

16/10/2025
odalarum

TO

The Principal,
B.V.C Engineering College(A),
odalarum.

Sub: Regarding Honorarium for the BOS Experts - Request Reg.

Respected Sir,

I, HOD of ME, kindly bring to your notice that our department have conducted BOS for BR25, M.Tech on 10/10/2025. I kindly request you to sanction an amount of 37,500/- as the honorarium for BOS experts.
Thirty seven thousand and five hundred rupees only.
I here with mention the account details

SBI Account NO : 32145928946

IFSC: SBIN0006832

Branch: Aganampudi

A/C Holder name: M. Naveen Srinivas

I kindly request you to consider the above request and take proper action.

Thank You Sir

Yours faithfully
Dr. M. Naveen Srinivas
Naveen
16/10/25



BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE (AUTONOMOUS)

ODALAREVU - 533 210, Allavaram Mandal, Dr.B.R.Ambedkar Konaseema District, Andhra Pradesh, INDIA

Email: bvce@bvcegroup.in

Website: www.bvcec.edu.in

Mobile:93925 22444

Odalarevu,
Dt: 16/10/2025

To
The Principal,
Bonam Venkata Chalamayya Engineering College(A),
Odalarevu.

Sub:Regarding Honorarium for External Members of BOS conducted on 10/10/2025 - request Reg.

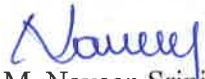
I, HOD of ME Dept. kindly bring to your notice that we have conducted BOS meeting for BR25 M. Tech course structure and syllabus ratification on 10/10/2025. In this regard, I am requesting you to sanction the following Honorarium for the BOS Experts. I kindly request you to look over this.

S.No	Name of the BOS Expert	Address	Honorarium
1	Dr. M. Ravi Sankar	IIT Tirupati	7500
2	Dr. T. Babu Rao	NIT AP	7500
3	Dr. M. Kumara Swamy	UCEK, Kakinada	15000
4	Mr. K M Dakshina Murty	Sr. Deputy General Manager, BHEL-Hyderabad	5000
5	Mr. Uggirala Srinivas	Technical officer C, PG Alumni	2500

37,500/-

Thanking you sir.

Yours Sincerely


Dr. M. Naveen Srinivas
HOD-ME



BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE

(An Autonomous)

(Approved by AICTE, New Delhi with PIO/Foreign National Status, Permanently Affiliated to JNTUK, Kakinada)

Sponsored by BONAM VENKATA CHALAMAYYA EDUCATIONAL SOCIETY, Edarapally, Amalapuram

Odalarevu – 533210, Allavaram Mandal, Dr. B. R. Ambedkar Konaseema District, Andhra Pradesh, India

Cell: 9392522444, Email: bvce@bvcgroup.in, Web: www.bvcec.edu.in

BVCE/BOS/MEC/2025

Date: 09.10.2025

To

Dr. M. Kumara Swamy,

Associate Professor

Department of Mechanical Engineering, UCEK(A), JNTUK Kakinada.

Sub: BVCE – Odalarevu - Request to attend the BOS Meeting – BR25_M.
Tech_ME_Course Structure & Syllabus – Reg.

Respected Sir,

Greetings from Board of Studies of Mechanical Engineering, B V C Engineering College, Odalarevu.

We thank you for your kind consent in scheduling our Advanced Manufacturing Systems, M. Tech – BOS meeting of BR25 curriculum. In this regard, we bring to your kind notice that the Mechanical Engineering Department BOS meeting is scheduled on 10th, October-2025(Friday) from 2pm in virtual mode (online).

The agenda of BOS meeting:

1. Discussion on the ratification of the course structure and syllabus of M.Tech in Advanced Manufacturing Systems (BR25).
2. Any other item.

On behalf of the Management and BOS of Mechanical Engineering, We whole heartedly invite you to attend this meeting and offer your valuable suggestions.

The details of online meeting link shall be shared with you

Thanking you sir.

Yours sincerely

(Dr. M. Naveen Srinivas)
Chairman-BOS



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BVCE/BOS/MEC/2025

Date: 09.10.2025

To

Mr. K. M. Dakshina Murty,

Sr. Deputy General Manager

Power Plant Dynamics & Simulation, BHEL, Hyderabad-93

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BVCE/BOS/MEC/2025

Date: 09.10.2025

To

Dr. T. Babu Rao,

Assistant Professor, Dept. of ME,

NIT Andhra Pradesh, 534101.

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Cell: 9392522444, Email: bvce@bvcgroup.in, Web: www.bvcec.edu.in

BVCE/BOS/MEC/2025

Date: 09.10.2025

To

Mr. Uggirala Srinivas,

Technical officer-C,

ISRO-SHAR, Sriharikota, Andhra Pradesh - 524124

Sub: BVCE – Odalarevu - Request to attend the BOS Meeting – BR25_M.
Tech_ME_Course Structure & Syllabus – Reg.

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Cell: 9392522444, Email: bvce@bvcgroup.in, Web: www.bvcec.edu.in

BVCE/BOS/MEC/2025

Date: 09.10.2025

To

Dr. M. Ravi Sankar,

Professor & HOD, Dept. of ME,

IIT Tirupati, Andhra Pradesh, - 517619.

Sub: BVCE – Odalarevu - Request to attend the BOS Meeting – BR25_M.
Tech_ME_Course Structure & Syllabus – Reg.

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BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, ODALAREVU

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

M.Tech in Advanced Manufacturing Systems

BOS MEETING (BR 25 REGULATION)

Date of meet: 10/10/2025

TIME: 2.00 p.m

MINUTES OF MEETING

Chairman of Board of Studies (BOS) welcomed all the members of the BOS to the meeting of 3rd BOS for R25 Regulation, conducted in Virtual mode on 10th, October, 2025 from 2.00 PM. Following are the Minutes of this meeting:

1. The Chairman, BOS, briefed the agenda of the 3rd BOS meeting for the R25 Regulation of the M.Tech. program in Advanced Manufacturing Systems.

2. *Item-2: R25 I & II Year Course Structure & Syllabus*

Presented the Course Structure and Syllabus for I and II Year M.Tech (I and II Semesters), prepared in line with JNTUK-R25 Regulations.


Chairperson- BOS of
Mechanical Engineering



BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, ODALAREVU

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

Members Present:

Sl.No.	Name of Member	Signature
1	Dr.M.Naveen Srinivas, Asst.Professor & HOD, Chairman-BOS	Naveen
2	Dr. M. Kumara swamy, Assoc.Professor, Dept of ME, UCEK, JNTUK, Kakinada	online
3	Dr. Mamilla Ravi Shankar, Professor & Head, Dept of ME, IITTP, Thirupathi.	online
4	Dr. Thella Babu Rao, Assistant Professor & Head, Dept of ME, NITAP, TadepalliGudem	online
5	Sri. K.M.Dakshina Murty, Sr, Dy. General Manager, Bharat Heavy Electricals Limited, Hyderabad	online
6	Mr. Uggirala Srinivas, Technical officer-c, ISRO-SHAR, Sriharikota	online
7	Dr. GOSANGI NARASA RAJU, Professor	Gosangi
8	Dr. SUJEET KUMAR. Asst. Professor	Sujeet
9	Mr. BATHULA SRINIVAS, Professor	
10	Mr. Y V RAMANA MURTY, Associate Professor	Y V Ramana Murty
11	Mr. GIDDI VENKATESWARARAO, Associate Professor	Giddi Venkateswararao
12	Mr. NITCHENAKOLLA VASUDEVA RAO, Associate Professor	N. Venkata Rao
13	Mr. GUBBALA GANESH, Asst.Professor	G. Ganesh
14	Mr. NATHI GURU MURTHY, Asst.Professor	N. G. Murthy
15	Mr. K. Krishna Chaitanya, Asst.Professor	K. Krishna Chaitanya
16	Mr. S. Manoj Kumar	S. Manoj Kumar

Naveen
Chairperson- BOS of
Mechanical Engineering



BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, ODALAREVU

(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

M.Tech in Advanced Manufacturing Systems

BOS MEETING (BR 25 REGULATION)

Date of meet: 10/10/2025

TIME: 2.00 p.m

AGENDA

1. Welcome address by BOS chair person.
2. Discussion on the ratification of the course structure and syllabus of M.Tech in Advanced Manufacturing Systems (BR25).

Copy circulation through e-mail

External BOS members:

- 1) Dr. M. Kumara Swamy
Associate Professor, Dept. of ME, UCEK(A), JNTUK
- 2) Dr. M. Ravi Sankar
Professor & HOD, Dept. of ME, IIT Tirupati
- 3) Dr. T. Babu Rao
Assistant Professor, Dept. of ME, NIT Andhra Pradesh
- 4) Mr. K M Dakshina Murty
Sr. Deputy General Manager, BHEL-Hyderabad
- 5) Mr. Uggirala Srinivas
Technical officer-C, ISRO-SHAR, Andhra Pradesh



BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE, ODALAREVU
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

INTERNAL BOS MEMBERS

Sl.No.	Name of Member
1	Dr.M.Naveen Srinivas, Asst.Professor & HOD, Chairman-BOS
2	Dr. GOSANGI NARASA RAJU, Professor
3	Dr. SUJEET KUMAR. Asst. Professor
4	Mr. B. SRINIVAS, Professor
5	Mr. Y V RAMANA MURTY, Associate Professor
6	Mr. GIDDI VENKATESWARARAO, Associate Professor
7	Mr. NITCHENAKOLLA VASUDEVA RAO, Associate Professor
8	Mr. GUBBALA GANESH, Asst.Professor
10	Mr. NATHI GURU MURTHY, Asst.Professor
11	Mr. K. Krishna Chaitanya, Asst.Professor
12	Mr. S. Manoj Kumar, Asst.Professor


Chairperson- BOS



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BVCE/BOS/MEC/2025

Date: 09.10.2025

To
Dr. T. Babu Rao,
Assistant Professor, Dept. of ME,
NIT Andhra Pradesh, 534101.

Sub: BVCE - Odalarevu - Request to attend the BOS Meeting - BR25_M.
Tech_ME_Course Structure & Syllabus - Reg.
Respected Sir,

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On behalf of the Management and BOS of Mechanical Engineering, We whole heartedly invite you to attend this meeting and offer your valuable suggestions.

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Thanking you sir.

Yours sincerely

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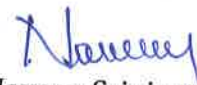
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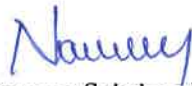
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Chairman-BOS

**BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE***(An Autonomous Institution)***Department of Mechanical Engineering****M. TECH (BR25) ADVANCED MANUFACTURING SYSTEMS****COURSE STRUCTURE & SYLLABUS****Course Structure:****I - Semester**

S.No	Course Code	Course Name	L	T	P	Credits
1	25AM1T01	Automation in Manufacturing	3	1	0	4
2	25AM1T02	Advanced Manufacturing Processes	3	1	0	4
3	25AM1T03	AI&ML for Mechanical Engineering	3	1	0	4
4		Program Elective – 1	3	0	0	3
	25AM1D01	Design for Manufacturing & Assembly				
	25AM1D02	Quality Engineering in Manufacturing				
	25AM1D03	Industrial Robotics				
	25AM1D04	Introduction to Quantum Technologies				
5		Program Elective – 2	3	0	0	3
	25AM1D05	Optimization & Reliability				
	25AM1D06	Nano Technology				
	25AM1D07	Precision Engineering				
	25AM1D08	Additive Manufacturing				
6	25AM1L01	Advanced CAD Lab	0	0	4	2
7	25AM1L02	Advanced Manufacturing Lab	0	0	4	2
8	25AM1S01	Seminar I	0	0	2	1
Total						23

online	online	online	online	online	Names
Dr. M. Kumara Swamy Assoc. Professor, Dept. of ME, UCEK (A), JNTUK	Dr. M. Ravi Sankar Prof. & Head, Dept. of ME, IITTP	Dr. T. Babu Rao, Asst. Professor, Dept. of ME, NITAP	Mr. K. M. Dakshina Murty, Sr. DGM, BHEL-HYD	Mr. U. Srinivas Technical officer C, ISRO-SHAR, Sriharikota	Dr. M. Naveen Srinivas, HOD-ME, BVCE(A)
Member-Affiliating Univ. Nominee	Subject Expert	Subject Expert	Industry Expert	PG Alumni	Chair-person BOS

**BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE***(An Autonomous Institution)***Department of Mechanical Engineering****M. TECH (BR25) ADVANCED MANUFACTURING SYSTEMS****COURSE STRUCTURE & SYLLABUS****Course Structure:****III-Semester**

S.No	Course Code	Course Name	L	T	P	Credits
1	25HM3D01	Research Methodology and IPR/Swayam 12 Week MOOC Course RM&IPR	3	0	0	3
2	25AM3P01	Summer Internship/Industrial Training (8-10 Weeks)	0	0	0	3
3	25AM3V01	Comprehensive Viva	0	0	0	2
4	25AM3P02	Dissertation Part - A	0	0	20	10
Total						18

*MOOCS/NPTEL certification courses as per the approved list of internal BoS at the time of registration.

* Student Attended Summer/ Year Break and Assessment will be done in 3rd Sem

**Comprehensive viva can be conducted for the courses completed up to the Second Semester

*** Dissertation –Part A, Internal Assessment

Course Structure:**IV-Semester**

IV SEMESTER						
S.No	Course Code	Course Name	L	T	P	Credits
1	25AM4P03	Dissertation Part - B	0	0	32	16
Total						16

* External Assessment

online	online	online	online	online	Naveen
Dr. M. Kumara Swamy Assoc. Professor, Dept. of ME, UCEK (A), JNTUK	Dr. M. Ravi Sankar Prof. & Head, Dept. of ME, IITTP	Dr. T. Babu Rao, Asst. Professor, Dept. of ME, NITAP	Mr. K. M. Dakshina Murty, Sr. DGM, BHEL-HYD	Mr. U. Srinivas Technical officer C, ISRO-SHAR, Sriharikota	Dr. M. Naveen Srinivas, HOD-ME, BVCE(A)
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**BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE***(An Autonomous Institution)***Department of Mechanical Engineering****M. TECH (BR25) ADVANCED MANUFACTURING SYSTEMS****COURSE STRUCTURE & SYLLABUS****Course Structure:****III-Semester**

S.No	Course Code	Course Name	L	T	P	Credits
1	25HM3D01	Research Methodology and IPR/Swayam 12 Week MOOC Course RM&IPR	3	0	0	3
2	25AM3P01	Summer Internship/Industrial Training (8-10 Weeks)	0	0	0	3
3	25AM3V01	Comprehensive Viva	0	0	0	2
4	25AM3P02	Dissertation Part - A	0	0	20	10
Total						18

*MOOCS/NPTEL certification courses as per the approved list of internal BoS at the time of registration.

* Student Attended Summer/ Year Break and Assessment will be done in 3rd Sem

**Comprehensive viva can be conducted for the courses completed up to the Second Semester

*** Dissertation –Part A, Internal Assessment

Course Structure:**IV-Semester**

IV SEMESTER						
S.No	Course Code	Course Name	L	T	P	Credits
1	25AM4P03	Dissertation Part - B	0	0	32	16
Total						16

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online	online	online	online	online	Naveen
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**BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE***(An Autonomous Institution)***Department of Mechanical Engineering****M. TECH (BR25) ADVANCED MANUFACTURING SYSTEMS****COURSE STRUCTURE & SYLLABUS**

Year I Semester	AUTOMATION INMANUFACTURING (PROGRAMME CORE 1) (25AM1T01)	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

The objectives of this course are to:

1. Provide an overview of manufacturing systems and the role of automation in modern production environments.
2. Introduce hardware components and control systems used in automation, including PLCs and computer-based control.
3. Explain material handling systems, automated storage, and identification technologies like barcodes and RFID.
4. Describe manufacturing systems, assembly lines, automated production lines, and flexible manufacturing concepts.
5. Discuss quality control strategies, inspection techniques, and manufacturing support systems in automated environments.

COURSE OUTCOMES (COS)

Upon successful completion of this course, students will be able to:

CO No.	Course Outcome	Bloom's Level
CO1	Explain the structure and functions of production systems and the role of automation in manufacturing.	Understand
CO2	Identify and describe hardware components used in automation, including sensors, PLCs, and controllers.	Remember / Understand
CO3	Analyze and compare various material handling, storage, and identification technologies.	Analyze
CO4	Design and evaluate manufacturing and assembly systems including automated production lines and FMS.	Apply / Analyze
CO5	Assess quality control methods, inspection systems, and support tools used in automated manufacturing.	Evaluate

UNIT – I:

OVER VIEW OF MANUFACTURING AND AUTOMATION : Production systems,

Automation in production systems, Automation principles and strategies, Manufacturing

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operations, production facilities. Basic elements of an automated system, levels of automation; Hardware components for automation and process control, programmable logic controllers and personal computers.

UNIT – II:

MATERIAL HANDLING AND IDENTIFICATION TECHNOLOGIES: Material handling, equipment, Analysis. Storage systems, performance and location strategies, Automated storage systems, AS/RS, types. Automatic identification methods, Barcode technology, RFID.

UNIT – III:

MANUFACTURING SYSTEMS AND AUTOMATED PRODUCTION LINES:

Manufacturing systems: components of a manufacturing system, Single station manufacturing cells; Manual Assembly lines, line balancing Algorithms, Mixed model Assembly lines, Alternative Assembly systems. Automated production lines, Applications, Analysis of transfer lines.

UNIT – IV:

AUTOMATED ASSEMBLY SYSTEMS: Fundamentals, Analysis of Assembly systems. Cellular manufacturing, part families, cooling, production flow analysis. Group Technology and flexible Manufacturing systems, Quantitative Analysis.

UNIT – V:

QUALITY CONTROL AND SUPPORT SYSTEMS: Quality in Design and manufacturing, inspection principles and strategies, Automated inspection, contact Vs non contact, CMM. Manufacturing support systems. Quality function deployment, computer aided process planning, concurrent engineering, shop floor control, just in time and lean production.

TEXT BOOK:

1. Automation, production systems and computer integrated manufacturing/ Mikell.P Groover/PHI/3rd edition/2012,

REFERENCES:

1. CAD/CAM/CIM/ P. Radha Krishnan & S. Subrahmanyarn and Raju/New Age International Publishers/2003.
2. System Approach to Computer Integrated Design and Manufacturing/ Singh/John Wiley /96.
3. Computer Aided Manufacturing/Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang/ Pearson/ 2009
4. Manufacturing and Automation Technology / R Thomas Wright and Michael Berkeihiser / Good Heart/Willcox Publishers

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**BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE***(An Autonomous Institution)***Department of Mechanical Engineering****M. TECH (BR25) ADVANCED MANUFACTURING SYSTEMS****COURSE STRUCTURE & SYLLABUS**

I Year I Semester	ADVANCED MANUFACTURING PROCESSES (PROGRAMME CORE 2) (25AM1T02)	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

The course is designed to:

1. Provide knowledge on surface treatment techniques and advanced coating processes used in modern manufacturing.
2. Introduce processing methods for ceramics and composite materials, including powder metallurgy and finishing techniques.
3. Familiarize students with fabrication techniques used in the manufacture of microelectronic devices.
4. Explain the principles, working, and applications of advanced electrical and chemical machining processes.
5. Introduce laser, electron beam, abrasive jet, and water jet machining techniques and their role in precision manufacturing.

COURSE OUTCOMES (COS)

Upon successful completion of this course, the student will be able to:

CO No.	Course Outcome	Bloom's Level
CO1	Explain various surface treatment and coating methods and evaluate their suitability for industrial applications.	Understand / Evaluate
CO2	Describe and compare processing techniques of ceramics and composites, including reinforcement strategies.	Understand / Analyze
CO3	Demonstrate understanding of microelectronic device fabrication processes, including lithography and packaging.	Understand / Apply
CO4	Analyze the principles, mechanisms, and applications of EDM, Wire EDM, and ECM processes.	Analyze
CO5	Evaluate non-traditional machining processes such as LBM, EBM, AJM, and WJM for advanced manufacturing applications.	Evaluate / Analyze

UNIT-I

SURFACE TREATMENT: Scope, Cleaners, Methods of cleaning, Surface coating types, and

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ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapor deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

UNIT- II

PROCESSING OF CERAMICS: Applications, characteristics, classification .Processing of particulate ceramics, Powder preparations, consolidation, drying, sintering, hot compaction, Area of application, finishing of ceramics. Processing of Composites: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

UNIT- III

FABRICATION OF MICROELECTRONIC DEVICES:

Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in microelectronics, surface mount technology, Integrated circuit economics.

UNIT - IV

ADVANCED MACHINING PROCESSES: EDM, Wire EDM, ECM, LBM, EBM, AJM, WJM – Principle, working, limitations and applications.

UNIT -V

RAPID PROTOTYPING: Working Principles, Methods, Stereo Lithography, Laser Sintering, Fused Deposition Method, Applications and Limitations, Rapid tooling, Techniques of rapid manufacturing

TEXT BOOKS:

1. Manufacturing Engineering and Technology / Kalpakijian / Adisson Wesley, 1995.
2. Process and Materials of Manufacturing / R. A. Lindburg / 1th edition, PHI 1990.

REFERENCES:

1. Microelectronic packaging handbook / Rao. R. Thummala and Eugene, J. Rymaszewski / Van Nostrand Renihold,
2. MEMS & Micro Systems Design and manufacture / Tai — Run Hsu / TMGH
3. Advanced Machining Processes / V.K.Jain / Allied Publications.
4. Introduction to Manufacturing Processes / John A Schey / Mc Graw Hill.

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**BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE***(An Autonomous Institution)***Department of Mechanical Engineering****M. TECH (BR25) ADVANCED MANUFACTURING SYSTEMS****COURSE STRUCTURE & SYLLABUS**

I Year I Semester	AI & ML FOR MECHANICAL ENGINEERING (PROGRAMME CORE 3) (25AM1T03)	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- 1) To impart the basic concepts of artificial intelligence and the principles of knowledge representation and reasoning.
- 2) To introduce the machine learning concepts and supervised learning methods
- 3) To enable the students gain knowledge in unsupervised learning method and Bayesian algorithms.
- 4) To make the students learn about neural networks and genetic algorithms.
- 5) To understand the machine learning analytics and applications of deep learning techniques to mechanical engineering.

COURSE OUTCOMES:

At the end of the course, student will be able to

CO1: Explain the basic concepts of artificial intelligence (K3).

CO2: Learn about the principles of supervised learning methods (K3)

CO3: Gain knowledge in unsupervised learning method and Bayesian algorithms (K2)

CO4: Get knowledge about neural networks and genetic algorithms (K2).

CO5: Understand the machine learning analytics and apply deep learning techniques to mechanical engineering applications (K2).

UNIT- I:

Introduction: Definition of Artificial Intelligence, Evolution, Need, and applications in real world. Intelligent Agents, Agents and Environments; Good Behaviour - concept of rationality, the nature of environments, structure of agents. Introduction to Machine Learning (ML): Definition, Evolution, Need, applications of ML in industry and real-world, regression and classification problems, performance metrics, differences between supervised and unsupervised learning paradigms, bias, variance, overfitting and under fitting. Supervised Learning: Linear regression, logistic regression, Distance-based methods, Nearest Neighbours, Decision Trees, Support Vector Machines, Nonlinearity and Kernel Methods.

UNIT- II:

Unsupervised Learning: Clustering, K-means, Dimensionality Reduction, PCA and Kernel.

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Bayesian and Computational Learning: Bayes theorem, concept learning, maximum likelihood of normal, binomial, exponential, and Poisson distributions, minimum description length principle, Naïve Bayes Classifier, Instance-based Learning- K-Nearest neighbour learning.

UNIT- III:

Neural Networks and Genetic Algorithms: Neural network representation, problems, perceptron, multilayer networks and backpropagation, steepest descent method, Convolutional neural networks and their applications, Local vs Global optima, Introduction to Genetic algorithms.

UNIT- IV:

Deep Learning: Recurrent Neural Networks and their applications, LSTM, Deep generative models, Deep auto-encoders, Applications of Deep Networks. Machine Learning Algorithm Analytics: Evaluating Machine Learning algorithms, Model, Selection, Ensemble Methods - Boosting, Bagging, and Random Forests.

UNIT- V:

Overview of Applications to Mechanical Engineering: Introduction to Machine learning packages, preparation of dataset for machine learning (cleansing and featurizing) Design of 1D mechanical structures, Crack detection, fatigue life and creep estimation, Defect detection in casting and welding, Tool wear and Surface roughness prediction in CNC machining, Heat exchanger design optimization, fault classification.

TEXT BOOKS:

- 1) Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 2/e, Pearson Education, 2010.
- 2) Tom M. Mitchell, Machine Learning, McGraw Hill, 2013.
- 3) Ethem Alpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press, 2004.

REFERENCE BOOKS:

- 1) Elaine Rich, Kevin Knight and Shivashankar B. Nair, Artificial Intelligence, 3/e, McGraw Hill Education, 2008.
- 2) Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, PHI Learning, 2012.

ONLINE RESOURCES: <https://www.tpointtech.com/artificial-intelligence-ai>
<https://www.geeksforgeeks.org/>

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**BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE***(An Autonomous Institution)***Department of Mechanical Engineering****M. TECH (BR25) ADVANCED MANUFACTURING SYSTEMS****COURSE STRUCTURE & SYLLABUS**

I Year I Semester	DESIGN FOR MANUFACTURING AND ASSEMBLY (PROGRAM ELECTIVE-1) (25AM1D01)	L	P	C
		3	0	3

COURSE OBJECTIVES:

1. To identify the manufacturing constraints that influences the design of parts and part systems.
2. To introduce the Design for Manufacturability (DFM) methodology.
3. To understand infeasible or impractical designs.
4. To know automatic assembly transfer system.
5. To understand design of manual assembly.

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

CO1 Explain the basic concepts of DFMA & their applications. Apply design rules to manual assembly (K2).

CO2 Apply design rules for ease of machining and understand the design recommendations for machined parts (K3).

CO3 Enlist the selection, simulation, and design rules of casting processes. Also, to explain the design considerations for extruded sections and various forming processes (K2).

CO4 Explain the design considerations and effect of thermal stresses in welded joints and the design factors for forging (K2).

CO5 Describe the design considerations for automatic assembly and do quantitative analysis of assembly systems (K1).

UNIT - I

Introduction to DFM, DFMA: How Does DFMA Work? Reasons for Not Implementing DFMA, What Are the Advantages of Applying DFMA During Product Design? Typical DFMA Case Studies, Overall Impact of DFMA on Industry.

Design for Manual Assembly: General Design Guidelines for Manual Assembly, Development of the Systematic DFA Methodology, Assembly Efficiency, and Effect of Part Symmetry, Thickness, and Weight on Handling Time, Effects of Combinations of Factors, Application of the DFA Methodology.

UNIT - II

Machining processes: Overview of various machining processes-general design rules for machining-dimensional tolerance and surface roughness-Design for machining – ease – redesigning of components for machining ease with suitable examples. General design

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recommendations for machined parts.

UNIT - III

Metal casting: Appraisal of various casting processes, selection of casting process, -general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting.

Extrusion & Sheet metal work: Design guide lines extruded sections-design principles for punching, blanking, bending, and deep drawing-Keeler Goodman forging line diagram – component design for blanking.

UNIT - IV

Metal joining: Appraisal of various welding processes, factors in design of weldments – general design guidelines-pre and post treatment of welds-effects of thermal stresses in weld joints-design of brazed joints. Forging: Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations.

UNIT - V

Design for Assembly Automation: Fundamentals of automated assembly systems, System configurations, parts delivery system at workstations, various escapement and placement devices used in automated assembly systems, Quantitative analysis of Assembly systems, Multi station assembly systems, and single station assembly lines.

TEXT BOOKS:

1. Product Design for Manufacture and Assembly, Geoffrey Boothroyd , Peter Dewhurst, Winston A. Knight, CRC Press, Third Edition, 2010.
2. Design for Manufacturability Handbook, James G. Bralla, The McGraw-Hill Companies, Inc. 2nd edition, 1999.
3. Assembly Automation and Product Design/ Geoffrey Boothroyd/ Marcel Dekker Inc., NY, 1992.
4. Engineering Design - Material & Processing Approach/ George E. Deiter/McGraw Hill Intl. 2nd Ed. 2000.
5. Hand Book of Product Design/ Geoffrey Boothroyd/ Marcel and Dekken, N.Y. 1990.

REFERENCE BOOKS:

1. ASM Hand book, ASM International, 1997.
2. A Text Book of PRODUCTION TECHNOLOGY (Manufacturing Processes), P. C. Sharma, S. Chand Publishing, 2007.

WEB REFERENCES:

- Please include hyperlinks related to NPTEL/VLabs etc

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I Year I Semester	QUALITY ENGINEERING IN MANUFACTURING (PROGRAM ELECTIVE-1) (25AM1D02)	L	T	P	C
		3	0	0	3

Course Objectives

The objectives of this course are to:

1. Introduce the concepts and importance of quality engineering in product and process design.
2. Explain the application of loss functions, tolerance design, and parameter design in improving quality and reducing variability.
3. Provide a foundation in statistical methods such as Analysis of Variance (ANOVA) for quality improvement.
4. Develop skills in designing and analyzing experiments using orthogonal arrays and Taguchi methods.
5. Familiarize students with Six Sigma methodology and tools for quality improvement in both manufacturing and service environments.

Course Outcomes (COs)

Upon successful completion of this course, students will be able to:

CO No.	Course Outcome	Bloom's Level
CO1	Explain the role of quality engineering in product and process design, including the use of loss functions.	Understand
CO2	Apply tolerance and parameter design concepts to improve quality in engineering designs.	Apply
CO3	Perform Analysis of Variance (ANOVA) for evaluating the effect of multiple factors on quality characteristics.	Analyze /
CO4	Design and analyze experiments using orthogonal arrays to identify key process parameters and optimize performance.	Analyze / Evaluate
CO5	Implement Six Sigma DMAIC methodology and use statistical tools for process and quality improvement.	Apply / Evaluate

UNIT - I

online	online	online	online	online	Naveen
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QUALITY VALUE AND ENGINEERING: An overall quality system, quality engineering in production design, quality engineering in design of production processes. Loss Function and Quality Level: Derivation and use of quadratle loss function, economic consequences of tightening tolerances as a means to improve quality, evaluations and types tolerances (N-type, S- type and L-type)

UNIT II:

TOLERANCE DESIGN AND TOLERANCING: Functional limits, tolerance design for N-type. L-type and S-type characteristics, tolerance allocation fbr multiple components. Parameter and Tolerance Design: Introduction to parameter design, signal to noise ratios, Parameter design strategy, some of the case studies on parameter and tolerance designs.

UNIT - III

ANALYSIS OF VARIANCE (ANOVA): Introduction to ANOVA, Need for ANOVA, NO-way ANOVA, One-way ANOVA, Two-way ANOVA, Critique of F-test, ANOVA for four level factors, multiple level factors.

UNIT - IV

ORTHOGONAL ARRAYS: Typical test strategies, better test strategies, efficient test strategies, steps in designing, conducting and analyzing an experiment. Interpolation of Experimental Results: Interpretation methods, percent contributor, estimating the mean.

UNIT - V

SIX SIGMA AND THE TECHNICAL SYSTEM: Six sigma DMAIC methodology, tools for process improvement, six sigma in services and small organizations, statistical foundations, statistical methodology.

TEXT BOOK:

1. Taguchi Techniques for Quality Engineering / Phillip J. Ross / McGraw Hill/ Intl. II Edition, 1995.

REFERENCES:

1. Quality Engineering in Production systems by G. Taguchi, A. Elsayed et al, McGraw Hill Intl. Pub 1989.
2. Taguchi Methods explained: Practical steps to Robust Design / Papan P. Bagchi / Prentice Hall Pvt. Ltd., New Delhi

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I Year I Semester	INDUSTRIAL ROBOTICS (Program Elective – I) (25AM1D03)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce Robotics and Automation including robot classification, design and selection, analysis and applications in industry.
2. To provide information on various types of end effectors, their design, interfacing and selection.
3. To provide the details of operations for a variety of sensory devices that are used on robot , the meaning of sensing, classification of sensor, that measure position, velocity & acceleration of robot joint.
4. To familiarize the basic concepts of transformations performed by robot, to perform kinematics to and to gain knowledge on programming of robots.

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

CO1 Figure out, demonstrate the terminologies related to robotics technology, hardware components and apply logic for selection of robotic sub systems and systems (K2&K3).

CO2 Apply the spatial transformations to evaluate forward Kinematics, inverse kinematics and Jacobian for serial and parallel robots (K3&K5).

CO3 Demonstrate knowledge of end effectors, design considerations and the interpretation of data from data acquisition systems (K2).

CO4 Apply the fundamental knowledge of robot programming methods to write small programs for desired application (K3).

CO5 Apply and design robot cell layouts and analyse their applications in various fields (K3&K6).

UNIT – I:

Introduction: Automation and Robotics, Robot anatomy, robot configuration, motions joint notation scheme, work volume, robot drive systems, control systems and dynamic performance, precision of movement. Control System and Components: basic concepts and motion controllers, control system analysis, robot actuation and feedback components. Sensors: Desirable features, tactile, proximity and range sensors, uses sensors in robotics. Positions sensors, velocity sensors, actuators, power transmission systems

UNIT – II:

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Dr. M. Kumara Swamy Assoc. Professor, Dept. of ME, UCEK (A), JNTUK	Dr. M. Ravi Sankar Prof. & Head, Dept. of ME, IITTP	Dr. T. Babu Rao, Asst. Professor, Dept. of ME, NITAP	Mr. K. M. Dakshina Murty, Sr. DGM, BHEL-HYD	Mr. U. Srinivas Technical officer C, ISRO-SHAR, Sriharikota	Dr. M. Naveen Srinivas, HOD-ME, BVCE(A)
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BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE
(An Autonomous Institution)

Department of Mechanical Engineering
M. TECH (BR25) ADVANCED MANUFACTURING SYSTEMS
COURSE STRUCTURE & SYLLABUS

Motion Analysis and Control: Manipulator kinematics, position representation, forward and inverse transformations, homogeneous transformations, manipulator path control, robot arm dynamics, configuration of a robot controller. Robot joint control design.

UNIT – III:

End Effectors: Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design. Machine Vision: Functions, Sensing and Digitizing-imaging devices, Lighting techniques, Analog to digital single conversion, image storage: Image processing and Analysis-image data reduction, Segmentation, feature extraction, Object recognition. Training the vision system, Robotic application.

UNIT – IV:

Robot Programming: Lead through programming, Robot program as a path in space, Motion interpolation, WAIT, SIGNAL AND DELAY commands, Branching, capabilities and Limitations of lead through methods. Robot Languages: Textual robot Languages, Generations of robot programming languages, Robot language structures, Elements and function.

UNIT – V:

Robot Cell Design and Control: Robot cell layouts-Robot centered cell, In line robot cell, Considerations in work design, Work and control, Interlocks, Error detection, Work cell controller. Robot Applications: Material transfer, Machine loading/unloading, Processing operation, Assembly and Inspection, Future Application. Introduction to Drone Technologies and its Applications.

TEXTBOOKS:

1. Industrial Robotics / Groover M P / Pearson Edu.
2. Introduction to Robotic Mechanics and Control by JJ Craig, Pearson, 3rd edition.

REFERENCE BOOKS:

1. Robotics / Fu K S/ McGraw Hill.
2. Robotic Engineering / Richard D. Klafter, Prentice Hall.
3. Robot Analysis and Intelligence / Asada and Slotine / Wiley Inter-Science.
4. Robot Dynamics & Control – Mark W. Spong and M. Vidyasagar / John Wiley
5. Introduction to Robotics by SK Saha, TheMcGrah Hill Company, 6th, 2012.
6. Robotics and Control / Mittal R K &Nagrath I J / TMH.

WEB REFERENCES:

- Please include hyperlinks related to NPTEL/VLabs etc.

Online	online	online	online	online	Naveen
Dr. M. Kumara Swamy Assoc. Professor, Dept. of ME, UCEK (A), JNTUK	Dr. M. Ravi Sankar Prof. & Head, Dept. of ME, IITTP	Dr. T. Babu Rao, Asst. Professor, Dept. of ME, NITAP	Mr. K. M. Dakshina Murty, Sr. DGM, BHEL-HYD	Mr. U. Srinivas Technical officer C, ISRO-SHAR, Sriharikota	Dr. M. Naveen Srinivas, HOD-ME, BVCE(A)
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M. TECH (BR25) ADVANCED MANUFACTURING SYSTEMS
COURSE STRUCTURE & SYLLABUS

I Year I Semester	INTRODUCTION TO QUANTUM TECHNOLOGIES (Program Elective – I) (25AM1D04)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce fundamental concepts of quantum mechanics and its mathematical formalism.
2. To explore quantum computing and communication principles and technologies.
3. To understand the physical implementation and limitations of quantum systems.
4. To enable students to relate quantum theory to practical applications in computing, cryptography, and sensing.
5. To familiarize students with the emerging trends in quantum technologies.

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

- CO1 Explain core principles of quantum mechanics and their technological implications (K2).
CO2 Analyze quantum phenomena like superposition and entanglement (K4).
CO3 Apply mathematical tools to model and solve quantum systems (K3).
CO4 Demonstrate understanding of quantum algorithms and quantum circuits (K2&K3).
CO5 Evaluate potential applications and challenges in quantum communication and sensing (K5).

UNIT – I:

Fundamentals of Quantum Mechanics: Historical background: Blackbody radiation, photoelectric effect, and Compton scattering; Dual nature of light and matter; De Broglie hypothesis; Schrodinger equation; Free particle, infinite potential well, step potential; Operators and observables: position, momentum, Hamiltonian; Commutation relations and uncertainty principle; Quantum postulates and measurement theory; Eigenvalues, Eigen functions.

UNIT – II:

Quantum Information Theory: Classical vs. quantum information; Qubit representation using Bloch sphere; Quantum superposition and quantum entanglement; Dirac notation (bra-ket), tensor products, and composite systems; Bell states; Quantum gates: Pauli-X, Y, Z; Hadamard; Phase; T; CNOT; Quantum circuit models and notation; Measurement in computational basis;

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Department of Mechanical Engineering

M. TECH (BR25) ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABUS

Quantum teleportation and no-cloning theorem; Quantum state tomography (introductory)

UNIT – III:

Quantum Computing: Classical computing review and limitations; Quantum parallelism and interference; Deutsch and Deutsch-Jozsa algorithms; Grover's search algorithm, Oracle and amplitude amplification; Shor's factoring algorithm (overview and significance); Quantum Fourier Transform (QFT); Quantum error correction: Bit-flip, phase-flip, Introduction to quantum programming: Qiskit(overview)

UNIT – IV:

Quantum Communication: Introduction to quantum cryptography; Quantum key distribution (QKD): BB84 protocol; Entanglement-based QKD: Ekert protocol (E91); Eavesdropping and security of QKD; Quantum teleportation (circuit and protocol); Quantum dense coding; Quantum networks and entanglement swapping; Role of quantum repeaters; Single-photon sources and detectors; Implementation challenges (loss, decoherence, noise)

UNIT – V:

Quantum Technologies and Applications: Quantum sensors: magnetometry, gravimetry; Quantum metrology: standard time, atomic clocks; Quantum imaging and lithography; Quantum materials: topological insulators, graphene, quantum dots; NV centers in diamonds for sensing; Hardware platforms: Superconducting qubits, Trapped ions, Photonic quantum processors; Quantum supremacy and NISQ era.

TEXTBOOKS:

1. "Quantum Computation and Quantum Information" by Michael A. Nielsen and Isaac L. Chuang
2. "Quantum Mechanics: Concepts and Applications" by Nouredine Zettili

WEB REFERENCES: • Please include hyperlinks related to NPTEL/VLabs etc.

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**BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE***(An Autonomous Institution)***Department of Mechanical Engineering****M. TECH (BR25) ADVANCED MANUFACTURING SYSTEMS****COURSE STRUCTURE & SYLLABUS**

I Year I Semester	OPTIMIZATION AND RELIABILITY (PROGRAM ELECTIVE-2) (25AM1D05)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To impart the knowledge on Micro-manufacturing and Scaling Laws.
2. To train the students to gain the skill in Mechanical micromachining, Advanced micromachining processes and associated computer/laboratory work.
3. To create the awareness on Metrology, Micro-machine tool system, machining essentials including part registration and micro-manufacturing case studies.

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

CO1 Apply the theory of optimization methods and algorithms to develop and for solving various types of optimization problems (K3&K4).

CO2 Apply numerous numerical methods to solve the engineering problems for optimization (K3).

CO3 Apply GA and GP optimization methods to solve the differential equations and analyse the differences between GA and GP (K3&K4).

CO4 Apply optimization techniques to design and manufacturing (K3).

CO5 systems for the optimization of process parameters. Understand and apply major concepts of reliability in engineering design for analysing the statistical experiments leading to reliability modeling (K3&K4).

UNIT - I

CLASSICAL OPTIMIZATION TECHNIQUES: Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions, merits and demerits of classical optimization techniques.

UNIT - II

NUMERICAL METHODS FOR OPTIMIZATION: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method, Pattern search methods, conjugate method, types of penalty methods for handling constraints, advantages of numerical methods.

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UNIT - III

GENETIC ALGORITHM (GA): Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, drawbacks of GA,

GENETIC PROGRAMMING (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

MULTI-OBJECTIVE GA: Pareto's analysis, Non-dominated front, multi – objective GA, Non- dominated sorted GA, convergence criterion, applications of multi-objective problems .

UNIT – IV

APPLICATIONS OF OPTIMIZATION IN DESIGN AND MANUFACTURING SYSTEMS:

Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, optimization of springs and gears, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

UNIT V

RELIABILITY: Concepts of Engineering Statistics, risk and reliability, probabilistic approach to design, reliability theory, design for reliability, numerical problems, hazard analysis.

TEXT BOOKS:

1. Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers
2. Engineering Optimization – S.S.Rao, New Age Publishers
3. Reliability Engineering by L.S.Srinath
4. Multi objective genetic algorithm by Kalyanmoy Deb, PHI Publishers.

REFERENCES:

1. Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison- Wesley Publishers
2. Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers
3. Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers
4. An Introduction to Reliability and Maintainability Engineering by CE Ebeling, Waveland Printers Inc., 2009
5. Reliability Theory and Practice by I Bazovsky, Dover Publications, 2013

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Dr. M. Kumara Swamy Assoc. Professor, Dept. of ME, UCEK (A), JNTUK	Dr. M. Ravi Sankar Prof. & Head, Dept. of ME, IITTP	Dr. T. Babu Rao, Asst. Professor, Dept. of ME, NITAP	Mr. K. M. Dakshina Murty, Sr. DGM, BHEL-HYD	Mr. U. Srinivas Technical officer C, ISRO-SHAR, Sriharikota	Dr. M. Naveen Srinivas, HOD-ME, BVCE(A)
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**BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE***(An Autonomous Institution)***Department of Mechanical Engineering****M. TECH (BR25) ADVANCED MANUFACTURING SYSTEMS****COURSE STRUCTURE & SYLLABUS**

I Year I Semester	NANO TECHNOLOGY (PROGRAM ELECTIVE-2) (25AM1D06)	L	T	P	C
		3	0	0	3

Course Objectives

The course is designed to:

1. Introduce students to the fundamental concepts of nanotechnology and how material properties change at the nanoscale.
2. Provide knowledge of nanomaterial synthesis techniques including top-down and bottom-up approaches.
3. Familiarize students with various tools used for imaging and characterization of nanostructures.
4. Explore the synthesis, properties, and applications of metal, semiconductor nanoparticles, and nanowires.
5. Understand the structure, properties, and technological potential of carbon nanotubes in modern applications.

Course Outcomes (COs)

Upon successful completion of this course, students will be able to:

CO No.	Course Outcome	Bloom's Level
CO1	Describe nanoscale phenomena and how material properties change with size, and explain the working principles of nanosystems.	Understand
CO2	Explain and compare various nanomaterial synthesis techniques used in top-down and bottom-up nanofabrication.	Understand / Analyze
CO3	Identify and apply appropriate imaging and characterization techniques for analyzing nanostructures.	Apply
CO4	Analyze the synthesis methods and functional applications of nanoparticles and nanowires in electronics, bioengineering, and catalysis.	Analyze / Evaluate
CO5	Evaluate the unique properties and potential applications of carbon nanotubes in electronic and structural systems.	Evaluate

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BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE

(An Autonomous Institution)

Department of Mechanical Engineering

M. TECH (BR25) ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABUS

UNIT-I:

Introduction, Size and shape dependence of material properties at the nanoscale, scaling relations, can nanorobots walk and nanoplanes fly, Nano scale elements in conventional technologies, Mechanics at nanoscale Enhancement of mechanical properties with decreasing size, Nanoelectromechanical systems, nano machines, Nano fluidics, filtration, sorting, Molecular motors, Application of Nano Technology.

UNIT-II:

Nano material Synthesis Techniques: Top-down and bottom-up nanofabrication, Synthesis of nano composites, The Intel-IBM approach to nanotechnology: lithography, etching, ion implantation, thin film deposition, nano coatings and nano indentation, Electron beam lithography, Soft lithography: nanoimprinting and micro-contact printing, Solution/plasma-phase nanofabrication, sol-gel methods, template techniques.

UNIT-III:

Imaging/characterization of nanostructures General considerations for imaging, scanning probe techniques: XRD, SEM, TEM, AFM and NSOM.

UNIT-IV:

Metal and semiconductor nanoparticles Synthesis, stability, control of size, Optical and electronic properties, Ultra-sensitive imaging and detection with nano particles, bioengineering applications, Catalysis. Semiconductor and metal nanowires Vapor/liquid/solid growth and other synthesis techniques, Nanowire transistors and sensors.

UNIT-V:

Carbon nanotubes Structure and synthesis, Electronic, vibrational, and mechanical properties, how can C nanotubes enable faster computers, brighter TV screens, and stronger mechanical reinforcement?

TEXT BOOKS:

1. Nanoscale Science and Technology by Kelsall, Hamley, and Geoghegan, Wiley (2005)
2. Introduction to Nanoscale Science and Technology by Di Ventra, Evoy, and Heflin, Kluwer Academic Publishers (2004).

REFERENCES:

1. Introduction to Nanotechnology by Poole and Owens, Wiley (2003)
2. Nanochemistry: A Chemical Approach to Nanomaterials, Ozin and Arsenault, RSC Publishing (2006).

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Dr. M. Kumara Swamy Assoc. Professor, Dept. of ME, UCEK (A), JNTUK	Dr. M. Ravi Sankar Prof. & Head, Dept. of ME, IITTP	Dr. T. Babu Rao, Asst. Professor, Dept. of ME, NITAP	Mr. K. M. Dakshina Murty, Sr. DGM, BHEL-HYD	Mr. U. Srinivas Technical officer C, ISRO-SHAR, Sriharikota	Dr. M. Naveen Srinivas, HOD-ME, BVCE(A)
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**BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE***(An Autonomous Institution)***Department of Mechanical Engineering****M. TECH (BR25) ADVANCED MANUFACTURING SYSTEMS****COURSE STRUCTURE & SYLLABUS**

I Year I Semester	PRECISION ENGINEERING (PROGRAM ELECTIVE-2) (25AM1D07)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. Understand accuracy and precision and learn how to test and improve machine tool alignment and part accuracy.
2. Learn different precision manufacturing methods and surface finishing techniques.
3. Understand various measurement tools and techniques used to check dimensions and surface quality.
4. Learn the basics of nanotechnology and its applications in manufacturing tiny parts and materials.
5. Understand how to use fits, tolerances, and geometric dimensioning to design and assemble parts correctly.

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

CO1 Evaluate the part and machine tool accuracies (K5).

CO2 Understand principles of ultra-precision machining, micro-manufacturing methods, and additive manufacturing (K2)

CO3 Understand advanced metrology tools and techniques to measure and analyze components with high precision (K2).

CO4 Understand the principles and techniques of nanotechnology to develop and analyze nanoscale materials and devices for various applications (K2)

CO5 Design and apply fits and tolerances using principles of dimensional chains for individual features for parts and assemblies according to ISO standards (K3&K6).

UNIT I:

Accuracy and Precision: Introduction - Accuracy and precision – Need – Application of precision machining- Alignment testing of machine tools, Accuracy of numerical control system, Accuracy specification of parts and assemblies.

UNIT II:

Precision Manufacturing: Micro machining processes-Diamond machining - Micro engraving

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- Micro replication techniques-Forming, Casting, Injection molding - Micro embossing. Methods of obtaining high quality surfaces, Lapping, Honing, Super finishing and Burnishing processes

UNIT III:

Precision Metrology- In situ measurement- In process measurement of position of processing Point-Post process and online measurement of dimensional features- Mechanical measuring systems- Optical Measuring Systems- Optical Interferometry, Laser Scanning, White Light Interferometry Confocal Microscopy, Electron beam measuring Systems-Scanning Tunnelling-Atomic Force Microscope and XRay Computed Tomography. Surface Metrology Surface Roughness and Measurement.

UNIT IV:

Quality assurance Nano precision technology: Fundamentals of nanotechnology, Nano physical processing of atomic-bitunits Nano chemical and electrochemical atomic-bit processing. -Nano-Grating systems -Nano lithography, Electron beam lithography -Mirror grinding of ceramics, Focused Ion Beam (FIB) Milling, Atomic Layer Deposition (ALD), Nano processing of materials for super high-density ICs-Nano-mechanical parts, Nano machines NEMS, Applications- Nanoelectronics, Nanocomposites and nano coatings

UNIT V:

Geometric Dimensioning and Tolerancing: Tolerance and fits, Hole and shaft basis system, Types of fits- Types of assemblies-probability of clearance and interference fits in transitional fits, Concept of dimensional chain or tolerance stack. Dimensioning of stepped shaft and holes assigning tolerances on the constituent dimensions. Tolerance zone conversions-surfaces, Datum - Datum feature of representation-form controls, Logical approach to tolerancing-datum systems, Geometrical tolerances.

TEXTBOOKS:

1. Precision Engineering in Manufacturing, R.L.Murty, New Age International Publishers, 1996.
2. V.K. Jain, Advanced Machining Processes, 12th reprint, Allied Publishers Ltd, 2010.
3. James, D. and Meadow, S., "Geometric Dimensioning and Tolerancing", Marcel Dekker Inc.,1995.

REFERENCE BOOKS:

1. V.Kovan, "Fundamentals of Process Engineering", Foreign Languages Publishing House,

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Dr. M. Kumara Swamy Assoc. Professor, Dept. of ME, UCEK (A), JNTUK	Dr. M. Ravi Sankar Prof. & Head, Dept. of ME, IITTP	Dr. T. Babu Rao, Asst. Professor, Dept. of ME, NITAP	Mr. K. M. Dakshina Murty, Sr. DGM, BHEL-HYD	Mr. U. Srinivas Technical officer C, ISRO-SHAR, Sriharikota	Dr. M. Naveen Srinivas, HOD-ME, BVCE(A)
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Department of Mechanical Engineering

M. TECH (BR25) ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABUS

Moscow, 1975 2. J.L.Gadjala, "Dimensional control in Precision Manufacturing", McGraw Hill Publishers.

3. Norio Tanigichi "Nano Technology", oxford university press, 2003.

4. Venkatesh, V.C. and Sudin, I., "Precision Engineering", Tata McGraw Hill Co., NewDelhi, 2007.

5. Liangchi Zhang, "Precision Machining of Advanced Materials", Trans Tech Publications Ltd., Switzerland, 1st Edition, 2001.

6. X. Jane Jiang, Paul J. Scott, "Advanced Metrology: Freeform Surfaces", Academic Press Inc, April 2020.

WEB REFERENCES:

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**BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE***(An Autonomous Institution)***Department of Mechanical Engineering****M. TECH (BR25) ADVANCED MANUFACTURING SYSTEMS****COURSE STRUCTURE & SYLLABUS**

I Year I Semester	ADDITIVE MANUFACTURING (PROGRAM ELECTIVE-2) (25AM1D08)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To provide comprehensive knowledge of the wide range of additive manufacturing processes, capabilities and materials.
2. To understand the software tools and techniques used for additive manufacturing.
3. To create physical objects that facilitates product development/prototyping requirements

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

CO1 Demonstrate a basic technical understanding of the physical principles, materials, and operation of the types of AM processes such as VAT Photo polymerization (K2).

CO2 Explain the working principles and analyse the process parameters of jetting and extrusion-based additive manufacturing processes (K2&K4).

CO3 Describe the laminated sheet based and powder based additive manufacturing processes and analyse the characteristic feature of the developed AM components (K2&K4).

CO4 Identify appropriate solid-state additive manufacturing process for the desired application to generate metal AM components (K3).

CO5 Apply the key concepts of material science, and well-designed guidelines to analyse the effect of post processing operations of different AM processes (K3&K4).

UNIT – I:

Introduction to Additive Manufacturing: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Steps in AM, Classification of AM processes, Advantages of AM and Types of materials for AM. VAT Photo polymerization AM Processes: Stereo lithography (SL), Materials, Process Modelling, SL resin curing process, SL scan patterns, Micro stereo lithography, Mask Projection Processes, Two-Photon vat photo polymerization, Process Benefits and Drawbacks, Applications of Vat Photo polymerization, case studies.

UNIT – II:

Material Jetting AM Processes: Evolution of Printing as an Additive Manufacturing Process, Materials, Process Benefits and Drawbacks, Applications of Material Jetting Processes. Binder

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Jetting AM Processes: Materials, Process Benefits and Drawbacks, Research achievements in printing deposition, technical challenges in printing, Applications of Binder Jetting Processes. Extrusion-Based AM Processes: Fused Deposition Modelling (FDM), Principles, Materials, Process Modelling, Plotting and path control, Bio Extrusion, Contour Crafting, Process Benefits and Drawbacks, Applications of Extrusion-Based Processes, case studies.

UNIT – III:

Sheet Lamination AM Processes: Bonding Mechanisms, Materials, Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Gluing, Thermal bonding, LOM and UC applications, case studies. Powder Bed Fusion AM Processes: Selective laser Sintering (SLS), Materials, Powder fusion mechanism and powder handling, Process Modelling, SLS Metal and ceramic part creation, Electron Beam melting (EBM): Process Benefits and Drawbacks, Applications of Powder Bed Fusion Processes, case studies.

UNIT – IV:

Directed Energy Deposition AM Processes: Process Description, Material Delivery, Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Electron Beam Based Metal Deposition, Processing-structure properties, relationships, Benefits and drawbacks, Applications of Directed Energy Deposition Processes. Friction stir additive manufacturing: process, parameters, advantages, limitations and applications, Additive friction stir deposition process: principle, parameters, applications, functionally graded additive manufacturing components, Case studies. Wire Arc Additive Manufacturing: Process, parameters, applications, advantages and disadvantages, case studies.

UNIT – V:

Materials science for AM - Multifunctional and graded materials in AM, Role of solidification rate, Evolution of non-equilibrium structure, micro structural studies, Structure property relationship, case studies. Post Processing of AM Parts: Support Material Removal, Surface Texture Improvement, Accuracy Improvement, Aesthetic Improvement, Preparation for use as a Pattern, Property Enhancements using Non-thermal and Thermal Techniques, case studies. Guidelines for Process Selection: Introduction, Selection Methods for a Part, Challenges of Selection, Example System for Preliminary Selection, Process Planning and Control.

TEXTBOOKS:

1. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Ian Gibson, David W Rosen, Brent Stucker, Springer, 2015, 2nd Edition.

online	online	online	online	online	Name
Dr. M. Kumara Swamy Assoc. Professor, Dept. of ME, UCEK (A), JNTUK	Dr. M. Ravi Sankar Prof. & Head, Dept. of ME, IITTP	Dr. T. Babu Rao, Asst. Professor, Dept. of ME, NITAP	Mr. K. M. Dakshina Murty, Sr. DGM, BHEL-HYD	Mr. U. Srinivas Technical officer C, ISRO-SHAR, Sriharikota	Dr. M. Naveen Srinivas, HOD-ME, BVCE(A)
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M. TECH (BR25) ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABUS

2. 3D Printing and Additive Manufacturing: Principles & Applications, Chua CheeKai, Leong Kah Fai, World Scientific, 2015, 4th Edition.

REFERENCE BOOKS:

1. Rapid Prototyping: Laser-based and Other Technologies, Patri K. VenuVinod and Weiyin Ma, Springer, 2004.
2. Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, D.T. Pham, S.S. Dimov, Springer 2001.
3. Rapid Prototyping: Principles and Applications in Manufacturing, RafiqNoorani, John Wiley & Sons, 2006.
4. Additive Manufacturing, Second Edition, Amit BandyopadhyaySusmita Bose, CRC Press Taylor & Francis Group, 2020.
5. Additive Manufacturing: Principles, Technologies and Applications, C.P Paul, A. N. Junoop, McGraw Hill, 2021.

WEB REFERENCES:

- <https://www.nist.gov/additive-manufacturing>
- <https://www.metal-am.com/>
- <http://additivemanufacturing.com/basics/>
- <https://www.3dprintingindustry.com/>
- <https://www.thingiverse.com/>
- <https://reprap.org/wiki/RepRap>

online	online	online	online	online	Naveen
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I Year I Semester	ADVANCED CAD LAB (25AM1L01)	L	T	P	C
		0	0	4	2

Course Objectives

The objectives of this lab course are to:

1. Develop skills in advanced 3D modeling techniques including solid and surface modeling.
2. Enable students to perform assembly and disassembly of complex mechanical systems using CAD tools.
3. Impart knowledge on applying dimensional, form, and assembly tolerances in CAD models.
4. Introduce students to Finite Element (FE) analysis of structural components in 1D, 2D, and 3D.
5. Enhance proficiency in using CAD and FEA software tools for design validation and simulation.

Course Outcomes (COs)

Upon successful completion of this lab, students will be able to:

CO No.	Course Outcome	Bloom's Level
CO1	Create accurate 3D models using solid and surface modeling techniques.	Apply
CO2	Assemble and disassemble mechanical components using CAD software.	Apply / Analyze
CO3	Apply appropriate dimensional, form, and assembly tolerances in CAD models.	Apply
CO4	Perform basic Finite Element Analysis (FEA) on 1D, 2D, and 3D structural components.	Apply / Analyze
CO5	Interpret FEA results to validate mechanical designs under different loading conditions.	Analyze / Evaluate

online	online	online	online	online	Naveen
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Students shall carry out the modeling of the following:

1. Product Modelling- Surface Modelling and Solid modelling
2. Assembly of different mechanical components
3. Disassembly of different mechanical components
4. Dimensional and Form Tolerances
5. Assembly tolerances
6. FE Analysis of 1D structural components
7. FE Analysis of 2D structural components
8. FE Analysis of 3D structural components

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COURSE STRUCTURE & SYLLABUS

I Year I Semester	ADVANCED MANUFACTURING LAB (25AM1L02)	L	T	P	C
		0	0	4	2

Course Objectives

The objectives of the Advanced Manufacturing Lab are to:

1. Provide hands-on experience in the fabrication of components using conventional manufacturing processes like casting, forging, forming, and welding.
2. Introduce the application of powder metallurgy techniques and evaluate sintering characteristics.
3. Expose students to additive manufacturing technologies such as 3D printing for component fabrication.
4. Enable students to measure and analyze machining performance parameters such as chip reduction, shear angle, cutting forces, and tool life.
5. Develop the ability to select appropriate manufacturing processes for different engineering applications based on process characteristics and output quality.

Course Outcomes (COs)

Upon successful completion of this lab course, students will be able to:

CO No. Course Outcome

Bloom's Level

CO1	Fabricate mechanical components using metal casting, forging, forming, and welding processes.	Apply
CO2	Analyze the fabrication process in powder metallurgy and calculate green and sintered densities.	Apply / Analyze
CO3	Operate additive manufacturing equipment (3D printing) to fabricate simple components.	Apply
CO4	Perform metal cutting experiments and evaluate parameters like chip reduction coefficient, shear angle, cutting forces, and tool life.	Apply / Analyze
CO5	Select and justify suitable manufacturing processes for specific applications based on material, geometry, and functional needs.	Analyze / Evaluate

Students shall carry out the experiments on the following:

1. Fabrication of component through any metal Casting processes
2. Fabrication of component through any Forging processes
3. Fabrication of component through any Forming Processes –blanking, bending and deep

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drawing

4. Fabrication of a Weldment – arc, gas or spot-welding processes
5. Fabrication of component through Powder metallurgy- Calculation of Green Density and sintering density
6. Fabrication of component through Additive Manufacturing –simple parts in 3D printing
7. Metal removal using a Machining process - Estimation of chip reduction coefficient and shear angle in orthogonal turning, Measurement of cutting forces and average cutting temperature, and Estimation of tool life of a single point turning tool.

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I Year I Semester	SEMINAR I (25AM1S01)	L	T	P	C
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COURSE STRUCTURE & SYLLABUS

I Year II Semester	ADVANCED FINITE ELEMENT METHODS (Program Core 4) (25AM1T04)	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

1. The course's goal is to familiarize students with the fundamentals of the Finite Element Technique, a numerical method for solving various practical and the method's fundamentals will eventually be covered before moving on to various areas of implementation.
2. To present analytical approaches for structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

- CO1 Apply several kinds of computational methods to develop and evaluate the governing equations for various engineering problem (K3&K5)
- CO2 Develop, solve, and analyse problems involving one-dimensional axially loaded bars, trusses, and beam elements (K3&K4)
- CO3 Apply the numerical methods of FEM to derive element matrices. Solve and analyse two dimensional CST, axi-symmetric problems subjected to various boundary conditions (K3&K4)
- CO4 Apply and develop the solutions for the numerous engineering problems using the concepts of iso-parametric formulation and convergence techniques (K3)
- CO5 Evaluate various engineering problems subjected to dynamic and thermal conditions for optimum solutions (K5)

UNIT I:

Formulation Techniques: Methodology, Engineering problems and governing differential equations, finite elements., Variational methods potential energy method, Raleigh Ritz method, strong and weak forms, Galerkin and weighted residual methods, calculus of variations, Essential and natural boundary conditions

UNIT – II:

One-Dimensional Problems: Bar, trusses, beams and frames, displacements, stresses and temperature effects.

UNIT – III:

Two Dimensional Problems: CST, Axisymmetric Problems: Axisymmetric formulations,

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Element matrices, boundary conditions.

UNIT – IV:

Iso-Parametric Formulation: Concepts, sub-parametric, super parametric elements, numerical integration, LST, four-noded and eight-noded rectangular elements, Lagrange basis for triangles and rectangles, serendipity interpolation functions. Convergence: Requirements for convergence, h refinement and p-refinement, complete and incomplete interpolation functions, pascal's triangle, Patch test

UNIT – V:

Dynamic Problems: Analysis, Eigen value problems, and their solution methods. Heat Transfer problems: Conduction and convection, examples: - One & two-dimensional fin. Introduction to nonlinear problems.

TEXTBOOKS:

1. Finite element methods by Chandrupatla&Belegundu.
2. Finite Element Analysis by P. Seshu, PHI learning private limited, New Delhi.

REFERENCE BOOKS:

1. J.N. Reddy, Finite element method in Heat transfer and fluid dynamics, CRC press, 1994
2. Zienkiwicz O.C. and R. L. Taylor, Finite Element Method, McGraw-Hill, 1983
3. K. J. Bathe, Finite element procedures, Prentice-Hall, 1996
4. Concepts and applications of finite element analysis, R.D.Cook et al. Wiley

WEB REFERENCES:

- Please include hyperlinks related to NPTEL/VLabs etc.

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I Year II Semester	COMPUTER INTEGRATED MANUFACTURING (Programme Core 5) (25AM1T05)	L	T	P	C
		3	1	0	4

Course Objectives

The course is designed to:

1. Provide foundational knowledge of CAD/CAM systems and the concepts of Computer Integrated Manufacturing (CIM).
2. Develop an understanding of production planning and control systems, including CAPP, MRP-II, and ERP.
3. Introduce Group Technology and Cellular Manufacturing concepts, including part classification and machine cell design.
4. Explain Flexible Manufacturing Systems (FMS) and Automated Guided Vehicle Systems (AGVS) with their applications and analysis.
5. Familiarize students with the fundamentals of industrial robotics, including anatomy, control systems, sensors, and programming.

Course Outcomes (COs)

Upon successful completion of this course, students will be able to:

CO No.	Course Outcome	Bloom's Level
CO1	Explain the components, models, and levels of automation in a CIM system, including lean and JIT principles.	Understand
CO2	Develop basic production planning and control strategies using CAPP, MRP, and ERP systems.	Apply / Analyze
CO3	Apply Group Technology concepts and solve simple problems related to part coding, machine layout, and clustering.	Apply / Analyze
CO4	Analyze FMS configurations and AGVS technologies for planning and control in automated manufacturing systems.	Analyze / Evaluate
CO5	Describe the structure, programming, and applications of industrial robots in manufacturing automation.	Understand / Apply

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UNIT I

INTRODUCTION- Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control Introduction to CAD/CAM – CIM concepts – Computerised elements of CIM system –Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance – Simple problems – Manufacturing Control – Simple Problems – Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In Time Production

UNIT II

PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING

Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning – Aggregate Production Planning and the Master Production Schedule – Material Requirement planning – Capacity Planning- Control Systems-Shop Floor Control Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) - Simple Problems.

UNIT III

CELLULAR MANUFACTURING

Group Technology (GT), Part Families – Parts Classification and coding – Simple Problems in Opitz Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method - Arranging Machines in a GT cell – Hollier Method – Simple Problems.

UNIT IV

FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE

SYSTEM (AGVS) Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control– Quantitative analysis in FMS – Simple Problems. Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety

UNIT V

INDUSTRIAL ROBOTICS

Robot Anatomy and Related Attributes – Classification of Robots- Robot Control systems – End Effectors – Sensors in Robotics – Robot Accuracy and Repeatability - Industrial Robot

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Applications – Robot Part Programming – Robot Accuracy and Repeatability – Simple Problems.

TEXT BOOK:

1. Mikell.P.Groover —Automation, Production Systems and Computer Integrated Manufacturing, Prentice Hall of India, 2008.
2. Radhakrishnan P, Subramanyan S.and Raju V., —CAD/CAM/CIM, 2nd Edition, New Age International (P) Ltd, New Delhi, 2000.

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I Year II Semester	ADVANCED CNC TECHNOLOGIES (Programme Core 6) (25AM1T06)	L	T	P	C
		3	1	0	4

Course Objectives

The course is designed to:

1. Introduce the fundamentals of Numerical Control (NC) and Computer Numerical Control (CNC) systems, including their classifications, components, and machine features.
2. Provide knowledge of NC part programming using both manual and computer-aided methods, including APT and CAD/CAM-based programming.
3. Explain the role of post processors, interpolators, and automatic tool path generation in CNC systems.
4. Familiarize students with tooling systems, Direct Numerical Control (DNC), and adaptive control techniques used in modern CNC machines.
5. Introduce microcontrollers and Programmable Logic Controllers (PLCs) used in CNC control systems, including their structure, programming, and applications.

Course Outcomes (COs)

Upon successful completion of this course, students will be able to:

CO No.	Course Outcome	Bloom's Level
CO1	Describe the principles, components, and classifications of NC/CNC machines and their drive and feedback systems.	Understand
CO2	Develop NC part programs using manual and computer-aided programming approaches for various machining operations.	Apply
CO3	Explain the functions and structure of post processors and interpolators used in CNC systems.	Understand / Analyze
CO4	Evaluate tooling systems, DNC architecture, and adaptive control strategies for enhanced CNC machining performance.	Analyze / Evaluate
CO5	Apply knowledge of microcontrollers and PLCs to understand control mechanisms and programming in CNC machines.	Apply

UNIT I:

Features of NC Machines Fundamentals of numerical control, advantage of NC systems,

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classification of NC systems, point to point, NC and CNC, incremental and absolute, open and closed loop systems, Features of NC Machine Tools, design consideration of NC machine tool, methods of improving machine accuracy. Systems Drives and Devices: Hydraulic motors, DC motors, stepping motors and AC motors, feedback devices, encoders, Induction tachometers.

UNIT II:

NC Part Programming: Manual programming-Basic concepts, Point to Point contour programming, canned cycles, parametric programming. Computer-Aided Programming: General information, APT programming, Examples APT programming problems (2D machining only). NC programming on CAD/CAM systems,

UNIT III:

Post Processors: Introduction to post processors, necessity of post processors, general structure of a post processor, functions of a post processor. Automatic tool path generation. Interpolators: DDA integrator, hardware interpolators for linear and circular interpolator, DDA software interpolators and CNC software interpolators, the reference pulse technique, sampled data technique.

UNIT IV:

Tooling for CNC machines: Inter changeable tooling system, preset and qualified tools, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers. DNC SYSTEMS AND Adaptive Control: Introduction, type of DNC systems, advantages and disadvantages of DNC, adaptive control with optimization, Adaptive control with constraints, Adaptive control of machining processes like turning, grinding

UNIT V:

Micro Controllers: Introduction, Hardware components, I/O pins, ports, external memory, counters, timers and serial data I/O interrupts. Selection of Micro Controllers, Embedded Controllers,

Applications and Programming of Micro Controllers. Programmable Logic Controllers (PLC's): Introduction, Hardware components of PLC, System, basic structure, principle of operations, Programming mnemonics timers, Internal relays and counters, Applications of PLC's in CNC Machines.

TEXT BOOKS:

1. Computer Control of Manufacturing Systems / Yoram Koren / Mc Graw Hill Int. 1983.
2. Machining Tools Hand Book Vol 3, (Automation & Control)/ Manfred Weck / John Wiley and Sons, 1984

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I Year II Semester	SMART MATERIALS (PROGRAM ELECTIVE-3) (25AM1D09)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. Knowing the behavior of Piezoelectric and magnetostrictive materials and their suitability as sensors in smart structures.
2. Understanding the behavior of IPMC, Shape memory alloys and Rheological fluids and applied as Biometric sensors, as actuators in medical devices, aerospace and automotive industry, and as insulating membrane in bearings respectively.
3. Studying about different sensors and their role in health monitoring systems.
4. Develop different actuators for vibration control.
5. Designing the smart systems using self sensing and self healing systems.

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

CO1 Knowing the behavior of Piezoelectric and magnetostrictive materials and their suitability as sensors in smart structures (K2).

CO2 Understanding the behavior of IPMC, Shape memory alloys and Rheological fluids and applied as Biometric sensors, as actuators in medical devices, aerospace and automotive industry, and as insulating membrane in bearings respectively (K2).

CO3 Studying about different sensors and their role in health monitoring systems (K2 & K4)

CO4 Develop different actuators for vibration control (K3&K6).

CO5 Designing the smart systems using self sensing and self healing systems (K6)

UNIT – I:

Introduction: Introduction to Smart Materials, Principles of Piezoelectricity, Perovskite Piezoceramic Materials, Single Crystals vs Polycrystalline Systems, Piezoelectric Polymers, Principles of Magnetostriction, Rare earth Magnetostrictive materials, Giant Magnetostriction and Magneto-resistance Effect.

UNIT – II:

Introduction to Electro-active Materials, Electronic Materials, Electro-active Polymers, Ionic Polymer Matrix Composite (IPMC), Shape Memory Effect, Shape Memory Alloys, Shape

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(An Autonomous Institution)

Department of Mechanical Engineering
M. TECH (BR25) ADVANCED MANUFACTURING SYSTEMS
COURSE STRUCTURE & SYLLABUS

Memory Polymers, Electro-rheological Fluids, Magneto Rheological Fluids.

UNIT – III:

Piezoelectric Strain Sensors, In-plane and Out-of Plane Sensing, Shear Sensing, Accelerometers, Effect of Electrode Pattern, Active Fibre Sensing, Magnetostrictive Sensing, Villari Effect, Matteuci Effect and Nagoka-Honda Effect, Magnetic Delay Line Sensing, Application of Smart Sensors for Structural Health Monitoring (SHM), System Identification using Smart Sensors.

UNIT – IV:

Modelling Piezoelectric Actuators, Amplified Piezo Actuation – Internal and External Amplifications, Magnetostrictive Actuation, Joule Effect, Wiedemann Effect, Magnetovolume Effect, Magnetostrictive Mini Actuators, IPMC and Polymeric Actuators, Shape Memory Actuators, Active Vibration Control, Active Shape Control, Passive Vibration Control, Hybrid Vibration Control.

UNIT – V:

Self-Sensing Piezoelectric Transducers, Energy Harvesting Materials, Autophagous Materials, Self-Healing Polymers, Intelligent System Design, Emergent System Design.

TEXT BOOKS:

1. Brian Culshaw, Smart Structures and Materials, Artech House, 2000
2. Functional and Smart materials by Z L Wang and Z C Kang, Plenum Press
3. Gauenzi, P., Smart Structures, Wiley, 2009

REFERENCE BOOKS:

1. Cady, W. G., Piezoelectricity, Dover Publication
2. Smart materials: Integrated design, Engineering approaches and potential applications, AncaFilimon, Apple Academic Press

WEB REFERENCES:

- Please include hyperlinks related to NPTEL/VLabs etc.

online	online	online	online	online	Naveen
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COURSE STRUCTURE & SYLLABUS

I Year II Semester	PRODUCTION AND OPERATION MANAGEMENT (Program Elective 3) (25AM1D10)	L	T	P	C
		3	0	0	3

Course Objectives

1. To introduce the fundamentals of operations management, production systems, and product design concepts including concurrent engineering.
2. To explain value engineering principles, plant location, and layout strategies for effective production management.
3. To familiarize students with aggregate planning, inventory control, MRP, MRP-II, and Just-In-Time (JIT) production systems.
4. To develop understanding of project management techniques such as PERT, CPM, and project crashing for efficient project execution.
5. To provide insights into supply chain management concepts, processes, and decision-making models for optimized operations.

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

CO No.	Course Outcome	Bloom's Level
CO1	Explain the core concepts of operations management, product design, and concurrent engineering principles.	Understand
CO2	Apply value engineering techniques and determine suitable plant location and layout for manufacturing facilities.	Apply
CO3	Analyze and formulate aggregate production plans and inventory control strategies including MRP and JIT systems.	Analyze
CO4	Use project management tools like PERT and CPM to plan, schedule, and control projects effectively.	Apply / Analyze
CO5	Describe supply chain management concepts and apply SCM models to improve organizational performance.	Understand / Apply

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UNIT - I

OPERATION MANAGEMENT: Definition – Objectives – Types of production systems – historical development of operations management – Current issues in operation management. Product design – Requirements of good product design – product development – approaches – concepts in product development – standardization – simplification – Speed to market – Introduction to concurrent engineering.

UNIT – II

VALUE ENGINEERING: objective – types of values – function & cost – product life cycle-steps in value engineering – methodology in value engineers – FAST Diagram – Matrix Method. Location – Facility location and layout – Factors considerations in Plant location-Comparative Study of rural and urban sites – Methods of selection plant layout – objective of good layout – Principles – Types of layout – line balancing.

UNIT - III

AGGREGATE PLANNING: definition – Different Strategies – Various models of Aggregate Planning.

Advance inventory control systems push systems – Material Requirement – Terminology – types of demands – inputs to MRP- techniques of MRP – Lot sizing methods – benefits and drawbacks of MRP –Manufacturing Resources Planning (MRP –II), Pull systems – Vs Push system – Just in time (JIT) philosophy Kanban System – Calculation of number of Kanbans Requirements for implementation JIT – JIT Production process – benefits of JIT.

UNIT - IV

PROJECT MANAGEMENT: Programming Evaluation Review Techniques (PERT) – three times estimation – critical path – probability of completion of project – critical path method – crashing of simple nature.

UNIT – V

SUPPLY CHAIN MANAGEMENT: Concepts, process of SCM, selection of channel strategy, core operations capabilities, SCM decisions, SCM models.

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TEXT BOOKS:

1. Operations Management/ E.S. BuffA/ John Wiley & Sons / 2007
2. Production and Operations Management/ Chary/ Mc Graw Hill/2004

REFERENCES:

1. Operations Management Theory and Problems/ Joseph G. Monks / Macmillan / McGraw Hill / 3rd Edition.
2. Production and Operations Management - Theory and Practice by Dipak Kumar Battacharyya, Universities Press Pvt Ltd, 2012.
3. Production Systems Management/ James I. Riggs / John Wiley & Sons.
4. Operations Management/ Richard Chase/ Mc Graw Hill/2006
5. Production and Operation Management / Panner Selvam / PHI.
6. Production and Operation Analysis/ Nahima/ Mc Graw Hill/2004

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I Year II Semester	MEMS: DESIGN AND MANUFACTURING (PROGAM ELECTIVE-3) (25AM2D11)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. Basic knowledge on overview of MEMS (Micro electro Mechanical System) and various fabrication techniques.
2. To design, analysis, fabrication and testing the MEMS based components.
3. To find various opportunities in the emerging field of MEMS about the application and utility of Mechatronics used in various sectors and fields.

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

CO1 Synthesize and characterize nanomaterials for engineering applications (K3&K4)

CO2 Design and analyze methods and tools for micro and nano manufacturing (K2&K3).

CO3 Improve the quality of MEMS by analyzing the variables of the underlying micro and nano manufacturing method (K2).

CO4 Apply the concepts of thermo fluid engineering (K2&K3).

CO5 Select appropriate industrially-viable process, equipment and tools for a specific product (K2).

UNIT I:**OVERVIEW AND WORKING PRINCIPLES OF MEMS AND MICROSYSTEMS**

MEMS & Microsystems, Evolution of Micro fabrication, Microsystems & Microelectronics, Microsystems & Miniaturization, Applications of MEMS in Industries, Micro sensors, Micro actuation, MEMS with Micro actuators Micro accelerometers, Micro fluidics.

UNIT II:**ENGINEERING SCIENCE FOR MICROSYSTEMS DESIGN AND FABRICATION:**

Atomic structure of Matter, Ions and Ionization, Molecular Theory of Matter and Intermolecular Force, Doping of Semiconductors, The diffusion Process, Plasma Physics, Electrochemistry, Quantum Physics

UNIT III:**ENGINEERING MECHANICS FOR MICROSYSTEMS DESIGN:**

Static Bending of thin Plates, Mechanical Vibration, Thermo mechanics Fracture Mechanics,

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Thin-Film Mechanics, Overview of Finite Element Stress Analysis

UNIT IV:

Design Considerations, Process Design Mechanical Design, Mechanical design using FEM, Design of a Silicon Die for a Micro pressure sensor.

Materials for MEMS: Substrates and Wafers, Active substrate materials, Silicon as a substrate material, Silicon compounds, Silicon Piezo resistors, Gallium Arsenide, Quartz, Piezoelectric Crystals and Polymers and Applications

UNIT V:

Microsystems and their fabrication: Introduction to Micro systems Photolithography, Ion implantation, Diffusion and oxidation, Chemical and Physical vapor deposition, etching, Bulk micro manufacturing, Surface Micromachining, The LIGA Process and Applications.

TEXTBOOKS:

1. Tia-Ran Hsu, MEMS & Microsystems. Design & Manufacturing, TMH 2002
2. Foundation of MEMS/ Chang Liu/Pearson, 2012

REFERENCE BOOKS:

1. An Introduction to Micro electro mechanical Systems Engineering by Maluf M., Artech House, Boston 2000
2. Micro robots and Micromechanical Systems by Trimmer, W.S.N., Sensors & Actuators, Vol 19, 1989.
3. Applied Partial Differential Equations by Trim, D.W., PWS-Kent Publishing, Boston, 1990.

WEB REFERENCES:

- Please include hyperlinks related to NPTEL/VLabs etc.

online	online	online	online	online	Naveen
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I Year II Semester	TOTAL QUALITY MANAGEMENT (PROGRAM ELECTIVE-3) (25AM1D12)	L	T	P	C
		3	0	0	3

Course Objectives

1. To introduce the fundamental concepts of Total Quality Management (TQM) and its impact on business performance and organizational culture.
2. To explain the importance of customer focus, customer satisfaction, and benchmarking as part of quality management.
3. To describe the organizational structures and systems required for effective implementation of TQM, including quality circles and productivity improvement techniques.
4. To understand the cost of quality, methods of measuring quality costs, and the use of quality cost information for decision-making.
5. To familiarize students with international quality standards, particularly ISO 9000, certification processes, and their significance in quality management systems.

Course Outcomes (COs)

Upon successful completion of this course, students will be able to:

CO No.	Course Outcome	Bloom's Level
CO1	Explain the principles and benefits of Total Quality Management and its role in enhancing business performance.	Understand
CO2	Analyze customer needs and apply customer satisfaction and benchmarking techniques to improve quality.	Analyze / Apply
CO3	Organize and implement TQM concepts such as quality circles and productivity enhancement methods within organizations.	Apply / Evaluate
CO4	Calculate and interpret the cost of quality and use this information to guide quality improvement decisions.	Analyze
CO5	Understand and apply ISO 9000 standards and certification processes to develop effective quality management systems.	Apply / Understand

UNIT – I:

INTRODUCTION: The concept of TQM, Quality and Business performance, attitude and

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involvement of top management, communication, culture and management systems. Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs, Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

UNIT – II:

CUSTOMER FOCUS AND SATISFACTION: The importance of customer satisfaction and loyalty- Crating satisfied customers, Understanding the customer needs, Process Vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships. Bench Marketing: Evolution of Bench Marketing, meaning of Bench marketing, benefits of bench marketing, the bench marketing process, pitfalls of bench marketing.

UNIT – III:

ORGANIZING FOR TQM: The systems approach, Organizing for quality implementation, making the transition from a traditional to a TQM organizing, Quality Circles. Productivity, Quality and Reengineering: The leverage of Productivity and Quality, Management systems Vs. Technology, Measuring Productivity, Improving Productivity Re-engineering.

UNIT – IV:

THE COST OF QUALITY: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost Information, Accounting Systems and Quality Management.

UNIT – V:

ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQCQ-90. Series Standards, benefits of ISO9000 certification, the third party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

TEXT BOOKS:

1. Total Quality Management / Joel E.Ross/Taylor and Franscis Limited
2. Total Quality Management/P.N.Mukherjee/PHI REFERENCES:
3. Beyond TQM / Robert L.Flood
4. Statistical Quality Control / E.L. Grant / McGraw Hill.
5. Total Quality Management- A Practical Approach/H. Lal
6. Quality Management/Kanishka Bedi/Oxford University Press/2011
7. Total Engineering Quality Management/Sunil Sharma/Macmillan

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Dr. M. Kumara Swamy Assoc. Professor, Dept. of ME, UCEK (A), JNTUK	Dr. M. Ravi Sankar Prof. & Head, Dept. of ME, IITTP	Dr. T. Babu Rao, Asst. Professor, Dept. of ME, NITAP	Mr. K. M. Dakshina Murty, Sr. DGM, BHEL-HYD	Mr. U. Srinivas Technical officer C, ISRO-SHAR, Sriharikota	Dr. M. Naveen Srinivas, HOD-ME, BVCE(A)
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COURSE STRUCTURE & SYLLABUS

I Year II Semester	MECHATRONICS (PROGRAM ELECTIVE-4) (25AM1D13)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To impart the basic knowledge and importance on Mechatronics in Engineering Fields among the students.
2. To create the awareness on Mechatronics in Research and Application area.
3. To impart the knowledge about the application and utility of Mechatronics used in various sectors and fields.

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

CO1 Identification and demonstration of key elements of mechatronics system and its representation in terms of block diagram (K2).

CO2 Describe the use of solid-state electronic devices, diodes, amplifiers, etc. in designing the mechatronics systems and MEMS (K2).

CO3 Illustrate the applications of various hydraulic, pneumatic, mechanical, electrical actuating systems and valves in designing the mechatronic systems (K3).

CO4 Develop the PLC ladder programming for the creation of real-time mechatronic system (K6).

CO5 Develop dynamic models using system interfacing and data acquisition methods to design mechatronics systems for future applications (K6)

UNIT – I:

Mechatronics systems, elements, levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement, position, proximity, velocity, motion, force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

UNIT – II:

Solid state electronic devices, P-N junction diode, BJT, FET, DIA and TRIAC. Analog signal conditioning, amplifiers, filtering. Introduction to MEMS & typical applications.

UNIT – III:

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Hydraulic and pneumatic actuating systems, Fluid systems, Hydraulic and pneumatic systems, components, control valves, electro-pneumatic, hydro pneumatic, electro-hydraulic servo systems, Mechanical actuating systems and electrical actuating systems.

UNIT – IV:

Digital electronics and systems, digital logic control, microprocessors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT – V:

System and interfacing and data acquisition, DAQS, SCADA, Analogue to Digital and Digital to Analogue conversions; Dynamic models and analogies, System response. Design of mechatronics systems & future trends. Modeling and analysis of mechatronics systems (case studies)

TEXTBOOKS:

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran & GK VijayaRaghavan/WILEY India Edition/2008.
2. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering by W Bolton, Pearson Education Press, 3rd edition, 2005.

REFERENCE BOOKS:

1. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.
2. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
3. Mechatronics System Design / Devdasshetty / Richard / Thomson.
4. Mechatronics / M.D. Singh / J.G. Joshi/PHI.
5. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition, Pearson, 2012 W. Bolton.
6. Mechatronics – Principles and Application Godfrey C. Onwubolu, Wlsevier, 2006 Indian print.

WEB REFERENCES:

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I Year II Semester	THEORY OF PLASICITY (PROGRAM ELECTIVE-4) (25AMID14)	L	T	P	C
		3	0	0	3

Course Objectives

1. To introduce fundamental concepts of plasticity, including stress tensors, yield criteria, and strain-displacement relationships in materials under load.
2. To explain the principles of virtual work, stability postulates, and flow rules governing elastic-plastic behavior in materials.
3. To discuss incremental stress-strain relations and deformation theories applicable to plastic materials with hardening behavior.
4. To provide an understanding of finite element methods for elastic-plastic analysis and numerical techniques for solving nonlinear problems.
5. To study advanced topics like bounding surface theory, anisotropic plasticity, and theorems of limit analysis for complex loading conditions.

Course Outcomes (COs)

Upon successful completion of this course, students will be able to:

CO No.	Course Outcome	Bloom's Level
CO1	Understand and explain the fundamental stress-strain relations and yield criteria in plastic materials.	Understand
CO2	Apply virtual work principles, stability postulates, and flow rules to analyze elastic-plastic material behavior.	Apply
CO3	Analyze and solve problems using incremental stress-strain relationships and deformation theories of plasticity.	Analyze
CO4	Implement finite element formulations and numerical methods to solve elastic-plastic problems in materials.	Apply / Analyze
CO5	Evaluate anisotropic plasticity and apply limit analysis theorems to determine safe load-carrying capacities of bodies.	Evaluate

UNIT – 1

Introduction: Modeling Uniaxial behavior in plasticity. Index notation, Cartesian tensors. Yield and failure criteria Stress, stress deviator tensors. Invariants, principal, mean stresses, Elastic

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strain energy, Mohr's representation of stress in 2 & 3 dimensions, Haigh-Westergaard stress space, Equilibrium equations of a body. Yield criteria: Tresca's, von Mises rules, Drucker-Prager criterion, anisotropic yield criteria. Strain at point: Cauchy's formulae for strains, principal strains, and principal shear strains, derivative strain tensor. Strain-displacement relationships. Linear elastic stress strain relations, Generalized Hooke's law, nonlinear elastic stress strain relations

UNIT – 2

Principle of virtual work and its rate forms: Drucker's stability postulate, normality, convexity and uniqueness for an elastic solid. Incremental stress strain relations. Criteria for loading and unloading: Elastic and plastic strain increment tensors, Plastic potential and flow rule associated with different Yield criteria, Convexity, normality and uniqueness considerations for elastic-plastic materials. Expansion of a thick walled cylinder.

UNIT – 3

Incremental stress strain relationships: Prandtl-Reuss material model. J2 deformation theory, Drucker-Prager material, General Isotropic materials. Deformation theory of plasticity: Loading surface, Hardening rules. Flow rule and Drucker's stability postulate. Concept of effective stress and effective strain, mixed hardening material. Problems.

UNIT – 4

Finite element formulation for an elastic plastic matrix: Numerical algorithms for solving non linear equations, Convergence criteria, Numerical implementations of the elastic plastic incremental constitutive relations

UNIT – 5

Bounding surface theory: Uniaxial and multiaxial loading anisotropic material behavior Theorems of limit analysis: Statically admissible stress field and kinematically admissible velocity field. Upper and lower bound theorems, examples and problems.

TEXT BOOK:

1. Theory of Elasticity by S.P. Timoshenko & J.K Goodier, MGH

REFERENCES:

1. Plasticity for structural engineering W.F.Chen s and D.J.Han, Springer verlag-1987.
2. Mechanics of Materials –II, Victor E. Saouma.
3. Theory of plasticity, Sadhu Singh

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I Year II Semester	DESIGN AND ANALYSIS OF EXPERIMENTS (Program Elective 4) (25AM1D15)	L	T	P	C
		3	0	0	3

Course Objectives

1. Understand the fundamental concepts and assumptions of Analysis of Variance (ANOVA) in one-way and two-way classifications.
2. Apply principles of experimental designs including Completely Randomized Design (CRD), Randomized Block Design (RBD), and Latin Square Design (LSD) to practical problems.
3. Analyze the role of blocking and layout strategies in reducing experimental errors and improving data accuracy.
4. Evaluate main and interaction effects in factorial experiments such as 2^2 and 2^3 designs using statistical methods.
5. Use statistical software tools (Excel, MS Word) to process experimental data and effectively communicate results.

Course Outcomes (Cos)

1. Demonstrate the ability to perform ANOVA for one-way and two-way classifications on experimental data (K3).
2. Design experiments using CRD, RBD, and LSD layouts and interpret critical differences to control variability (K4&K5).
3. Handle missing data in experimental designs and perform appropriate statistical adjustments and analyses (K4&K5).
4. Analyze factorial experiment data to determine main and interaction effects using Yates procedure and related methods (K4).
5. Prepare comprehensive reports and present findings from experimental data using spreadsheet tools and documentation software (K5&K6).

Unit – 1:

Analysis of variance (ANOVA) Concept, Definition and assumptions. ANOVA one way classification – mathematical model, analysis – with equal and unequal classification. ANOVA two way classification – mathematical model, analysis and problems.

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Unit – 2:

Completely Randomised Design (CRD) Definition, terminology, Principles of design of experiments, CRD – Concept, advantages and disadvantages, applications, Layout, Statistical analysis. Critical Differences when hypothesis is significant.

Unit – 3:

Randomised Block Design (RBD) Concept, advantages and disadvantages, applications, Layout, Statistical analysis and Critical Differences. Efficiency of RBD relative to CRD. RBD with one missing value and its analysis, problems.

Unit – 4:

Latin Square Design Concept, advantages and disadvantages, applications, Layout, Statistical analysis and Critical Differences. Efficiency of LSD over RBD and CRD. Estimation of one missing value in LSD and its analysis, problems.

Unit – 5:

Factorial experiments Main effects and interaction effects of 2^2 and 2^3 factorial experiments and their Statistical analysis. Yates procedure to find factorial effect totals.

Practical Syllabus

1. ANOVA - one - way classification with equal number of observations.
2. ANOVA - one - way classification with unequal number of observations.
3. ANOVA Two-way classification.
4. Analysis of CRD and critical differences.
5. Analysis of RBD and critical differences. Relative efficiency of CRD with RBD.
6. Estimation of single missing observation in RBD and its analysis.
7. Analysis of LSD and efficiency of LSD over CRD and RBD.
8. Estimation of single missing observation in LSD and its analysis.
9. Analysis of 2^2 with RBD layout.
10. Analysis of 2^3 with RBD layout.

Note: Training shall be on establishing formulae in Excel cells and derive the results. The excel output shall be exported to MS word for writing inference.

References

1. S. C. Gupta & V. K. Kapoor: Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

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Dr. M. Kumara Swamy Assoc. Professor, Dept. of ME, UCEK (A), JNTUK	Dr. M. Ravi Sankar Prof. & Head, Dept. of ME, IITTP	Dr. T. Babu Rao, Asst. Professor, Dept. of ME, NITAP	Mr. K. M. Dakshina Murty, Sr. DGM, BHEL-HYD	Mr. U. Srinivas Technical officer C, ISRO-SHAR, Sriharikota	Dr. M. Naveen Srinivas, HOD-ME, BVCE(A)
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2. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI.
3. M. R. Saluja: Indian Official Statistics. ISI publications.

Suggested Co-curricular Activities:

1. Training of students by related industrial experts
2. Assignments including technical assignments if any.
3. Seminars, Group Discussions, Quiz, Debates etc on related topics.
4. Preparation of audio and videos on tools of diagrammatic and graphical representations.
5. Collection of material/figures/photos/author photoes of related topics.
6. Invited lectures and presentations of stalwarts to those topics.
7. Visits/field trips of firms, research organizations etc.

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COURSE STRUCTURE & SYLLABUS

I Year II Semester	GREEN MANUFACTURING (Program Elective 4) (25AM1D16)	L	T	P	C
		3	0	0	3

Course Objectives

1. To introduce the concepts, motivations, and challenges associated with Green Manufacturing and its environmental, social, and policy impacts.
2. To familiarize students with metrics and methodologies used to measure and evaluate green manufacturing processes and supply chains.
3. To explore closed-loop production systems, including lifecycle assessment, sustainable factory design, and eco-efficient manufacturing processes.
4. To study the environmental implications of advanced technologies like nano-manufacturing and the role of clean energy in green manufacturing.
5. To analyze the role of sustainable packaging and supply chain practices in minimizing environmental footprints.

Course Outcomes (COs)

Upon completion of the course, students will be able to:

CO No.	Course Outcome	Bloom's Level
CO1	Explain the principles, motivations, and barriers of green manufacturing within social, business, and policy contexts.	Understand
CO2	Apply various green manufacturing metrics and life cycle assessment methodologies to evaluate manufacturing processes.	Apply
CO3	Analyze and design closed-loop production systems for economic and ecological sustainability.	Analyze
CO4	Assess the environmental impacts of nano-manufacturing technologies and propose clean energy solutions for manufacturing.	Evaluate
CO5	Evaluate packaging and supply chain strategies to enhance sustainability and reduce environmental impact.	Evaluate

Unit – 1:

Introduction to Green Manufacturing, Why Green Manufacturing, Motivations and Barriers to

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Green Manufacturing, Environmental Impact of Manufacturing, Strategies for Green Manufacturing. The Social, Business, and Policy Environment for Green Manufacturing: Introduction, The Social Environment—Present Atmosphere and Challenges for Green Manufacturing, The Business Environment: Present Atmosphere and Challenges, The Policy Environment—Present Atmosphere and Challenges for Green Manufacturing.

Unit – 2:

Metrics for Green Manufacturing Introduction, Overview of Currently Used Metrics, Overview of LCA Methodologies, Metrics Development Methodologies, Outlook and Research Needs. Green Supply Chain: Motivation and Introduction, Definition, Issues in Green Supply Chains (GSC), Techniques/Methods of Green Supply Chain, Future of Green Supply Chain. Principles of Green Manufacturing: Introduction, Background, and Technology Wedge Principles Mapping Five Principles to Other Methods and Solutions.

Unit – 3:

Closed-Loop Production Systems Life Cycle of Production Systems, Economic and Ecological Benefits of Closed Loop Systems, Machine Tools and Energy Consumption, LCA of Machine Tools, Process Parameter Optimization, Dry Machining and Minimum Quantity Lubrication, Remanufacturing, Reuse, Approaches for Sustainable Factory Design.

Unit – 4:

Environmental Implications of Nano-manufacturing Introduction, Nano-manufacturing Technologies, Conventional Environmental Impact of Nano manufacturing, Unconventional Environmental Impacts of Nano-manufacturing, Life Cycle Assessment (LCA) of Nanotechnologies. Green Manufacturing Through Clean Energy Supply: Introduction, Clean Energy Technologies, Application Potential of Clean Energy Supplying Green Manufacturing

Unit – 5:

Packaging and the Supply Chain A Look at Transportation, Introduction, Background, Recommended Method to Determine Opportunities for Improved Pallet Utilization, Discussion.

Text Book:

1. David Dornfeld “Green Manufacturing Fundamentals and Applications”, Springer, 2013
2. Reference:
3. J. Paulo Davim “Green Manufacturing Processes and Systems” Springer-Verlag Berlin Heidelberg, 2013

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COURSE STRUCTURE & SYLLABUS

I Year II Semester	MATERIAL CHARACTERIZATION LAB (25AM2L03)	L	T	P	C
		0	1	2	2

Course Objectives

1. To introduce various microscopy techniques and their applications in material characterization, focusing on imaging theory, resolution, and magnification.
2. To provide hands-on experience in optical microscopy for microstructural analysis including grain size and phase percentage estimation.
3. To develop skills in evaluating mechanical properties such as hardness, tensile strength, compression strength, and flexural strength of metals.
4. To expose students to non-destructive testing methods like dye penetrant and magnetic particle inspection for detecting surface defects.
5. To familiarize students with advanced characterization techniques such as XRD, FESEM, and digital scanning calorimetry for material analysis.

Course Outcomes (COs)

Upon successful completion of this lab, students will be able to:

CO No.	Course Outcome	Bloom's Level
CO1	Demonstrate knowledge of different microscopy techniques and apply optical microscopy to analyze microstructures.	Understand & Apply
CO2	Perform micro hardness testing and mechanical property evaluation (tensile, compression, and flexural) on metals.	Apply
CO3	Conduct and interpret non-destructive tests such as dye penetrant and magnetic particle inspection.	Apply & Analyze
CO4	Evaluate tribological properties of ferrous and non-ferrous materials using pin-on-disc testing.	Analyze
CO5	Interpret XRD, FESEM, and DSC images/data for advanced material characterization.	Analyze & Evaluate

1. Microscopy: Different microscopy techniques, Resolution, Magnification, Depth of field

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Imaging – theory and concepts.

2. Optical Microscopy: Grain size estimation, Phase Percentage Estimation
3. Micro hardness evaluation of Ferrous and Non ferrous metals.
4. Testing of Tensile Properties of mild steel material
5. Testing of Compression Properties
6. Testing of Flexural Strength on Ferrous metals.
7. Die penetrant test
8. Magnetic particle Inspection
9. Evaluation of Tribological properties of Ferrous and Non ferrous metals through Pin on Disc Tester.
10. Study of XRD Analysis
11. Study of FESEM Images
12. Study of digital scanning calorimetry images

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COURSE STRUCTURE & SYLLABUS

I Year II Semester	FINITE ELEMENT SIMULATION OF MANUFACTURING PROCESSES LAB (25AM2L04)	L	T	P	C
		0	1	2	2

Course Objectives

1. To provide students with practical knowledge of modeling various manufacturing processes using Finite Element Analysis (FEA) tools.
2. To develop skills in simulating casting processes, focusing on solidification, temperature distribution, residual stresses, and defect prediction.
3. To enable students to analyze forging processes including cold and hot working, and study material flow, deformation, and defects.
4. To familiarize students with the simulation of forming processes such as blanking, bending, and deep drawing, identifying typical process defects.
5. To introduce the simulation of welding processes including arc, spot, and laser welding, and analysis of associated thermal and mechanical defects.

Course Outcomes (COs)

Upon successful completion of this lab, students will be able to:

CO No.	Course Outcome	Bloom's Level	
CO1	Develop finite element models for casting processes and analyze solidification, temperature, and residual stress patterns.	Apply	&
CO2	Simulate forging processes (cold and hot working) and assess material deformation and potential defects.	Analyze	&
CO3	Model forming processes such as blanking, bending, and deep drawing to predict process behavior and defects.	Evaluate	&
CO4	Conduct finite element simulations of welding processes and analyze thermal cycles and defect formation.	Apply	&
CO5	Interpret simulation results to optimize manufacturing processes and minimize defects.	Analyze	&
		Evaluate	

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Students shall carry out the modeling and FE analysis of the following:

1. Casting processes - Study of Solidification, temperatures, Residual stresses, metallurgical phases, defects, etc.
2. Forging processes - Study of cold working and hot working processes for extrusion, drawing, rolling, defects, etc.
3. Forming Processes – Study of blanking, bending, deep drawing, defects, etc.
4. Welding Processes – Study of arc, spot, laser welding, defects, etc.

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I Year II Semester	SEMINAR II (25AM2S02)	L	T	P	C
		0	0	2	1

online	online	online	online	online	Nannu
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II Year I Semester	RESEARCH METHODOLOGY AND IPR (25HM3D01)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- 1.To understand the knowledge on basics of research and its types.
- 2.To impart the concept of Literature Review, Technical Reading, Attributions and Citations.
- 3.To know the Ethics in Engineering Research.
- 4.To know the concepts of Intellectual Property Rights in Engineering.

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

CO1 Explain the meaning of engineering research and apply to develop an appropriate framework for research studies (K2&K3).

CO2 Identify the procedure of Literature Review, Technical Reading, etc. and apply to develop a research design during their project work (K2&K3).

CO3 Explain and apply the fundamentals of patent laws and drafting procedure in their research works (K2&K3).

CO4 Demonstrate the copyright laws, subject matters of copyrights, designs etc. to apply in patent filing (K2&K3).

CO5 Identify the new developments in IPR and employ the applications of computer software in writing/filing patents in future (K6).

UNIT – I:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT – II:

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

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UNIT – III:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT – IV:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT – V:

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR.

TEXTBOOKS:

1. C.R. Kothari , 2nd Edition, “Research Methodology: Methods and Techniques”.
2. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step-by-Step Guide for beginners”

REFERENCE BOOKS:

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students.
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”.
3. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
4. Mayall, “Industrial Design”, McGraw Hill, 1992.
5. Niebel, “Product Design”, McGraw Hill, 1974.
6. Asimov, “Introduction to Design”, Prentice Hall, 1962.
7. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.
8. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

WEB REFERENCES:

- Please include hyperlinks related to NPTEL/VLabs etc.

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II Year I Semester	SUMMER INTERNSHIP (25AM3P01)	L	T	P	C
		0	0	0	3

COURSE OBJECTIVES:

1. Internships provide students with an opportunity to put into practice skills they have learned while in college.
2. In addition, students should have an opportunity to enhance those skills, obtain the perspective of a work environment and benefit from a mentor or supervisor's experience and advice.

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

CO1 Integrate theory and practice to assess interests and abilities in their field of study (K3&K4).

CO2 Develop work habits, attitudes necessary to appreciate work and its function in the economy (K3).

CO3 Develop communication, interpersonal and other critical skills to build a record of work experience (K3).

Based on suggested Revised Blooms Taxonomy Level (BTL) K1: Remember K2: Understand
K4: Analyse K5: Evaluate, K6: Create

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II Year I Semester	COMPREHENSIVE VIVA (25AM3V01)	L	T	P	C
		0	0	0	2

online	online	online	online	online	Naveen
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II Year I Semester	DISSERTATION PART A (25AM3P02)	L	T	P	C
		0	0	20	10

COURSE OBJECTIVES:

- 1.To impart fundamental and disciplinary concepts and methods in ways appropriate to their principal areas of study.
- 2.To familiarise how to incorporate skill and knowledge of current information and technological tools and techniques specific to the professional field of study.
- 3.Expose to the critical aspects like identifying, analysing and solving problems creatively through sustained critical investigation using effective oral, written and visual communications.
- 4.To inculcate the key aspects like awareness and application of appropriate personal, societal and professional ethical standards to excellence needed to engage in lifelong learning.

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

CO1 Carryout a critical review of literature on a chosen topic of research and identify gaps in the literature to define a problem for research work (K3&K4).

CO2 Formulate/adapt a clear methodology using multi-disciplinary approach and modern tools (K3&K6).

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II Year II Semester	DISSERTATION PART B (25AM4P03)	L	T	P	C
		0	0	32	16

COURSE OBJECTIVES:

- 1.To impart fundamental and disciplinary concepts and methods in ways appropriate to their principal areas of study.
- 2.To familiarise how to incorporate skill and knowledge of current information and technological tools and techniques specific to the professional field of study.
- 3.Expose to the critical aspects like identifying, analysing and solving problems creatively through sustained critical investigation using effective oral, written and visual communications.
- 4.To inculcate the key aspects like awareness and application of appropriate personal, societal and professional ethical standards to excellence needed to engage in lifelong learning.

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

CO1 Carryout design/analysis of a product/system or devise experiments to study and develop a system/process/product (K3&K4).

CO2 Interpret & validate results of analysis/experiments conducted to study behaviour of a product /system/ process considered for the research leading to valid conclusions that add value to the body of knowledge (K3&K5).

CO3 Write and present a technical report of the project work (K6).

Based on suggested Revised Blooms Taxonomy Level (BTL) K1: Remember K2: Understand K4: Analyse K5: Evaluate K6: Create

online	online	online	online	online	Nbunny
Dr. M. Kumara Swamy Assoc. Professor, Dept. of ME, UCEK (A), JNTUK	Dr. M. Ravi Sankar Prof. & Head, Dept. of ME, IITTP	Dr. T. Babu Rao, Asst. Professor, Dept. of ME, NITAP	Mr. K. M. Dakshina Murty, Sr. DGM, BHEL-HYD	Mr. U. Srinivas Technical officer C, ISRO-SHAR, Sriharikota	Dr. M. Naveen Srinivas, HOD-ME, BVCE(A)
Member-Affiliating Univ. Nominee	Subject Expert	Subject Expert	Industry Expert	PG Alumni	Chair-person BOS



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Odalarevu – 533210, Allavaram Mandal, Dr. B. R. Ambedkar Konaseema District, Andhra Pradesh, India
Cell: 9392522444, Email: bvce@bvcgroup.in, Web: www.bvcec.edu.in

BVCE/BOS/MEC/2025

Date: 09.10.2025

To

Dr. M. Kumara Swamy,
Associate Professor

Department of Mechanical Engineering, UCEK(A), JNTUK Kakinada.

Sub: BVCE – Odalarevu - Request to attend the BOS Meeting – BR25_M.
Tech_ME_Course Structure & Syllabus – Reg.

Respected Sir,

Greetings from Board of Studies of Mechanical Engineering, B V C Engineering College, Odalarevu.

We thank you for your kind consent in scheduling our Advanced Manufacturing Systems, M. Tech – BOS meeting of BR25 curriculum. In this regard, we bring to your kind notice that the Mechanical Engineering Department BOS meeting is scheduled on 10th, October-2025(Friday) from 2pm in virtual mode (online).

The agenda of BOS meeting:

1. Discussion on the ratification of the course structure and syllabus of M.Tech in Advanced Manufacturing Systems (BR25).
2. Any other item.

On behalf of the Management and BOS of Mechanical Engineering, We whole heartedly invite you to attend this meeting and offer your valuable suggestions.

The details of online meeting link shall be shared with you

Thanking you sir.

Yours sincerely

(Dr. M. Naveen Srinivas)
Chairman-BOS



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Cell: 9392522444, Email: bvce@bvcgroup.in, Web: www.bvcec.edu.in

BVCE/BOS/MEC/2025

Date: 09.10.2025

To
Mr. K. M. Dakshina Murty,
Sr. Deputy General Manager
Power Plant Dynamics & Simulation, BHEL, Hyderabad-93

Sub: BVCE - Odalarevu - Request to attend the BOS Meeting - BR25_M.
Tech_ME_Course Structure & Syllabus - Reg.
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Cell: 9392522444, Email: bvce@bvcgroup.in, Web: www.bvcec.edu.in

BVCE/BOS/MEC/2025

Date: 09.10.2025

To
Dr. T. Babu Rao,
Assistant Professor, Dept. of ME,
NIT Andhra Pradesh, 534101.

Sub: BVCE – Odalarevu - Request to attend the BOS Meeting – BR25_M.
Tech_ME_Course Structure & Syllabus – Reg.

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Cell: 9392522444, Email: bvce@bvcgroup.in, Web: www.bvcec.edu.in

BVCE/BOS/MEC/2025

Date: 09.10.2025

To

Mr. Uggirala Srinivas,

Technical officer-C,

ISRO-SHAR, Sriharikota, Andhra Pradesh - 524124

Sub: BVCE – Odalarevu - Request to attend the BOS Meeting – BR25_M.
Tech_ME_Course Structure & Syllabus – Reg.

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Cell: 9392522444, Email: bvce@bvcgroup.in, Web: www.bvcec.edu.in

BVCE/BOS/MEC/2025

Date: 09.10.2025

To
Dr. M. Ravi Sankar,
Professor & HOD, Dept. of ME,
IIT Tirupati, Andhra Pradesh, - 517619.

Sub: BVCE – Odalarevu - Request to attend the BOS Meeting – BR25_M.
Tech_ME_Course Structure & Syllabus – Reg.
Respected Sir,

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