



# SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY**

(DEEMED TO BE UNIVERSITY)

Accredited with "A" Grade by NAAC

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

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## School of Mechanical Engineering

### Department of Mechanical Engineering

Minutes of meeting of Board of Studies Virtual meet held on 8<sup>th</sup> 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



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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.

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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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	



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## 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		

### 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.

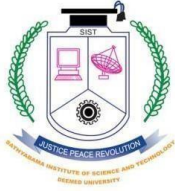
Strategic issues: - Actions - Issues - Focus - Leadership - Management of teams Training. Focused factory concept Availability, Variability, Lean implementation strategies, causes for failures, sustaining lean, and constraint management.

#### 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**



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## 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 Willey & 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 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 proposed for 2019 batch Bachelors of Engineering- Mechanical Engineering course syllabus



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## SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY

SCHOOL OF MECHANICAL ENGINEERING

Department of Mechanical Engineering

### Minutes of Board of Studies Virtual meeting held on 18<sup>th</sup> 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



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**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**