SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Accredited with 'A' grade by NAAC
Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 600 119.

Department of Mechatronics Engineering

School of Mechanical Engineering

Minutes of Board of Studies Meeting held on 12-06-2021 (Saturday)

Meet Time: 10.45 a.m. to 12.30 noon

The meeting started with the welcome address delivered by Dr. S. Prakash, Professor and Dean (Session Chair). He introduced the various new courses and revised courses offered to Mechatronics Engineering students to the BOS panel members. The following are the BOS members were present during the Mechatronics Engineering BOS meeting.

Sl. No.	Name	Designation	Institution	Role
1	Dr. S. Prakash	Professor and Dean	Sathyabama Institute of Science & Technology	Chair person
2	Dr.L.Vijayaraghavan	Professor	IIT Madras, Chennai	BoS Member (External)
3	Dr.N.GaneshKumar	Associate Professor	PSG Tech, Coimbatore	BoS Member (External)
4	Dr. B. Kanimozhi	Professor	Sathyabama Institute of Science & Technology	Member
5	Dr. S. Sivasaravanan	Associate Professor	Sathyabama Institute of Science & Technology	Member
6	Dr. M Sangeetha	Associate Professor	Sathyabama Institute of Science & Technology	Member
7	Dr. J. R. Deepak	Associate Professor	Sathyabama Institute of Science & Technology	Member
8	Dr.J. Lilly Mercy	Assistant Professor	Sathyabama Institute of Science & Technology	Member
9	Mr. V. Jayaprakash	Assistant Professor	Sathyabama Institute of Science & Technology	Member
10	Mr. J. Senthil Kumar	Assistant Professor	Sathyabama Institute of Science & Technology	Member
11	Mr. M Vigneshwar	Students	Sathyabama Institute of Science & Technology	Student Member
12	Mr Aman Dinodya	Students	Sathyabama Institute of Science & Technology	Student Member

- Dr. J. R. Deepak proposed a new course entitled **Robotics and Machine Vision System SMR1401** (Theory) and **Robotics Lab SMR4052** (Practical) courses based on the futuristic requirements for the students in the field of robotics and Automation. On learning this course students will be able to design and develop various robots and End effectors for various applications. Students will be able to write programs for robots for various industrial automation applications. The course curriculum able the student to select the appropriate end effector, actuator, driver for various process and loading applications.

- **SMR1402 Computer Aided Design** (Theory) **SPR4054 CAD / CAM Lab** (Practical) course was proposed by Dr. Sangeetha as the students has to learn the basics concepts of CAD and to learn 2D and 3D modelling CAD and CAM software's likes PROE, CREO, SOLIDWORKS, CATIA, FANUC Simulator, MASTER CAM which enhances the modelling and programing skill which will help the student to become a CAD Designer and CNC Programmers in manufacturing and automation industries.

- **SMRA2501 Mechatronics and Simulation lab** course was revised and proposed from the **2018 regulation** practical course **SME4058 Mechatronics Lab** by Mr. V. Jayaprakash as the students has to learn the basics of Fluid Sim Software enhances the programing skill which will help the student to become a Hydraulic and pneumatic system Designer for automation industries. Students will be able simulation package by constructing the system models for the specified

- Dr. N. Ganesh Kumar, Associate Professor from PSG Tech welcomed the idea of introducing **Robotics and Machine Vision System SMR1401** (Theory) and **Robotics Lab SMR4052** (Practical) courses saying that skill set of the students of Sathyabama Institute of science and technology will match the current needs of the industry in introducing **Robotics and Machine Vision System SMR1401** (Theory) and **Robotics Lab SMR4052** (Practical) in the curriculum

- Dr. L. Vijayaraghavan, Professor from IIT Madras, Chennai and Dr. N. Ganesh Kumar, Associate Professor from PSG Tech (External BOS members) reviewed all the courses. The Board members appreciated the inclusion of the new courses in 2019 Regulation.

• NEWELY PROPOSED AND REVISED COURSES

SMR1401	Robotics And Machine Vision System	2021	7	New
SMR1402	Computer Aided Design	2021	7	New
SPR4054	CAD / CAM Lab	2021	7	New
SMR4052	Robotics Lab	2021	7	New
SMRA2501	Mechatronics and Simulation lab	2021	5	Revised

• NEW COURSES

SMR1401 ROBOTICS AND MACHINE VISION SYSTEM
L T P Credits Total Marks
3 0 0 3 100
COURSE OBJECTIVE
 Upon completion of this course, the students can able to apply the basic engineering knowledge for the design of robotics
UNIT 1 BASICS OF ROBOTICS 9 Hrs.
Introduction- Basic components of robot-Laws of robotics- classification of robot-work space accuracy- resolution – repeatability of robot. Power transmission system: Rotary to rotary motion, Rotary to linear motion, Harmonics drives
UNIT 2 ROBOT END EFFECTORS 9 Hrs.
Robot End effectors: Introduction- types of End effectors- Mechanical gripper- types of gripper mechanism- gripper force analysis- other types of gripper- special purpose grippers.
UNIT 3 ROBOT MECHANICS 9 Hrs.
Robot kinematics: Introduction- Matrix representation- rigid motion & homogeneous transformation forward & inverse kinematics- trajectory planning. Robot Dynamics: Introduction – Manipulator dynamics – Lagrange - Euler formulation- Newton - Euler formulation
UNIT 4 MACHINE VISION FUNDAMENTALS 9 Hrs.
Machine vision: image acquisition, digital images-sampling and quantization-levels of computation Feature extraction- windowing technique- segmentation- Thresholding- edge detection- binary morphology - grey morphology
UNIT 5 ROBOT PROGRAMMING 9 Hrs.
Robot programming: Robot Languages- Classification of robot language-Computer control and robot software-Val system and Languages- application of robots.
Max. 45 Hours

COURSE OUTCOMES
On completion of the course, student will be able
CO1 - To understand the basic concepts of Robotics.
CO2 - To educate the various types of End effectors used in robots for various applications.
CO3 - To introduce the position representation on work space.
CO4 - To understand machine vision system and its applications.
CO5 - To impart knowledge on robot programming language and to educate how to program a robot.
CO6 - Upon completion of this course, the students can able to apply the basic engineering knowledge for the design of robotics.
TEXT / REFERENCE BOOKS:
1. M.P.Groover, M.Weiss ,R.N. Nagal, N.G.Odrey, "Industrial Robotics - Technology, programming and Applications" Tata , McGraw-Hill Education Pvt Limited, 2008
2. Sathya Ranjan Deb, "Robotics Technology & flexible Automation" Sixth edition, Tata McGraw- Hill Publication, 2003.

3. K.S.Fu, R.C.Gonzalez, C.S.G.Lee, "Robotics: Sensing, Vision & Intelligence", Tata McGraw- Hill Publication, 1987.
4. John.J.Craig, "Introduction to Robotics: Mechanics & control", Second edition, 2002.
5. Jazar, "Theory of Applied Robotics: Kinematics, Dynamics and Control", Springer, Indian Reprint, 2010
END SEMESTER EXAM QUESTION PAPER PATTERN
Max. Marks : 100 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 16 marks 80 Marks

SMR1402 COMPUTER AIDED DESIGN
L T P Credits Total Marks
3 0 0 3 100
COURSE OBJECTIVES
 To provide an overview of how computers are being used in mechanical component design
 Enable students to use computer and CAD software's for modeling of mechanical components
UNIT 1 FUNDAMENTALS OF COMPUTER GRAPHICS 9 Hrs.
Product cycle- Design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations homogeneous coordinates - Line drawing -Clipping- viewing transformation
UNIT 2 GEOMETRIC MODELING 9 Hrs.
Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling– surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG and B-rep
UNIT 3 VISUAL REALISM 9 Hrs.
Hidden – Line-Surface-Solid removal algorithms – shading – colouring – computer animation.
UNIT 4 ASSEMBLY OF PARTS 9 Hrs.
Assembly modelling – interferences of positions and orientation – tolerance analysis-mass property calculations – mechanism simulation and interference checking.
UNIT 5 CAD STANDARDS 9 Hrs.
Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchangeimagesOpen Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, CALSetc. - communication standards.
Max. 45 Hours
COURSE OUTCOMES
On completion of the course, student will be able to
CO1 - Understand the basics of computer graphics, different graphics systems and applications of computer graphics
CO2 - Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.
CO3 - Use of geometric transformations on graphics objects and their

application in composite form.
CO4 - Extract scene with different clipping methods and its transformation to graphics display device.
CO5 - Explore projections and visible surface detection techniques for display of 3D scene on 2D screen.
CO6 - Render projected objects to naturalize the scene in 2D view and use of illumination models for this.
SATHYABAMA UNIVERSITY FACULTY OF MECHANICAL ENGINEERING
B.E. / B. TechREGULAR 89 REGULATIONS 2018
TEXT / REFERENCE BOOKS:
1. Ibrahim Zeid “Mastering CAD CAM” Tata McGraw-Hill Publishing Co.2007
2. Chris McMahon and Jimmie Browne “CAD/CAM Principles", "Practice and Manufacturing management “ Second Edition, Pearson Education, 1999.
3. William M Neumann and Robert F.Sproul “Principles of Computer Graphics”, McGraw Hill Book Co. Singapore, 1989.
4. Donald Hearn and M. Pauline Baker “Computer Graphics”’. Prentice Hall, Inc, 1992.
5. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson Education - 2003.
END SEMESTER EXAM QUESTION PAPER PATTERN
Max. Marks : 100 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 16 marks 80 Marks

SPR4054 CAD /CAM LAB
(For Mech, Mech&Prod & Auto)
L T P Credits Total Marks
0 0 4 2 100
SUGGESTED LIST OF EXPERIMENTS
A.CAD LAB
CAD ANALYSIS USING ANALYSIS SOFTWARE
Exercises will be given on Analyzing of mechanical components using Suitable Software
1. Cantilever beam with Point load at the end
2. Simply supported beam with inclined load
3. Overhanging beam with Uniformly distributed load (UDL)
4. Determination of deflection for a Truss system
5. Determination of deflection in a Pressure vessel
6. Determination of deflection in a Bent tube
7. Determination of temperature distribution in a stepped bar
8. Analysis of a bicycle frame
9. Thermal - mixed boundary example
B.CAM LAB
1. CNC Milling
(i). Part Programming for: Point to point motions, Contour motions, Circular milling, Linear motions, Pocket milling, Mirroring Commands, Circular interpolations (both CW & CCW), Rectangular milling.
(ii). Part Programming involving fixed or canned cycles: Drilling, Peck drilling, Boring and Tapping. (iii). Part programming using: Do loops, Sub Routines.
2. CNC Lathe
(i). Part programming for: Turning, Facing, Chamfering, Grooving, Step Turning, Taper Turning, Circular Interpolation.
(ii). Part programming using standard fixed cycles: Turning, Facing, Taper Turning, Thread Cuttings.
COURSE OUTCOME
CO1 - Execute steps required for modeling 3D objects by using protrusion, cut, sweep, extrude commands
CO2 - Convert 3D solid models into 2D drawing-different views, sections
CO3 - Use isometric views and dimensioning of part models
CO4 - Machine simple components on CNC machines
CO5 - Use CAM software to generate NC code
CO6 - Implement CNC programs for milling and turning machining operations

SMR4052 ROBOTICS LAB
L T P Credits Total Marks
0 0 4 2 100
SUGGESTED LIST OF EXPERIMENTS
1. Study of Robot anatomy and programming methods
2. Study of sensor operations using LEGO kits
3. Study of Actuators using LEGO kits
4. Programming of basic motion commands using Teach pendant
5. Programming for pick and place operation in ROBOT
6. Programming the robot for a drilling application
7. Programming on palletizing operation
8. Programming a parallel kinematic robot for a pick and place application
9. Introduction to Matlab for Image processing
10. Reduction and Noise and Grey levels using Matlab
Course Outcome
After the successful completion of the course the students will be able to:
CO1 - Explain the fundamentals of robotics and its components
CO2 - Illustrate the Kinematics and Dynamics of robotics
CO3 - Elucidate the need and implementation of related Instrumentation & control in robotics
CO4 - Illustrate the movement of robotic joints with computers/microcontrollers.
CO5 - Explain sensors and instrumentation in robotics
CO6 - To learn about application of robot

- **REVISED COURSES**

SMRA2501 MECHATRONICS AND SIMULATION LAB
L T P Credits Total Marks
0 0 4 2 100
COURSE OBJECTIVES
ÿ To teach basics about the mechatronics systems and its interfacing.
ÿ To teach basic concepts of lab view software and its applications.
ÿ To teach fundamentals about image processing techniques.

SUGGESTED LIST OF EXPERIMENTS
a. Basic cylinder sequencing operations using pneumatic trainer kit.
b. Simulation of basic hydraulic and pneumatic circuits using software.
c. Experiment on cylinder sequencing for A+ B+ A- B- using pneumatic trainer kit.
d. Proportional Integral Derivative (PID) controller interfacing.
e. Basic operations and interfacing of sensors in lab view.
f. Study of Boolean operations in lab view.
g. Speed control of stepper and servo motor using microprocessor kit.
h. A/D and D/A Conversion.
i. Assembly language programming of 8085 – Addition – Subtraction – Multiplication – Division – Sorting – code conversion.
j. Design and testing of fluid power circuits to control (i) Velocity (ii) direction and (iii) force of single and double
acting actuators.
k. Study of Image Processing Technique.

COURSE OUTCOMES
On completion of the course, student will be able to
CO1 - Understand basics about pneumatic and hydraulic circuits.
CO2 - Understand basics about valves and controls.
CO3 - Understand the concepts of using PID controllers.
CO4 - Understand the knowledge of servo and stepper drives.
CO5 - Understand the concept of using Lab views.
CO6 - Understand the basics of analogue to digital convertors.

SME4058 MECHATRONICS LAB (2018 – Regulation)

(For Mech, Mech & Prod and Mechatronics)
L T P Credits Total
Marks
0 0 4 2 100

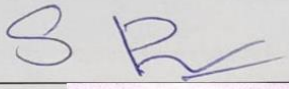
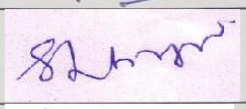
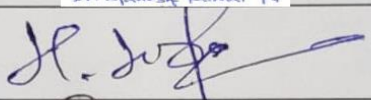
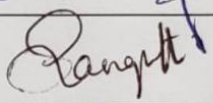
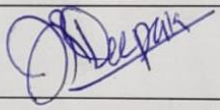
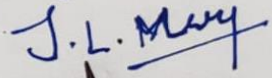
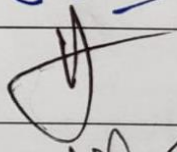
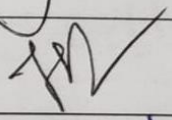
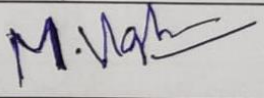
SUGGESTED LIST OF EXPERIMENTS
1. Basic cylinder sequencing operations using Pneumatic trainer Kit.
2. Simulation of basic Hydraulic and Pneumatic circuits using software
3. Experiment on cylinder sequencing for A+ B+ A- B- using pneumatic trainer kit.
4. Development of ladder logic programs based on Timer and Counter instructions
5. Proportional Integral Derivative (PID) controller interfacing
6. Basic operations and interfacing of Sensors in Lab view.
7. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using LAB VIEW software
8. Speed control of stepper and servo motor using microprocessor kit.
9. A/D and D/A Conversion
10. Study of frequency response of closed loop systems using MATLAB

COURSE OUTCOMES
On completion of the course, student will be able to
CO1: Recommend the pneumatic/ hydraulic circuit and the component specifications required for the stated fluid power application using a fluid power simulation package.
CO2: Use the pneumatic/ hydraulic trainer kit to make the required pneumatic/ hydraulic cylinder sequencing.
CO3: Predict the system behavior using a simulation package by constructing the system models for the specified mechatronic systems.
CO4: Examine the signal conditioning systems and interfacing systems used in the mechatronics systems.
CO5: Develop the ladder programming in a simulation package for the given mechatronics systems.
CO6: Make the mechatronic circuit using the microprocessor/ microcontroller for the required mechatronic application.

Note:

- The Contents Highlighted in Green Colour are new inclusions
- The Contents Highlighted in Yellow Colour remains unchanged
- The Contents Highlighted in red colour are the portions being removed.

- Signature of BOS members

Sl. No.	Name	Signature
1	Dr. S. Prakash	
2	Dr.L.Vijayaraghavan	
3	Dr.N.Ganesh Kumar	
4	Dr. S. Sivasaravanan	
5	Mrs. M Sangeetha	
6	Mr. J. R. Deepak	
7	Dr. J. Lilly Mercy	
8	Mr. V. Jayaprakash	
9	Mr. J. Senthil Kumar	
10	Mr. M Vigneshwar	
11	Mr Aman Dinodya