailed overview of Forced Vibrations.
- Discuss the fundamentals of Gears, Gyroscopes and Governors.

UNIT 1 MECHANISMS AND CAMS**9 Hrs.**

Mechanisms – Terminology and definitions – Kinematics inversions of 4 bars and slider crank chain – Kinematic analysis in simple mechanisms. Types of cams and followers - Terminology and definitions – Displacement diagrams – SHM, uniform velocity, uniform acceleration and retardation. Graphical constructions of cam profiles – Disc cam with knife edge follower, roller follower and flat-faced follower.

UNIT 2 FLY WHEELS AND BALANCING**9 Hrs.**

Turning moment diagrams – Fluctuation of Energy and speed – Energy stored in Flywheel – Mass of Flywheel – Dimensions of Flywheel. Balancing – Static and Dynamic Balancing of Rotating Masses - Balancing of several masses rotating in same plane and in different planes- Partial Balancing of locomotives – Variation of tractive force, Hammer blow and swaying couple.

UNIT 3 FUNDAMENTALS OF VIBRATION**9 Hrs.**

Basic features of vibratory systems - Lumped mass systems - Degrees of freedom - Free vibration of Longitudinal, Transverse and Torsional systems of Single degree of freedom - Equations of motion - Natural frequency – Whirling of shafts and critical speed - Dunkerley's Method – Torsional vibration of Two and Three rotor system. Damped free vibration - Types of Damping –Critical damping coefficient - Damping Factor – Logarithmic Decrement.

UNIT 4 FORCED VIBRATION**9 Hrs.**

Forced vibration of single degree freedom system with damping - Response to periodic forcing- Harmonic Forcing - Force transmissibility and amplitude transmissibility - Reciprocating and rotating unbalance - vibration isolation and transmissibility - Support motion - self excited vibration with examples.

UNIT 5 GEARS, GOVERNORS AND GYROSCOPES**9 Hrs**

Spur gear terminology – law of toothed gearing – Involute gearing – Path of contact, arc of contact and contact ratio. Interchangeable gears – Gear tooth action – interference and undercutting – Gear trains – Epicyclic gear train – tabular method **of finding velocity ratio.** Governors - Types - Centrifugal governors – Porter– Characteristics –Sensitivity – Stability – Hunting – Isochronisms – equilibrium speed - Controlling Force- Gyroscopes - Gyroscopic couple - Gyroscopic stabilization - Gyroscopic effects in Aeroplanes.

Max.45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Recommend the cam and follower arrangement for the specific case study.
- CO2 - Examine the balancing of rotating and reciprocating unbalanced mass systems using analytical and graphical methods.
- CO3 - Design the flywheels for the specific mechanical system using analytical techniques.
- CO4 - Establish the free and/or forced vibration characteristics of the given mechanical system using analytical methods.
- CO5 - Predict the gyroscopic effects on the stability of the given moving vehicle analytically.
- CO6 - Compare the characteristics of governors for the specific automotive system.

TEXT/REFERENCE BOOKS

1. Khurmi R.S. & Gupta J.S, "Theory of Machines", 16th Edition, S.Chand & Company, 2005, Reprint 2016.
2. Singh V.P, "Mechanical Vibrations", 3rd Edition, Dhanpatrai & Co., 2006.
3. Ghosh A. and Malik A.M, "Theory of Mechanism and Machines", 4th Edition, Affiliated East West Press (P) Ltd., 2009.
4. Ashok G. Ambekar, "Mechanism and Machine Theory", 1st Edition, PHI Learning Private limited, 2009.
5. Rattan S. S, Theory of Machines, 3rd Edition, Tata McGraw Hill, 2009.
6. Gordon R Pennock, Joseph E Shigley, "Theory of Machine and Mechanisms" SI Edition, 4th Edition, Oxford University Press, 2014.

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**

SMEA1402	MECHANICS OF MACHINES	Sc	60	10	10	30	Total Marks
			3	0	0	3	

COURSE OBJECTIVES:

The aim of the course is to:

- Provide the insights of the fundamentals of Mechanisms and Cams.
- Understand the basics of Flywheels, Balancing of Rotating and Reciprocating unbalance systems.
- Enhance knowledge of Single degree - Free and Damped Vibrations.
- Provide the detailed overview of Forced Vibrations.
- Discuss the fundamentals of Gyroscopes and Governors.

UNIT I MECHANISMS AND CAMS

9 hrs

Mechanisms – Terminology and definitions – Kinematics inversions of 4 bars and slider crank chain – Kinematic analysis in simple mechanisms. Types of cams and followers - Terminology and definitions – Displacement diagrams – SHM, uniform velocity, uniform acceleration and retardation. Graphical constructions of cam profiles – Disc cam with knife edge follower, roller follower and flat-faced follower.

UNIT II FLY WHEELS AND BALANCING

9 Hrs

Turning moment diagrams – Fluctuation of Energy and speed – Energy stored in Flywheel – Mass of Flywheel – Dimensions of Flywheel. Balancing – Static and Dynamic Balancing of Rotating Masses - Balancing of several masses rotating in same plane and in different planes- Partial Balancing of locomotives – Variation of tractive force, Hammer blow and swaying couple.

UNIT III FUNDAMENTALS OF VIBRATION

9 Hrs

Basic features of vibratory systems - Lumped mass systems - Degrees of freedom - Free vibration of Longitudinal, Transverse and Torsional systems of Single degree of freedom - Equations of motion - Natural frequency – Whirling of shafts and critical speed - Dunkerley's Method – Torsional vibration of Two and Three rotor system. Damped free vibration - Types of Damping – Critical damping coefficient - Damping Factor – Logarithmic Decrement.

UNIT IV FORCED VIBRATION

9 Hrs

Forced vibration of single degree freedom system with damping - Response to periodic forcing- Harmonic Forcing - Force transmissibility and amplitude transmissibility - Reciprocating and rotating unbalance - vibration isolation and transmissibility - Support motion - self excited vibration with examples

UNIT V GOVERNORS AND GYROSCOPES

9 Hrs

Gyroscopes and gyroscopic effects-Effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships gyroscopic couple, (Demonstration of models in video). Governors - types and applications - Watt, Porter and Proell governors - Spring loaded governors -Hartnell and Hartung with auxiliary springs. Sensitiveness-isochronisms and hunting.

Max Hours: 45 Hrs

COURSE OUTCOMES:

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

- CO1: Investigate the Mechanisms and Cams.
CO2: Determine the principle of Flywheel, Rotating and Reciprocating masses.
CO3: Analyze the Single degree - Free and Damped Vibrations.
CO4: Evaluate the force transmitted to the foundation for mechanical systems in Forced Vibrations.
CO5: Apply the fundamentals of Gyroscopes.
CO6: Apply the fundamentals of Governors

TEXT/REFERENCE BOOKS:

1. Khurmi R.S& Gupta J.S, "Theory of Machines", 16th Edition, S.Chand & Company, 2005, Reprint 2016.
2. Singh V.P, "Mechanical Vibrations", 3rd Edition, Dhanpatrai & Co., 2006.
3. Ghosh A. and Malik A.M, "Theory of Mechanism and Machines", 4th Edition, Affiliated East West Press (P) Ltd. 2009.
4. Ashok G. Ambekar, "Mechanism and Machine Theory", First Edition,PHI Learning Private limited, 2009.
5. Rattan S. S, Theory of Machines, 3rd Ed., Tata McGraw Hill, 2009.
6. Gordon R Pennock, Joseph E Shigley, "Theory of Machine and Mechanisms SI Edition, 4th Edition, Oxford University Press, 2014

END SEMESTER EXAM 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

SMEA4003	INDUSTRY 4.0 FOR DESIGN AND MANUFACTURING	L	T	P	Credits	Total Marks
		2	-	0	2	100

COURSE OBJECTIVES

- To enable students understand the fundamentals and the contributing technologies of Industry 4.0.
- To make the students evaluate the suitability of Industry 4.0 technologies for the design and Manufacturing sectors.
- To help the students implement the Industry 4.0 technologies to diverse applications.

UNIT 1 CONTRIBUTING TECHNOLOGIES**8 hrs**

Brief introduction to the industrial revolutions. Contributing technologies to Industry 4.0: Additive manufacturing, Digital twin, Internet of things, Smart sensors, AR and VR, Artificial intelligence, Cloud computing, Block chain, Big data and analytics. Challenges and opportunities.

UNIT 2 ADVANCED CAD TECHNOLOGIES**8 hrs**

Introduction to CAD. Enabling technologies: Digital twin, AR/VR, AI. Cloud computing, Touch/Voice/Motion enabled CAD, Customized CAD, Cloud based CAD, Digital twin and live simulation.

UNIT 3 SMART MANUFACTURING SYSTEMS**8 hrs**

Enabling technologies: AI, Cloud computing, Robotics, IoT. Digital manufacturing: CNC, Cloud based manufacturing, IoT based manufacturing, Advanced CNC programming. Additive manufacturing. Micro electro mechanical systems. Robotics: Robotic automation, Collaborative robots, Autonomous robots, Swarm robots, and Modular robots.

UNIT 4 SMART FACTORY ENABLERS**8 hrs**

Enabling technologies. Smart energy: Improving energy efficiency with data, Smart grids. Clean energy. Smart logistics. Smart Inspection. Smart decision making.

UNIT 5 AUTOMOMOUS VEHICLES**8 hrs**

Introduction: Traditional mobility versus autonomous driving, Levels of automation, and challenges. Enabling technologies. Self-propelled vehicles, Drones, Unmanned aerial vehicles, Space crafts

UNIT 6 CASE STUDIES**5 hrs**

Case studies related to Industry 4.0 applications, such as, transportation, energy, infrastructure, manufacturing, and product design sectors.

Max. 45 Hrs.

COURSE OUTCOMES

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

CO1: Justify how the digitalization technologies are advantageous to the design and manufacturing industries.

CO2: Use the advanced CAD technologies to create the CAD models.

CO3: Use the smart manufacturing technologies to produce the components and products.

CO4: Recommend the enabling technologies to make various factory operations smarter.

CO5: Choose the suitable sensors and technologies to the future autonomous vehicles, drones and space crafts.

CO6: Prepare a report with the challenges faced currently, the enabling technologies to become smarter, and the steps needed for the effective implementation for the given case study.

TEXT / REFERENCE BOOKS

1. 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.
2. Klaus Schwab, "Fourth Industrial Revolution", Random House USA Inc, New York, USA, 2017.
3. Oliver Grunow, "Smart Factory and Industry 4.0. The current state of Application Technologies", Studylab Publications, 2016
4. Alasdair Gilchrist, "Industry 4.0: Industrial Internet of Things", Apress, 2016
5. Sang C. Suh, U. John Tanik, John N Carbone, Abdullah Eroglu, "Applied Cyber-Physical Systems", Springer Publications, New York, 2013.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 11 Questions of 2 marks each - No choice

22 Marks

PART B: 2 Questions from each unit with internal choice, each carrying 13 marks **78 Marks**

SMEA3021	QUALITY CONTROL AND RELIABILITY ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

(Use of approved statistical table permitted in the examination)

COURSE OBJECTIVES:

- To understand process control and acceptance sampling procedure and their application.
- To learn the concept of reliability.

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES

9Hrs

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 for variables – X chart, R chart and chart - process capability – process capability studies and simple problems. Six sigma concepts

UNIT II PROCESS CONTROL FOR ATTRIBUTES

9Hrs

Control chart for attributes –control chart for non conforming– p chart and np chart – control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

UNIT III ACCEPTANCE SAMPLING

9hrs

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.

UNIT IV LIFE TESTING – RELIABILITY

9Hrs

Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, 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.

UNIT V QUALITY AND RELIABILITY

9Hrs

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.

Course Outcomes:

Max. 45 Hours

On completion of the course, student will be able to

CO1: Apply the concept of SQC in process control for reliable component production

CO2: Perform statistical analysis using control charts

CO3: Apply sampling techniques for non conformities

CO4: Evaluate the quality of components by failure analysis

CO5: Design for reliability of component parts

CO6: Develop product analysis for new product development

TEXT BOOKS/ REFERENCES

1. Douglas.C. Montgomery, " Introduction to Statistical quality control", 4th edition, John Wiley 2001.
2. Srinath. L.S., "Reliability Engineering", Affiliated East west press, 1991.
3. John.S. Oakland. "Statistical process control", 5th edition, Elsevier, 2005
4. Connor, P.D.T.O., "Practical Reliability Engineering", John Wiley, 1993
5. Grant, Eugene .L "Statistical Quality Control", McGraw-Hill, 1996
6. Monohar Mahajan, "Statistical Quality Control", Dhanpat Rai & Sons, 2001.
7. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publishers, 1998.

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



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School of Mechanical Engineering

Department of Mechanical Engineering

Minutes of meeting of Board of Studies Virtual meet held on 30th November 2019

The following Members are participated 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. Dr. J.Jayaprabhakar, Associate Professor- Mechanical Engineering- Internal Member
7. Dr.S.Ganesan, Associate Professor – Mechanical Engineering- Internal Member
8. Mr.Abhishek Singh Chauhan, Alumni- Internal Member.

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

1. Agenda item # 1 Addition of new Courses for Bachelors of Engineering– Mechanical Engineering

The Head of the department highlighted the feedback received from the Alumni for the inclusion of few elective courses to focus on emerging technologies and the suggestion from Dr.L.Vijayaraghavan is to include few elective courses like Precision Engineering. Er.James Michael Amulu suggested few elective courses like Rapid Prototyping. Based on BOS members suggestion, Department proposed the following new elective courses for the incorporation from 2016 batch onwards.

Course 1: Rapid Prototyping

Course 2: Precision Engineering

Resolutions:

The BOS resolved to recommend for approval of the suggested courses for inclusion in B.E



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Programme of Mechanical Engineering.

2. Agenda item # 2 Addition of Skill in the professional domains in order to promote industry ready competency among learners. Necessity of introduction of certification courses from competent Government authorities for improving the domain knowledge and thus improving core placement counts.

Head pointed out that the workshop offered by the Department such as Six Sigma certification and Advanced Machining process

Resolutions: The BoS members appreciated the same and suggested to follow in future also for making the industry ready competency among the students.

3. Agenda item # 3 Any other points with the permission of Chair - Academic flexibilities with extra credits acquired through either advanced study of some courses or with accumulation of additional credits from additional courses as per students' choice.

Head asked for the suggestions from the External members for students pursuing different specialization.

Resolutions: The BoS recommended that NPTEL courses. It can be selected based on the students specialization. Also recommend that the students can select the courses at the end of the fourth 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 to the Chair.



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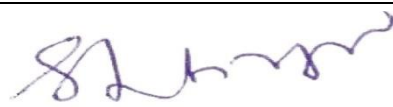
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Member	Designation	Signature
Dr.L.Vijayaraghavan	Professor	
Er.James Michael Amulu	Director	
Dr.G.Arunkumar	Professor and Head	
Dr.S.P.Venkatesan,	Associate Professor	
Dr.G.Senthilkumar	Associate Professor	
Dr. J.Jayaprabakar	Associate Professor	
Dr.S.Ganesan	Associate Professor	
Mr.Abhishek Singh Chauhan	Alumni Member	



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SPR1616	RAPID PROTOTYPING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1: Demonstrate an understanding of the concepts of Rapid Prototyping and their description. CO2: Explain the key characteristics of stereo lithography process and applications.

CO3: Analyze and select a rapid manufacturing technology for a given component.

CO4: Evaluate LENS, BPM processes; point out the application of RP system in medical field define virtual prototyping and identify simulation components.

CO5: Identify the errors during generation of STL files and minimize them.

CO6: Develop the RP system with Optimization techniques.

UNIT 1 INTRODUCTION

9 Hrs.

Need for the compression in product development, history of Rapid Prototyping systems, survey of applications, and growth of RP industry and classification of RP systems.

Stereo lithography Systems- Principle, process parameters, process details, data preparation, data files and machine details, applications. Fused Deposition Modeling- Principle, process parameters, path generation, applications

UNIT 2 RAPID PROTOTYPING TECHNIQUES

9 Hrs.

Selective Laser Sintering-Types of machines, principles of operation, process parameters, data preparation for SLS, applications. Laminated Object Manufacturing-Principle of operation, LOM materials, process details, applications.

Solid Ground Curing- Principle of operation, machine details, applications.

UNIT 3 CONCEPT MODELERS

9 Hrs.

Principle, Thermo jet printer, Sander's model market, 3-D printer, Genisys Xs printer, object Quadra system.

Laser Engineered Net Shaping (LENS) - Net shaping development at Sandia National Lab.

UNIT 4 RAPID TOOLING

9 Hrs.

Indirect rapid tooling - silicone rubber tooling, aluminum filled epoxy tooling, spray metal tooling, direct rapid tooling - quick cast process, sand casting tooling.

Software for RP- STL files, overview of solid view, magics, mimics and internet based software's.



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UNIT 5 RAPID MANUFACTURING PROCESS OPTIMIZATION

9 Hrs.

Factors influencing accuracy, data preparation errors, part building errors, errors in finishing, influence of part build orientation.

Allied Processes-Vacuum casting, surface digitizing, and surface generation from point cloud, surface modification, data transfer to solid models.

Max. 45 Hrs.

TEXT / REFERENCE BOOKS:

- 1) Terry Wohlers, "Wohlers Report 2001", Wohlers Associates, 2008.
- 2) Pham D T and Dimov S S, "Rapid Manufacturing", Verlag, 2001.
- 3) Paul F Jacobs, "Stereo lithography and other RP&M Technologies", SME, 1996.
- 4) FDM Maxum User Guide.
- 5) FDM 1650 User Guide.
- 6) Sinterstation 2500 plus System User Guide.
- 7) MK-Technology Gmbh. System User Guide.

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



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SPR1619	PRECISION ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES:

On completion of the course, student will be able to

C01: Understand the concepts of measurements and instruments used for it

C02: Analyze the deformation and thermal stability during machining process

C03: Familiarize with dimensioning standards and tolerance limits

C04: Understand the principle of micro fabrication techniques

C05: Familiarize with smart materials and micro machining technique

C06: Get hands-on training with the related components of the technology

UNIT 1 CONCEPTS OF ACCURACY IN MACHINE TOOLS

10Hrs

Accuracy & Errors of machine tools, Spindle and Displacement Accuracies, Errors due to Numerical Interpolation Displacement Measurement System and Velocity Lags. Accuracy of N.C system, Errors in the NC machines feed stiffness zero stability. Setting errors -Location of rectangular prism, cylinder - Basic type of tests Measuring instruments used for testing machine tools. Alignment tests-Straightness, Flatness, Parallelism, Squareness, Circularity, Cylindricity.

UNIT 2 STIFFNESS, THERMAL EFFECTS AND FINISH MACHINING

9 Hrs.

Overall stiffness of Machine Tools- compliance of work piece errors caused by cutting forces deformation in turning boring milling heat sources thermal effects Finish Turning, boring, grinding Surface roughness.

UNIT 3 DIMENSIONING

8 Hrs.

Definition of terms- Key dimension Superfluous dimension dimensional stepped shaft assigning tolerances in the constituent dimensions dimensional chains.

UNIT 4 MICRO-MACHINING AND MICRO FABRICATION

9 Hrs.

Micro Machining Photo resist process- Lithography LIGA Process Optical, processing of materials electron beam machining micro forming, diamond turning micro positioning devices etching physical vapour deposition Chemical vapour deposition

UNIT 5 SMART STRUCTURES, MATERIALS AND MICRO ACTUATORS

9 Hrs.

Smart structures Smart materials types and applications - smart sensors micro valves- MEMS Micro motors Micropumps micro dynamometer micro machines micro optics micro nozzles.

Max.45 Hrs.

TEXT / REFERENCE BOOKS: (Alignment and visibility)

1. Murthy R.L. "Precision Engineering in Manufacturing", New Age International Pvt. Limited.
2. Juliar W.Gardner. Vijay K. Varadan, 'Micro sensors, MEMS and Smart Devices, John Wiley and sons, 2001.
3. Stephen A.Campbell, "The Science and Engineering of Microelectronic Fabrication", Oxford University Press, 1996.
4. Raddy Frank, "Understanding smart sensors", Artech House, Boston, 1996.
5. MEMS Hand Book, CRC Press, 2001



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3.

5. Nakazawa, H. Principles of Precision Engineering, Oxford University Press, 1994.

6. Institute of Physics Publishing, Bristol and Philadelphia, Bristol, BSI 6BE U.K.

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



SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
SCHOOL OF MECHANICAL ENGINEERING

Department of Mechanical Engineering

Minutes of Board of Studies Virtual meeting held on 27th June 2019

Due to the pandemic the virtual meeting has been planned as per the Government guidelines.

The following members were participated 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. Dr. J. Jayaprabakar, Associate Professor- Mechanical Engineering- Internal Member
7. Dr. S. Ganesan, Associate Professor – Mechanical Engineering – Internal Member
8. Mr.Abhishek Singh Chauhan, Alumni- Internal Member.

At the outset, the Chair Person Dr.G.Arunkumar greeted the members of BoS and discussed the agenda for the consolidated views of the members. The following recommendations were made as per the items of the circulated agenda.

1.Agenda item # 1 Modifications proposed for 2017 batch Bachelors of Engineering– Mechanical Engineering course syllabus:

Head of the department informed that the need of revising the syllabus of SMEX1022– Fluid power systems, as per the recent advancements in the field and the following modifications have been considered.

Inclusion of the following topics in Unit I: 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 Pascal's Law- Laminar and Turbulent flow – Reynolds's number – Darcy's equation – Losses in pipe, valves and fittings.



Inclusion of the following topics in Unit V: Development of hydraulic / pneumatic circuits applied to machine tools, presses, material handling systems, automotive systems, packaging industries, manufacturing automation. Maintenance in fluid power systems – preventive and breakdown. Maintenance procedures. Trouble shooting of fluid power systems - fault finding process, equipments, tools used, causes and remedies. Safety aspects involved

Resolutions: The External members considered the revision as necessary as it broadly involved in application and safety. The changes mentioned under inclusion had been approved by all and modification in curriculum had been reflected. Also it was decided to implement for 2017 batch onwards.

2. Agenda item # 2 Addition of a few new Courses for Bachelors of Engineering- Mechanical Engineering and Master of Engineering- Thermal Engineering

The Head of the department highlighted the feedback received from the Alumni and Industrial experts and requested for the necessary new elective courses introduction on emerging technologies. Dr.L.Vijayaraghavan and Er.James Michael Amulu suggested to focus on Design for Manufacture and Assembly as the Industries look for the enhanced skills in the manufacturing industries. Also they pointed out to introduce Industrial Safety Engineering course so as to have completeness in skill addition during the study.

Based on the feedback, the following courses had been coined and were decided to be offered as elective courses from July 2019 onwards.

Course 1: Design for Manufacture and Assembly

Course 2: Industrial Safety Engineering

Resolutions: The BOS approved the suggested courses for inclusion in B.E. Mechanical Engineering programme curriculum. Dr. L. Vijayaraghavan and Mr. James Michael Amulu highlighted the importance of Design for Manufacture and Assembly & Industrial Safety Engineering for the ease of manufacturing in Industries and unanimously the syllabi developed by the team members were approved.

3. Agenda item # 3. Need of skills up in the professional domains to promote industry ready competency among learners. Necessary certification courses suggestion were taken for consideration to improve the domain knowledge.



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Dr. S.P. Venkatesan pointed out that the knowledge and skill on converting product in to patent will help the students to get the patent approval. Dr Ganesan also suggested the knowledge and skill on Non destructive testing methods will increase the employment opportunity in core Engineering fields. The members reviewed the requirements and suggested to plan workshops on Patent filing procedures and hands on training on Non Destructive Testing (NDT).

Resolutions: The BoS recommended and approved the agenda for enhancement of industry ready competency among learners.

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 students' choice

Internal members suggested the students' enrollment in NPTEL courses for completeness in learning . Dr L Vijayaraghavan pointed out that the completeness of learning fulfilled with the blend of curricular courses and NPTEL courses.

Resolutions: The BoS recommended and approved for introduction of advanced courses/NPTEL courses and it can be selected based on the specialization. Also the team recommended that creating awareness was necessary among the students and the students could select any of these courses at the end of the fourth semester.



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With the above discussion, the Head expressed his deep sense of gratitude to all members for an academic active discussion on the discussed contents. The members were thanked by the HoD and the meeting was smoothly completed.

Member	Designation	Signature
Dr.L.Vijayaraghavan	Professor	
Er.James Michael Amulu	Director	
Dr.G.Arunkumar	Professor and Head	
Dr.S.P.Venkatesan,	Associate Professor	
Dr.G.Senthilkumar	Associate Professor	
Dr. J.Jayaprabakar	Associate Professor	
Dr.S.Ganesan	Associate Professor	
Mr.Abhishek Singh Chauhan	Alumni Member	

1. Agenda item # 1 Modifications proposed for SME1302 – Fluid power systems Course.

SMEX1022	FLUID POWER SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I GENERAL INTRODUCTION **10 hrs.**

Introduction to fluid power – review of fundamental principles of fluid power – construction, operation and characteristics of gear pump, vane pump, variable displacement pump, piston pump. Fluid power actuators, linear and rotary – computation of force – flow requirement – cushioning – cylinder mountings – relative merits – selection criteria for specific applications – power pack design

UNIT II CONTROL SYSTEM COMPONENTS AND ACCESSORIES **10 hrs.**

Valves – non return valve for pressure control, direction control and flow control – servo valves and proportional control valves – valve actuation techniques – pressure, electrical and limit switches, Relief valve – brake valve – counter balance valve. Fluid power maintenance – filters – seals – reservoirs, selection of accumulators, hoses and couplings. Safety regulations as per BIS

UNIT III HYDRAULIC SYSTEMS **10 hrs.**

Fluid power symbols, hydraulic Circuits – regenerative – intensifier – metering out – bleed off. Design of circuits for specific applications – vehicle suspension systems – hydraulic press – low cost automation. Programmable logic control. Electrical control for FPCs. Temperature control in hydraulic circuits.

UNIT IV HYDRAULIC CIRCUIT **10 hrs.**

Circuits and selection of components with specification for the following applications – hydraulic or pneumatic systems for shapers – lift – hydraulic press – automatic reciprocating system – hydraulic cranes and earth moving equipments.

UNIT V PNEUMATIC SYSTEMS **10 hrs.**

Basic principles of pneumatic circuits – merits and demerits over hydraulic systems, pneumatic conditioners – filters – regulators – lubricators – mufflers – air dryers. Types of Air compressors – pneumatic actuators – control of pneumatic circuits – valves. Introduction to pneumatic logic control – pneumatic hydraulic circuits.

TEXT / REFERENCE BOOKS:

1. Anthony Esposito, Fluid Power with Applications – Prentice Hall, 1980
2. Princes M.J., and Ashby John, Power Hydraulics, Prentice Hall, 1980
3. Sullivan James P., Fluid Power Theory and Applications, Prentice Hall, 1989
4. James L Johnson, Introduction to Fluid power, Cengage Delmark Learning Edition, 2009.
5. Srinivasan, Hydraulics and Pneumatics, Tata McGraw Hill, 1st Edition, 2001
6. Shanthakumar S.R., Fluid power system, Anuradha Publications, 1996.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80

Exam Duration : 3 hrs.

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

20 marks

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

60marks

SME1302	FLUID POWER SYSTEMS (Common to Mech & M&P)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Perform the complete circuit analysis of the given hydraulic circuit taking into account the energy losses due to friction.
- CO2 - Suggest the appropriate system components, such as actuators, pumps, valves, switches, pipes and fittings, to the stated hydraulic applications.
- CO3 - Design a suitable hydraulic circuit for a specified application.
- CO4 - Suggest the appropriate system components, such as actuators, compressors, valves, switches etc. to the stated pneumatic applications.
- CO5 - Design a suitable pneumatic circuit for a specified application.
- CO6 - Recommend the safety guidelines, best practices, remedial actions and precautions for increasing the overall life of a hydraulic/ pneumatic applications.

UNIT 1 GENERAL INTRODUCTION OF CONTROL SYSTEM COMPONENTS AND ACCESSORIES 9 Hrs.

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 Pascal's Law- Laminar and Turbulent flow – Reynolds's number – Darcy's equation – Losses in pipe, valves and fittings. Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tandem, Rodless, Telescopic, Cushioning mechanism, Construction of doubleacting cylinder, Rotary actuators – Fluid motors, Gear, Vane and Piston motors – computation of force – flow requirement – cushioning – cylinder mountings

UNIT 2 HYDRAULIC CIRCUITS - I 9 Hrs.

Hydraulic Power – Pump classification – Gear pump, Vane Pump, piston pump – pump performance – Variable displacement pumps. Construction of Control Components : Director control valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Relief valve – brake valve - counter balance valve - Relays, ladder diagram - pressure, electrical and limit switches. Hydraulic Circuits – regenerative – intensifier – metering out – bleed off. Design of circuits for specific applications – vehicle suspension systems – hydraulic press - hydraulic copying machine circuit – low cost automation. Systems for shapers – lift – automatic reciprocating system – hydraulic cranes and earth moving equipments

UNIT 3 PNEUMATIC SYSTEMS 9 Hrs.

Pneumatic Components: Properties of air – Compressors – Filter, Regulator, and Lubricator Unit – mufflers – air dryers. Air control valves, Quick exhaust valves selection of accumulators. Types of Air compressors – pneumatic actuators – control of pneumatic circuits – valves.

UNIT 4 PNEUMATIC CIRCUITS 9 Hrs.

Basic principles of pneumatic circuits – merits and demerits over hydraulic systems, pneumatic conditioners – Programmable logic control- pneumatic hydraulic circuit. Electrical control for FPCs. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Pneumatic hydraulic circuit, Sequential circuit design for simple applications using cascade method.

UNIT 5 TROUBLESHOOTING AND APPLICATIONS 9 Hrs.

Development of hydraulic / pneumatic circuits applied to machine tools, presses, material handling systems, automotive systems, packaging industries, manufacturing automation. Maintenance in fluid power systems – preventive and breakdown. Maintenance procedures. Trouble shooting of fluid power systems - fault finding process, equipments, tools used, causes and remedies. Safety aspects involved

Max.

45 Hrs.

TEXT / REFERENCE BOOKS

1. Anthony Esposito, Fluid Power with Applications – Prentice Hall, 2003
2. Princes M.J., and Ashby John, Power Hydraulics, Prentice Hall, 1988
3. Sullivan James P., Fluid Power Theory and Applications, Prentice Hall, 1998
4. James L Johnson, Introduction to Fluid power, Cengage Delmark Learning Edition, 2009.
5. Srinivasan, Hydraulics and Pneumatics, Tata McGraw Hill, 2nd Edition, 2001.
6. Shanthakumar S.R., Fluid power system, Anuradha Publications, 1996.

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

2. Agenda item # 2 Addition of new Course for Bachelors of Engineering– Mechanical Engineering

SPR1604	DESIGN FOR MANUFACTURE AND ASSEMBLY	L	T	P	Credits	Total Marks
		3	0	0	3	100

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

CO1: Understand the concept of a product design procedure and accepted levels of tolerances. CO2: Classify products simply in terms of their basic shape and type of manufacturing process.

CO3: Apply a systematic approach in the field of design and redesigning of components in the manufacture of products.

CO4: Applying the design for assembly rules and application and design for reliability, quality and optimization to design new products

CO5: Understand and apply the concepts of value engineering in the design and manufacture of products.

CO6: Understand and apply the concepts of the reengineering in the design and manufacture of products. Performing case studies, brainstorming sessions to understand the concepts thoroughly to create new products.

UNIT 1 DFM METHOD AND TOLERANCE ANALYSIS

9 Hrs.

Elements of DFM-need for identification and problem definition concept generation and evaluation embodiment design-product architecture-configuration design-parametric design - Process capability - Feature tolerances-non Feature tolerances- Geometric tolerances ANSI symbol- Assembly limits Datum features - Tolerance stacks-computer aided tolerances.

UNIT 2 SELECTION OF MATERIALS AND MANUFACTURING PROCESS

8 Hrs.

Properties of engineering materials materials selections (ASHBY) chart- selections of shapes and co selection of materials and shapes- -design for bulk deformation process- design for sheet metal process design for machining design for powder metallurgy-design for polymer processing case studies

UNIT 3 COMPONENT DESIGN FROM CASTING CONSIDERATIONS AND MACHINING CONSIDERATION 10 Hrs.

Review of casting process-Cast holes- cored holes and machined holes-Possible and probable- parting lines.-Design for reducing /eliminating sand cores-Design considerations for turning, drilling, tapping, milling and grinding operations- provisions for clamping, reduction in machining area-Simplification by separation and amalgamation-productive machines.- redesigning of cast members using elements.

UNIT 4 DESIGN FOR ASSEMBLY AND RELIABILITY

8 Hrs.

Introduction-fits and tolerances. Assembly processes-Handling and insertion process-Manual, automatic and robotic Assembly-Cost of Assembly-Number of Parts-DFA guidelines- exploration of DFA software- failure mode effective analysis- design for reliability design for quality-design for optimization

UNIT 5 VALUE ENGINEERING AND RE- ENGINEERING

10 Hrs.

Value-types-functional- operational aesthetic cost- material design-process value and - worthiness procedure -brainstorming sessions- evaluation -case studies value estimation- value analysis - design for value - selection of alternatives -optimization implementation-Re-Engineering-Definition, Need & characteristics-frame work-case studies.

Max. 45 Hrs.

TEXT / REFERENCE BOOKS:

1. Harry Peck, Designing for Manufacture, Pitman Publications, 1983
2. George E Dieter, Engineering Design, McGraw-Hill Int Editions, 2000
3. Michael F. Ashby, Materials Selection in Mechanical Design, Fourth Edition

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

SPR1607	INDUSTRIAL SAFETY ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES:

On completion of the course, student will be able to

- CO1: Understand the functions and activities of safety engineering department.
- CO2: Explain the important legislations related to health, Safety and Environment and for the requirements mentioned in factories act for the prevention of accidents.
- CO3: Understand the statutory requirements for an Industry on registration, license and its renewal.
- CO4: Illustrate the role of hazardous waste management and use of critical thinking to identify and assess environmental health risks.
- CO5: Analyze the accident indices, frequency rate, severity rate, frequency severity-incidence, incident rate, accident rate, safety "t" score, safety activity rate and problems.
- CO6: Evaluate the safety performance of an organization from accident records and identify various agencies, support institutions and government organizations involved in safety training and promotion.

UNIT 1 INTRODUCTION

9 hrs

Evaluation of modern safety concepts - Safety management functions - safety organization, safety department - safety committee, safety audit - performance measurements and motivation - employee participation in safety - safety and productivity.

UNIT 2 OPERATIONAL SAFETY

9 hrs

Hot metal operation safety in Cutting safety in welding safety in Boilers- Pressure vessels Furnace (all types) - Heat treatment processes shops electroplating grinding forming processes- rolling forging - surface hardening casting Moulding coiling. Operational safety (cold metal operation), Safety in Machine shop - Cold bending and chamfering of pipes - metal cutting - shot blasting, grinding, painting - power press and other machines.

UNIT 3 SAFETY, HEALTH, WELFARE AND LAW

9hrs

Features of Factory Act explosive Act boiler Act ESI Act – workman's compensation Act industrial hygiene occupational safety diseases prevention ergonomics - Occupational diseases, stress, fatigue - Health, safety and the physical environment - History of legislations related to Safety-pressure vessel act-Indian boiler act - The environmental protection act - Electricity act - Explosive act.

UNIT 4 SAFETY PERFORMANCE MONITORING

9hrs

Permanent total disabilities, permanent partial disabilities, temporary total disabilities -Calculation of accident indices, frequency rate, severity rate, frequency severity-incidence, incident rate, accident rate, safety "t" score, safety activity rate problems.

UNIT 5 SAFETY MANAGEMENT

9hrs

Methods of promoting safe practice Safety organization- OSHA-Safety controls. visible and latent hazards - human factors and safety - safety audit - Case study roll of management and roll of Govt. in industrial safety - safety analysis Industrial fatigue- role of industrial psychology- risk analysis - safety training - accident and near miss investigations- promotional measures to avoid accidents - human reliability - safety management characteristics-industrial safety policies and implementation

Max. 45 Hrs.

TEXT / REFERENCE BOOKS:

1. Deshmukh, Industrial Safety Management, Tata McGraw Hill, 2008.
2. Krishnan N.V., "Safety in Industry", Jaico Publisher House, 1996
3. Nair P M C, Industrial safety and the law" Attam Publisher's, 1994
4. Roland P.Blake, Industrial Safety, Prentice Hall, 1963
5. Rollin.H.Simonds, John V, Grimaldi, Technology and Engineering, 1989
6. Roy Asfatil C, David W Rieske, Industrial safety and Health Management, Prentice Hall, 2009.
7. Joseph F. Gustin, Safety Management: A Guide for facility Management, The Fairmont Press, Inc., 2008

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 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

MECHANICAL ENGINEERING

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	4	100

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 SEMESTER examination)

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 rectangular 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	TE 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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SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY 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
4. Dr.S.P.Venkatesan, Associate Professor- Mechanical Engineering - Internal Member
5. Mr.R.Devaraj, Associate Professor- Mechanical Engineering - Internal Member
6. Dr.G.Senthilkumar, Assistant Professor- Mechanical Engineering - Internal Member
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 and development.

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, Heartz 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. Kevin 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**



SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
SCHOOL OF MECHANICAL ENGINEERING
Department of Mechanical Engineering

Minutes of Board of Studies meeting held on 10th November 2017

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.A.Krishnamoorthy, Professor and Head- Mechanical Engineering - Internal Member
4. Dr.S.P.Venkatesan, Associate Professor- Mechanical Engineering - Internal Member
5. Mr.R.Devaraj, Associate Professor- Mechanical Engineering - Internal Member
6. Dr.G.Senthilkumar, Assistant Professor- Mechanical Engineering - Internal Member
7. Mr.M.Purusothaman, Assistant Professor- Mechanical Engineering - Internal Member
8. Mr.Abhishek Singh Chauhan, Alumni- Internal Member

The meeting was started with the welcome speech by the Chair Person. The Chair person welcomed all the BoS members, and explained the agenda for the meeting. After deep discussion and recommendations, the following deliberations were made as per the items of the circulated agenda.

Agenda #1: Addition of new courses for Bachelors of Engineering- Mechanical Engineering

Based on the feedback from the Alumni, the Head of the department narrated the importance of including the courses on the emerging trends like renewable energy. Dr. L. Vijayaraghavan insisted the importance of non-conventional energy sources and the significance of including the same in the curriculum. Er. James Michael Amulu suggested the importance of fundamental knowledge on the elasticity for manufacturing sector. Based on their feedbacks and the mutual acceptance of majority, the Department proposed the following two courses to be included as the elective courses from January 2018.

Course1: SME1617 - Non Conventional Energy systems

Course 2: SME1620 - Theory of Elasticity

Resolutions:

The BOS members recommended for including the new courses in the curriculum, and approved for the inclusion in "B.E - Mechanical Engineering" programme.

Agenda #2: Skilling in professional domains to promote industry ready competency among learners. Necessary certification courses to improve the domain knowledge

The department offered the skill development programs, such as, Drafting and modelling using Solidworks, CATTIA and Tool path simulation. The head highlighted the salient features of these programs, and how these programs were effective for the students to promote Industry ready competency among learners.

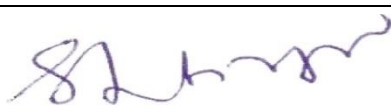
Resolutions: The BoS members approved the same to promote the industry ready competency among the students.

Agenda # 3: Any other points with the permission of Chair

The BoS members suggested the need of academic flexibilities so that the self-learning capabilities and advanced skills can be acquired by the students. The BoS members were also keen to know if any extra credits could be earned by students from off-campus learning.

Resolutions: The BoS recommended to promote the self-learning by encouraging students to opt for MOOC courses / NPTEL courses. It was also recommended 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, recommendations and resolutions, the Head expressed his deep sense of gratitude to all members for their valuable time, discussion, valuable suggestions and recommendations, and the approval. The meeting ended with the Vote of Thanks by the Chair.

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 courses for Bachelors of Engineering– Mechanical Engineering

SME1617	NON CONVENTIONAL ENERGY SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1: identify the energy demands and co relate with available energy resources

CO2: identify and to estimate the solar energy utilization and principles involved in solar energy Collection

CO3: understand the types of wind energy systems, and to implement the performance, safety and environmental aspects.

CO4: understand and pursue research work behind the concept of Bio mass, Bio gas and Bio diesel energy system

CO5: understand and evaluate tidal energy and other Renewable energies.

CO6: acquire knowledge on Geothermal energies and fuel cell systems.

UNIT 1 INTRODUCTION

9Hrs.

World Energy Use Reserves of Energy Resources Environmental Aspects of Energy Utilization –Renewable Energy Scenario in Tamilnadu, India and around the World - Potentials - Achievements / Applications Economics of renewable energy systems

UNIT 2 SOLAR ENERGY

9Hrs.

Solar Radiation Measurements of Solar Radiation - Flat Plate and Concentrating Collectors Solar direct Thermal Applications Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion Solar Cells Solar PV Power Generation Solar PV Applications.

UNIT 3 WIND ENERGY

9Hrs.

Wind Data and Energy Estimation Types of Wind Energy Systems Performance - Site Selection Details of Wind Turbine Generator Safety and Environmental Aspects

UNIT 4 BIO ENERGY

9Hrs.

Biomass direct combustion Biomass gasifiers Biogas plants Digesters Ethanol production Bio diesel Cogeneration - Biomass Applications

UNIT 5 OTHER RENEWABLE ENERGY SOURCES

9Hrs.

Tidal energy Wave Energy Open and Closed OTEC Cycles Small Hydro-Geothermal Energy Hydrogen and Storage - Fuel Cell Systems Hybrid Systems, Magneto Hydro dynamometer.

Max: 45 Hrs

TEXT/ REFERENCE BOOKS

1. G.D. Rai, Non Conventional Energy Sources, Khanna Publishers, New Delhi, 2011.
2. Twidell, J.W. & Weir, A., Renewable Energy Sources, EFN Spon Ltd., UK, 2006.
3. S.P. Sukhatme, Solar Energy, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
4. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K., 1996.
5. G.N. Tiwari, Solar Energy Fundamentals Design, Modelling & Applications, Narosa Publishing House, New Delhi, 2002.
6. David M. Mousdale Introduction to Biofuels, CRC Press, Taylor & Francis Group, USA 2010 Limited, New Delhi 2009.

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

SME1620	THEORY OF ELASTICITY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1: Understand the basic definitions of the theory of elasticity.

CO2: Understand the governing equations of elasticity.

CO3: Solve the 2D and 3D problems of elasticity

CO4: Evaluate the stress and strain conditions of beams.

CO5: Summarize the bending effects of various structures.

CO6: Evaluate the torsion effects on solid and hollow bars.

UNIT 1 INTRODUCTION

9 Hrs.

Definition, notations and sign conventions for stress and strain Stress - strain relations, Strain-displacement relations- Elastic constants. Coordinates and Tensors Transformation. Stress in Cartesian Coordinates. Principal Stresses and Principal Coordinates. Stress Ellipsoid.

UNIT 2 BASIC EQUATIONS OF ELASTICITY

9 Hrs.

Generalized Hooke's Law. Relationships between Elastic Moduli. Boundary-Value Problems in Elasticity. Navier's Equations. Beltrami-Michell's Equations. Saint-Venant's Principle.

UNIT 3 2D PROBLEMS OF ELASTICITY

10 Hrs.

Plane stress and plain strain problems -Airys stress function and cartesian coordinates. Biharmonic equations.

2-D problems Cantilever and simply supported beams. Thick-Walled Cylindrical Pure Bending of a Curved Beam in polar coordinates.

UNIT 4 3D PROBLEMS OF ELASTICITY

9 Hrs.

Bar Stretched by its Own Weight. Torsion of a Circular Shaft. Bending of a Prismatic Bar. Thermo elasticity- General Approach- Plane Thermoplastic Problem in Polar Coordinates.

UNIT 5 TORSION 8 Hrs.

Torsion of a uniform circular shaft. Torsion of Elliptical and Triangular sections bars. Torsion of hollow bars. Prandtl's theory- Membrane analogy.

Max: 45 Hrs

TEXT / REFERENCE BOOKS:

1. S.P. Timoshenko and J.N. Goodier, Theory of Elasticity, McGraw-Hill, 1985.
2. E. Sechler, "Elasticity in Engineering" John Wiley & Sons Inc., New York, 1980.
3. Ugural, A.C and Fenster, S.K, Advanced Strength and Applied Elasticity, Prentice hall, 2003
4. Wang, C.T. Applied elasticity, McGraw Hill 1993
5. Enrico Volterra and Caines, J.H, Advanced strength of Materials, Prentice Hall, 1991.

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**



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

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**SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
SCHOOL OF MECHANICAL ENGINEERING**

Department of Mechanical Engineering

Minutes of Board of Studies meeting held on 10th April 2017.

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.A.Krishnamoorthy, Professor and Head- Mechanical Engineering - Internal Member
4. Dr. S. P. Venkatesan, Associate Professor- Mechanical Engineering - Internal Member
5. Mr.R.Devaraj, Associate Professor- Mechanical Engineering - Internal Member
6. Dr.G.Senthilkumar, Assistant Professor- Mechanical Engineering - Internal Member
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 discussions of the members. The following deliberations were made as per the items of the circulated agenda.

1. Agenda Item # 1 :Syllabus Modifications proposed for the course SME1304 Power plant Engineering

The Head of the Department proposed some modifications for the course "SME1304 Power plant Engineering" based on the inputs from the subject experts. The suggested modifications are listed below:

Inclusion of the following topics in Unit I: Steam generators. Steam turbines, Binary cycles

Inclusion of the following topics in Unit II: Classification of plant instruments-Pressure gauges and types, Thermo-meters and types, Liquid level, gauges and types, Flow meter, pH measurement instruments, Gas Analysis, Impurity measurement instruments, Speed measuring instruments. Major Electrical Equipment in Power Plant-Layout of Electrical Equipment, Generator and Excites, Switch gear installations, Circuit breakers, Power transformers, Methods of Earthing a power system, Protective devices and control system used in power plant, Types of relays and voltage regulation.

Inclusion of the following topics in Unit III : Pressurized Water Reactor (PWR), CANada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants. Hydel plants – classification, selection of turbines, pumped storage system.

Inclusion of the following topics in Unit V Co-generation, types of Co-generation Systems and its economics , Waste Disposal Options for Coal and Nuclear Power Plants.

Resolutions: HOD pointed that the Inclusion of topics are necessary with viewpoints of Industrial requirements. The External members Dr. L. Vijayaraghavan and Er. James Michael Amulu are considered the revisions that are to be made and approved.

2. Agenda item # 2 Increase Skills in professional domains to promote industry ready competency among learners. Necessary Training programs and Value added courses

The Head pointed out that the Training program offered by the department in the field of Non Destructive Testing (NDT) and Value added program on Drafting and Modelling Using Solidworks will improve the skills in professional domains to promote industry ready competency among learners.

Resolutions: The BoS recommended the same and approved

3. Agenda Item #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 students' choice. Head asked for the suggestions from the BOS External members on students' specialization.

Resolutions: The BoS recommended that advanced courses/NPTEL courses and can be selected for the specialization.

With the above discussion, the Head expressed his deep sense of gratitude to all the 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 proposed SME1304 Power plant Engineering Course.

SMEX1016	POWER PLANT ENGINEERING	L	T	P	Credits	Total Marks
		2	1	0	3	100

UNIT I STEAM POWER PLANT

10 hrs.

Plant layout, types of firing systems – pulverized fuel, tilting and tangential firing system, pulverized bed combustion system. Coal handling systems – crushers – feeders, ash handling system – dust collectors and id fans – economizers, air preheaters, super-heaters, re-heaters.

UNIT II BOILER CALCULATIONS AND POWER CYCLES

10 hrs.

Subcritical and supercritical boilers, boiler calculations – boiler efficiencies, equivalent evaporation, boiler power. Condensers – types – calculation of vacuum efficiency, cooling towers – tower characteristics. Review of Rankine cycle – reheat regeneration with open and closed types of feed water heaters and their representation in TS diagram.

UNIT III GAS TURBINE, NUCLEAR AND HYDEL POWER PLANTS

10 hrs.

Gas turbine plants – open and closed cycles – construction details –, reheating regeneration and intercooling, combined cycle plants and their representation in TS diagram. Nuclear energy – fission – fusion reaction, nuclear fuel, enrichment, nuclear reactor – parts and types, waste disposal and safety in nuclear plants. Hydel plants – classification, selection of turbines, pumped storage system.

UNIT IV NON CONVENTIONAL ENERGY BASED POWER PLANT

10 hrs.

Non conventional energy – various forms – capacity – availability and limitations. Solar energy plants – various collecting devices – solar devices, photovoltaic cells and solar ponds, wind mills – types – site selection – capacity estimation – performance evaluation, tidal power plants, fuel cells – working – types – limitations, performance evaluation.

UNIT V ECONOMIC AND ENVIRONMENTAL ASPECTS

10 hrs.

Load curves, fixed and operating costs, economics of load sharing and plant selection, comparison of economics of various power plants and co-generation, environmental hazards of various power plants – SO₂, NO_x and particulate emissions and their control, land and water pollution.

TEXT / REFERENCE BOOKS:

1. Nagpal G.R., Power Plant Engineering – Khanna Publishers, 1996.
2. Domkundwar, Power Plant Engineering – Dhanpat Rai & Sons, Delhi, 1988.
3. Vopal and Stortzki, "Power Plant Engineering", PHI, 2007.
4. El Wakil M.N., "Power Plant Technology", McGraw Hill, 1985.
5. Joel Weisomon and Roy Eckart, "Modern Power Plant Engineering", PHI, 1985.
6. Rai G.D., "Non conventional sources of Energy", Khanna Publishers Delhi, 1994.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max Marks : 80

Exam Duration : 3 hrs.

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

20 marks

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

60marks

SME1304	POWER PLANT ENGINEERING (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 - Comprehend knowledge of various components and systems of steam power plant.
- CO2 - Evaluate the performance parameters of Boiler, condenser, feed water heater and cooling tower.
- CO3 - Examine the functions of various instruments used in power plant.
- CO4 - Analyze the various cycles of gas turbine and nuclear power plants.
- CO5 - Comprehend knowledge of various non-conventional energy based power plants.
- CO6 - Estimate the economic parameters and environmental aspects of power plant.

UNIT 1 STEAM POWER PLANT

9 Hrs.

Plant layout, types of firing systems – pulverized fuel, tilting and tangential firing system, pulverized bed combustion system. Coal handling systems – crushers – feeders, ash handling system – dust collectors and id fans – economizers, air preheaters, super-heaters, re-heaters, **Steam generators. Steam turbines, Binary cycles.**

UNIT 2 POWER PLANT EQUIPMENTS AND INSTRUMENTATION

9 Hrs.

Subcritical and supercritical boilers, boiler calculations – boiler efficiencies, equivalent evaporation, boiler power. Condensers types – Calculation of vacuum efficiency, Feed Heaters. cooling towers – tower characteristics. **Classification of plant instruments-Pressure gauges and types, Thermo-meters and types, Liquid level, gauges and types, Flow meter, pH measurement instruments, Gas Analysis, Impurity measurement instruments, Speed measuring instruments. Major Electrical Equipment in Power Plant-Layout of Electrical Equipment, Generator and Excites, Switch gear installations, Circuit breakers, Power transformers, Methods of Earthing a power system, Protective devices and control system used in power plant, Types of relays and voltage regulation.**

UNIT 3 GAS TURBINE, NUCLEAR AND HYDEL POWER PLANTS

9 Hrs.

Gas turbine plants – open and closed cycles – construction details –, reheating regeneration and intercooling, combined cycle plants and their representation in TS diagram. Nuclear energy – fission – fusion reaction, nuclear fuel, enrichment, nuclear reactor – parts and types, **Pressurized Water Reactor (PWR), CANada Deuterium- Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants. Hydel plants – classification, selection of turbines, pumped storage system.**

UNIT 4 NON CONVENTIONAL ENERGY BASED POWER PLANT

9 Hrs.

Non conventional energy – various forms – capacity – availability and limitations. Solar energy plants – various collecting devices – solar devices, photovoltaic cells and solar ponds, wind mills – types – site selection – capacity estimation –performance evaluation, tidal power plants, fuel cells – working – types – limitations, performance evaluation. Geo thermal and biogas power plant.

UNIT 5 ECONOMICS AND ENVIRONMENTAL ASPECTS

9 Hrs.

Load curves, fixed and operating costs, economics of load sharing and plant selection, comparison of economics of various power plants , **Co-generation, types of Co-generation Systems and its economics , environmental hazards of various power plants- CO₂ SO_x, NO_x and particulate emissions and their control, land and water pollution. Waste Disposal Options for Coal and Nuclear Power Plants.**

Max.45 Hrs.

TEXT / REFERENCE BOOKS

1. Nagpal G.R., Power Plant Engineering – Khanna Publishers, 1996.
2. Domkundwar, Power Plant Engineering – Dhanpat Rai & Sons, Delhi, 1988.
3. Vopal and Stortzki, "Power Plant Engineering", PHI, 2007.
4. El Wakil M.N., "Power Plant Technology", McGraw Hill, 1985.
5. Joel Weisomon and Roy Eckart, "Modern Power Plant Engineering", PHI, 1985.
6. Rai G.D., "Non conventional sources of Energy", Khanna Publishers Delhi, 1994.

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
PART B: 4 Questions each with internal choice from C01-C04, 1 question from C05 and
C06 with internal choice, each carrying 16 marks

20 Marks

80 Marks

 - **Modifications proposed SME1304 Power plant Engineering Course.**