JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
(Established by Govt. of A.P., ACT No.30 of 2008)
ANANTHAPURAMU – 515 002 (A.P) INDIA

M.TECH. IN ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABI

SEMESTER – I

S. No.	Course codes	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	21D87101	Automation in Manufacturing	PC	3	0	0	3
2.	21D87102	Computer Aided Manufacturing	PC	3	0	0	3
3.	21D87103a 21D87103b 21D87103c	**Program Elective Course - I** Precision Engineering Special manufacturing Processes Product Data Management	PE	3	0	0	3
	21D87104a 21D87104b 21D87104c	**Program Elective Course – II** Design for Manufacturing and Assembly Advanced CAD Advanced Mechatronics	PE	3	0	0	3
5.	21D87105	Automation Laboratory	PC	0	0	4	2
6.	21D87106	Metal Cutting Laboratory	PC	0	0	4	2
7.	21DRM101	Research Methodology and IPR	MC	2	0	0	2
8.	21DAC101a 21DAC101b 21DAC101c	**Audit Course – I** English for Research paper writing Disaster Management Sanskrit for Technical Knowledge	AC	2	0	0	0
Total							**18**

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SEMESTER – II

S.No.	Course codes	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	21D87201	Simulation of Manufacturing Systems	PC	3	0	0	3
2.	21D87202	Quality Engineering in Manufacturing	PC	3	0	0	3
3.	21D87203a 21D87203b 21D87203c	**Program Elective Course – III** Material Science & Technology Industrial Robotics Advanced Tool Design	PE	3	0	0	3
4.	21D87204a 21D87204b 21D11204a	**Program Elective Course – IV** Production & Operations Management Modeling of Manufacturing Systems Computational Fluid Dynamics	PE	3	0	0	3
5.	21D87205	Manufacturing Simulation Laboratory	PC	0	0	4	2
6.	21D87206	Advanced CAD/CAM Laboratory	PC	0	0	4	2
7.	21D87207	Technical seminar	PR	0	0	4	2
8.	21DAC201a 21DAC201b 21DAC201c	**Audit Course – II** Pedagogy Studies Stress Management for Yoga Personality Development through Life Enlightenment Skills	AC	2	0	0	0
Total							**18**

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SEMSTER - III

S.No.	Course codes	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	21D87301a 21D87301b 21D87301c	**Program Elective Course – V** Total Quality Management Theory of Elasticity and Plasticity Design and Manufacturing of MEMS and Micro Systems	PE	3	0	0	3
2.	21DOE301c 21DOE301g 21DOE301h	**Open Elective** Business Analytics Internet Of Things Mechatronics	OE	3	0	0	3
3.	21D87302	Dissertation Phase – I	PR	0	0	20	10
4.	21D87303	Co-curricular Activities					2
Total							**18**

SEMESTER - IV

S.No.	Course codes	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	21D87401	Dissertation Phase – II	PR	0	0	32	16
Total							**16**

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COURSE STRUCTURE & SYLLABI

Course Code	**AUTOMATION IN MANUFACTURING**	**L**	**T**	**P**	**C**
21D87101		**3**	**0**	**0**	**3**
	Semester	**I**			

Course Objectives: Student will be able to

- Understand the principles of automation, importance of automated flow lines and its types.
- Understand outline the system configurations used in automated production
- Recognize and articulate the foundational assumption of the transfer mechanism, types of transfer mechanism that may be used for work part transfer
- Describe automated assembly systems, and their associated system configurations , list the hardware components used for parts delivery at workstations Outline typical automated assembly processes

Course Outcomes (CO): Student will be able to

- Understand to know what is automation, types of automation, components of automation, strategies and levels of automation
- Understand to know what is automation, types of automation, components of automation, strategies and levels of automation
- Understand the types of flow lines, quantitative analysis of flow lines, how the assembly is carried out on automated flow line without interruption and how to balance the line and flexible assembly lines
- Understand automated transfer and storage system, recognize the equipments used in automated transfer and storage system.

UNIT - I	**OVER VIEW OF MANUFACTURING AND AUTOMATION**	Lecture Hrs:09

Production systems, Automation in production systems, Automation principles and strategies, Manufacturing operations, production facilities. Basic elements of an automated system, levels of automation; Hardware components for automation and process control, programmable logic controllers.

UNIT – II	**MATERIAL HANDLING AND IDENTIFICATION TECHNOLOGIES**	Lecture Hrs:09

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**	Lecture Hrs:09

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**	Lecture Hrs:09

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**	Lecture Hrs:09

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

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production.
Textbooks:
1. Automation, production systems and computer integrated manufacturing/ Mikell. P Groover/PHI/3rd edition/2012. 2. Automation, Production Systems and CIM/ Mike J P. Grower/PHI
Reference Books:
1. CAD/CAM/CIM/ P. **R**adha Krishnan **& S**. Subrahamanyarn 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
Online Learning Resources:
1. https://nptel.ac.in/courses/112/104/112104288/ 2. https://nptel.ac.in/courses/112/103/112103293/ 3. https://nptel.ac.in/courses/112/103/112103174/ 4. https://youtu.be/v-3TmN4HhLc 5. https://youtu.be/-NINgz6KQTA 6. https://youtu.be/CmQa2xoQdzk 7. https://youtu.be/yeHE4se7u5M

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Course Code	COMPUTER AIDED MANUFACTURING	L	T	P	C
21D87102		3	0	0	3
	Semester	I			

Course Objectives: Student will be able to

- Know and about computer Aided Manufacturing is highly demanded area now a day. Computer Aided Manufacturing deals with Design of components to manufacturing and also includes Planning and controlling the processes. Industries widely use CNC, FMS and Robotics technology now a day.
- Students will be familiar with its hardware and software and also able to write programs for machining.

Course Outcomes (CO): Student will be able to

- Describe basic concepts of CAM application and understand CAM wheel
- Prepare CNC programs for manufacturing of different geometries on milling and lathe machines.
- Prepare logic diagram for different application of automation.
- Classify different components using different techniques of group technology.
- Select layouts of FMS for industrial applications.
- Describe Robot for preliminary industrial applications like pick and place.
- Identify application of PPC, JIT, MRP-I, MRP-II, and Expert system to CAM.

UNIT – I	COMPUTER AIDED DESIGN AND PROGRAMMING	Lecture Hrs:09

General information, APT programming, Examples Apt programming problems. NC programming on CAD/CAM systems, post processing techniques, Introduction to CAD/CAM software, Automatic Tool Path generation.

UNIT – II	TOOLING FOR CNC MACHINES	Lecture Hrs:09

Interchangeable tooling system , preset and qualified tools, modular fixturing , quick change tooling system, automatic head changers. DNC Systems and Adaptive Control: Introduction, type of DNC systems, advantages arid disadvantages of DNC, adaptive control with optimization, Adaptive control with constrains, Adaptive control of machining processes like turning, grinding, types of control systems-open loop and closed loop control systems.

UNIT – III	POST PROCESSORS FOR CNC	Lecture Hrs:09

Introduction to Post Processors: The necessity of a Post Processor, the general structure of a Post Processor, the functions of a Post Processor, DAPP — based- Post Processor: Communication channels and major variables in the DAPP — based Post Processor, th creation of a DAPP— Based Post Processor

UNIT - IV	MICRO CONTROLLERS	Lecture Hrs:09

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. Programming 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.

UNIT - V	COMPUTER AIDED PROCESS PLANNING	Lecture Hrs:09

Hybrid CAAP System, Computer Aided Inspection and qualitycontrol, Coordinate Measuring Machine, Limitations of CMM, Computer Aided Testing, Optical Inspection Methods, Artificial Intelligence and expert system: Artificial Neural Networks, Artificial Intelligence in CAD, Experts systems and its structures.

Textbooks:

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1. Computer Control of Manufacturing Systems / YoramKoren / McGraw Hill. 1983.
2. Computer Aided Design Manufacturing – K. Lalit Narayan, K. MallikarjunaRao and M.M.M. Sarcar, PHI, 2008.

Reference Books:

1. CAD/CAM Principles and Applications, P.N.Rao, TMH
2. CAD / CAM Theory and Practice,/ Ibrahim Zeid,TMH
3. CAD / CAM / CIM, Radha krishnan and Subramanian, New Age
4. Principles of Computer Aided Design and Manufacturing, FaridAmirouche, Pearson

Online Learning Resources:

1. nptel.ac.in/courses/112/102/112102101/
2. nptel.ac.in/courses/112/104/112104289/

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Course Code	PRECISION ENGINEERING	L	T	P	C
21D87103a	Program Elective Course – I	3	0	0	3
Semester		I			

Course Objectives: Student will be able

- To impart knowledge about basics of precision machining and different Manufacturing technique in precision engineering.
- Accuracy and alignment tests.
- Influences of static stiffness and thermal effects.
- Precision machining.
- Nano measuring systems.
- Various lithography techniques

Course Outcomes (CO): Student will be able to

- Apply fits and tolerances for parts and assemblies according to ISO standards
- Apply selective assembly concept for quality and economic production
- Assign tolerances using principles of dimensional chains for individual features of a part or assembly.
- Evaluate the part and machine tool accuracies.

UNIT - I	CONCEPTS OF ACCURACY	Lecture Hrs:09

Introduction – Concept of Accuracy of Machine Tools – Spindle and Displacement Accuracies – Accuracy of numerical Control Systems – Errors due to Numerical Interpolation Displacement Measurement System and Velocity lags.

GEOMETIC DEIMENSIONING AND TOLERANCING:

Tolerance Zone Conversions – Surfaces, Features, Features of Size, Datum Features – Datum Oddly Configured and Curved Surfaces as Datum Features, Equalizing Datums – Datum Feature of Representation – Form controls, Orientation Controls – Logical Approach to Tolerancing.

UNIT - II	DATUM SYSTEMS	Lecture Hrs:09

Design of freedom, Grouped Datum Systems – different types, two and three mutually perpendicular grouped datum planes; Grouped datum system with spigot and recess, pin and hole; Grouped Datum system with spigot and recess pair and tongue – slot pair – Computation of Transnational and rotational accuracy, Geometric analysis and application.

UNIT - III	TOLERANCE ANALYSIS	Lecture Hrs:09

Process Capability, Mean, Variance, Skewness, Kurtosis, Process Capability Metrics, Cp, Cpk, Cost aspects, Feature Tolerances, Geometric Tolerances. Surface finish, Review of relationship between attainable tolerance grades and different machining process, Cumulative effect of tolerances sure fit law, normal law and truncated normal law.

UNIT - IV	TOLERANCE CHARTING TECHNIQUES	Lecture Hrs:09

Operation Sequence for typical shaft type of components,Preparation of Process drawings for different operations, Tolerance worksheets and centrally analysis, Examples, Design features to facilitate machining; Datum Features – functional and manufacturing Components design – Machining Considerations, Redesign for manufactured, Examples

UNIT - V	MEASURING SYSTEMS PROCESSING	Lecture Hrs:09

MEASURING SYSTEMS PROCESSING: In processing or in-situ measurement of position of processingpoint-Post process and on-machine measurement of dimensional features and surface-mechanical and optical measuring systems.

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Textbooks:
1. Precision Engineering in Manufacturing/Murthy R.L./New Age International (P) limited, 1996. 2. Geometric Dimensioning and Tolerancing / James D. Meadows / Marcel Dekker inc. 1995
Reference Books:
1. Nano Technology / Norio Taniguchi / Oxford University Press, 1996. 2. Engineering Design – A systematic Approach / Matousek / Blackie & Son Ltd., London 3. Precision Engineering/VC Venkatesh& S Izman/TMH
Online Learning Resources:
1. https://www.itsligo.ie/courses/beng-precision-engineering-design-online/ 2. https://www.bachelorsportal.com/studies/249110/precision-engineering-and-design.html 3. https://engineering.purdue.edu/online/courses/precision-manufacturing-systems

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Course Code	SPECIAL MANUFACTURING PROCESSES	L	T	P	C
21D87103b	Program Elective Course – I	3	0	0	3
	Semester	I			

Course Objectives: Student will be able

- To teach the students to understand the fundamentals of manufacturing and prototyping for product design and development.
- To teach the students to gain practical experience in manufacturing and prototyping for product design and development.
- To teach the students to develop ability to apply up-to-date technology in manufacturing products with considerations of safety and environmental factors

Course Outcomes (CO): Student will be able to

- Describe the principle and operation of common manufacturing and rapid prototyping processes for product development.
- Decide on the use of appropriate manufacturing processes in the manufacture of a product at the design stage.
- Develop a prototype with modern prototyping techniques.
- Apply up-to-date technology in manufacturing products with considerations of safety and environmental factors.
- Apply the reverse engineering process for product development.
- Appreciate and report on the common practice in the product development industry.

UNIT - I	SURFACE TREATMENT	Lecture Hrs:09

Scope, Cleaners, Methods of cleaning, Surface coating types, and 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	Lecture Hrs:09

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	Lecture Hrs:09

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

UNIT - IV	E-MANUFACTURING	Lecture Hrs:09

Nano manufacturing techniques and micromachining, High Speed Machining andhot machining. Internet based e-manufacturing covers the range of manufacturing activities for products and services, including product design, production control and condition monitoring, supply chain management, maintenance and sales and services through the internet.

UNIT - V	RAPID PROTOTYPING	Lecture Hrs:09

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

Textbooks:

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

Reference Books:

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3. Microelectronic packaging handbook / Rao. R. Thummala and Eugene, J. Rymaszewski / Van NostrandRenihold,
4. MEMS & Micro Systems Design and manufacture / Tai — Run Hsu / TMGH
5. Advanced Machining Processes / V.K.Jain / Allied Publications.
6. Introduction to Manufacturing Processes / John A Schey*I*McGraw Hill.
7. E-manufacturing applications and potentials – Kaiecherg, Richard,J. Bateman," Progress in Natural Science vol 18,Issue 11, November 2008, PP 1323-1328.

Online Learning Resources:

1. nptel.ac.in/courses/112/107/112107144/
2. https://www.tandfonline.com/toc/lmmp20/current
3. https://alison.com/course/manufacturing-paradigms?utm_source=google&utm_medium=cpc&utm_campaign=PPC_Tier-4_Course-3070_Manufacturing-Paradigms&utm_adgroup=Course-3070_Manufacturing-Paradigms&gclid=Cj0KCQjw8p2MBhCiARIsADDUFVGxg_R-KK7tz4wKmikdyRr7h-3lSkUk7zH4BARh9c-5hn4vZ6KJHrUaAmjnEALw_wcB

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Course Code	PRODUCT DATA MANAGEMENT	L	T	P	C
21D87103c	Program Elective Course – I	3	0	0	3
Semester		I			

Course Objectives: Student will be able to

- Familiarize the current principles, practices, and applications of Product Lifecycle Management (PLM).
- Aware that the sustainable design of product and process and the early consideration of the constraints and factors become more important to successfully develop competitive products.
- Learn integrated, information driven approach to all aspects of a product's life from its design inception, through its manufacture, deployment and maintenance, and culminating in its removal from service and final disposal.
- Aware that PLM technology is playing a critical role in most of the modern industries including aerospace, automobile, medical, etc.
- Experience effective integration of PLM technologies into the product development process that can put the industry at a competitive advantage to deliver innovative products ! Experience modern PLM strategies, methods, and tools.

Course Outcomes (CO): Student will be able to

- Remember the reasons for adopting PLM strategies and methods.
- Indentify PLM's impacts on corporate strategy, structure and operations.
- Distinguish product development processes.
- Distinguish associated engineering information with the product development process.
- Construct and manage product data using PLM/PDM technologies.
- Construct managed product data during the PD process.
- Defend information technology for supporting product development process.
- Distinguish the challenges in product data integration in product lifecycle.
- Construct general strategies and principles for the successful implementation.

UNIT - I	INTRODUCTION	Lecture Hrs:09

Need for IPPD – strategic importance of product development – integration of customer, designer, material supplier and process planner, Competitor and costumer – behavior analysis. Understanding customer – promoting customer understanding – involve customer in development and managing requirements – Organization – process management and improvement – Plan and establish product specification.

UNIT - II	CONCEPT GENERATION AND SELECTION	Lecture Hrs:09

Task – Structured approaches – Clarification – Search –Externally and internally – explore systematically – reflect on the solutions and process – concept selection– methodology – benefits.
PRODUCT ARCHETECTURE: Implications – Product change – variety – component standardization –product performance – manufacturability.

UNIT - III	PRODUCT DEVELOPMENT MANAGEMENT	Lecture Hrs:09

Establishing the architecture – creation – clustering –geometric layout development – fundamental and incidental interactions – related system level design issues – secondary systems – architecture of the chunks – creating detailed interface specifications.
INDUSTRIAL DESIGN: Integrate process design – Managing costs – Robust design – Integrating

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CAE,CAD, CAM tools – simulating product performance and manufacturing processing electronically – Need for industrial design – impact – design process.		
UNIT - IV	**INVESTIGATION OF CUSTOMER NEEDS**	Lecture Hrs:09
Investigation of customer needs – conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.		
UNIT - V	**DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT**	Lecture Hrs:09
Definition – Estimation of manufacturing cost – reducing the component costs and assembly costs – Minimize system complexity. Prototype basics – Principles of prototyping – planning for prototypes – Economics analysis – Understanding and representing tasks – baseline project planning – accelerating the project execution.		
Textbooks:		
1. Product Design and Development / Kari T. Ulrich and Steven D. Eppinger / McGraw Hill International Edns. 1999. 2. Concurrent Engg/integrated Product development / Kemnneth Crow / DRM Associates, 26/3, Via Olivera, Palos Verdes, CA 90274(310)377-569, Workshop Book.		
Reference Books:		
1. Effective Product Design and Development / Stephen Rosenthal / Business One Orwin, Homewood, 1992, ISBN, 1-55623-603-4. 2. Tool Design–Integrated Methods for Successful Product Engineering / Staurt Pugh / Addsion Wesley Publishing, Neyourk, NY, 1991, ISBN 0-202-41369-5. 3. Production and Operations Management/Chase/TMH		
Online Learning Resources:		
1. nptel.ac.in/courses/112/107/112107217/ 2. https://onlinecourses.nptel.ac.in/noc20_me69/preview 3. https://www.autodesk.com/solutions/pdm-product-data-management#:~:text=Product%20data%20management%20(PDM)%20is,(BOMs)%2C%20and%20more. 4. https://en.wikipedia.org/wiki/Product_data_management		

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Course Code	DESIGN FOR MANUFACTURING AND ASSEMBLY	L	T	P	C
21D87104a	Program Elective Course – II	3	0	0	3
Semester		I			

Course Objectives: Student will be able to

- Introduce design principle, properties of materials, fits and tolerances and datum features
- Understand the influence of materials on form design and able to select possible material and feasible design.
- Introduce design features to facilitate machining and design for mach inability, economy, accessibility and assembly.
- Know about redesign of castings, modifying the uneconomical design, group technology and applications of DFMA.
- Understand the Environmental objectives and issues and to design considering them.

Course Outcomes (CO): Student will be able to

- Select the design principle, suitable material, mechanism, fit and tolerance for designing a product/component.
- Select the appropriate material, proper working principle and a feasible design.
- Design (optimum) a component which requires less material removal, easy to machine, assemble, access and cost effective.
- Redesign the uneconomical casting design and know the applications of DFMA.
- Incorporate the Environmental Objectives, issues and guidelines into the design.

UNIT - I	INTRODUCTION	Lecture Hrs:09

Design philosophy steps in Design process - General Design rules for manufacturability -basic principles of design Ling for economical production - creativity in design. Materials: Selection of Materials for design Developments in Material technology - criteria for material selection - Material selection interrelationship with process selection process selection charts, material usage and sustainability.

UNIT - II	MACHINING PROCESS	Lecture Hrs:09

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 recommendations for machined parts.

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

UNIT - III	JOINING TECHNIQUES	Lecture Hrs:09

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 dies forging design - parting lines of die5 drop forging die design - general design recommendations. Extrusion & Sheet Metal Work: Design guidelines for extruded sections - design principles for Punching, Blanking, Bending, and Deep Drawing - Keeler Goodman Forming Line Diagram - Component Design for Blanking.

ADHESIVE BONDING: History of adhesive bonding, adhesives and sealants –working, mechanical properties of the joints, testing of the joints and different failure modes, applications of the joints.

UNIT - IV	ASSEMBLY ADVANTAGES	Lecture Hrs:09

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Development of the assemble process, choice of assemble method assemble advantages social effects of automation.

Automatic Assembly Transfer Systems: Continuous transfer, intermittent transfer, indexing mechanisms and operator - paced free – transfer machine.

UNIT - V	**DESIGN OF MANUAL ASSEMBLY**	Lecture Hrs:09

Design for assembly fits in the design process, general design guidelines for manual assembly, development of the systematic DFA methodology, assembly efficiency, classification system for manual handling, classification system for manual insertion and fastening, effect of part symmetry on handling time, effect of part thickness and size on handling time, effect of weight on handling time, parts requiring two hands for manipulation, effects of combinations of factors, effect of symmetry effect of chamfer design on insertion operations, estimation of insertion time.

Textbooks:

1. Assembly Automation and Product Design/ Geoffrey Boothroyd/ Marcel Dekker Inc., NY, 1992.
2. Engineering Design - Material & Processing Approach/ George E. Deiter/McGraw Hill Intl. 2nd Ed. 2000.

Reference Books:

3. Hand Book of Product Design/ Geoffrey Boothroyd/ Marcel and Dekken, N.Y. 1990.
4. Computer Aided Assembly London/ A Delbainbre/.
5. Product Design for Manufacturing and Assembly/ Geoffrey Boothroyd, Peter Dewhurst & Winston Ansthony Knight/CRC Press/2010
6. Dieter G.E. – Engineering Design –A materials and processing approach.- Mc Graw Hill -1991.
7. R.D. Adams , Adhesive Bonding – First edition.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc19_me48/preview
2. nptel.ac.in/courses/107/103/107103012/
3. https://www.3ds.com/3dexperience/cloud/dfma-anywhere

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ANANTHAPURAMU – 515 002 (A.P) INDIA

M.TECH. IN ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABI

Course Code	ADVANCED CAD	L	T	P	C
21D87104b	Program Elective Course – II	3	0	0	3
	Semester	I			

Course Objectives: Student will be able to

- Model the 3D geometric information of machine components including assemblies, and automatically generate 2- D production drawings, understand the basic analytical fundamentals that are used to create and manipulate geometric models in a computer program.
- Improve visualization ability of machine components and assemblies before their actual fabrication through modeling, animation, shading, rendering, lighting and coloring.
- Model complex shapes including freeform curves and surfaces,
- Integrate the CAD system and the CAM system by using the CAD system for modelling design Information and converting the CAD model into a CAM model for modelling the manufacturing Information.
- Use full scale CAD/CAM software systems designed for geometric modeling of machine Components and automatic generation of manufacturing information.

Course Outcomes (CO): Student will be able to

- Understand the concepts of wireframe, surface and solid modelling
- Understand part modelling and part data exchange standards (VDA,IGES and STEP)
- Develop knowledge in 2D-Transformations, 3D Transformations.
- Understand the Assembly Modelling, Assembly tree, and Assembly Methods.
- The Students become experts on Visualization and computer animation Techniques.

UNIT - I	PRINCIPLES OF COMPUTER GRAPHICS	Lecture Hrs:09

Introduction, graphic primitives, point plotting, lines, Bresenham's circle algorithm, ellipse, transformation in graphics, coordinate systems, view port, 2D and 3D transformation, hidden surface removal, reflection, shading and generation of characters.CAD –modeling of curves, surfaces and solids manipulation of CAD models, features based modelling, product data exchange standards.

UNIT - II	CAD TOOLS & GEOMETRICMODELLING	Lecture Hrs:09

CAD TOOLS: Definition of CAD Tools, Types of system CAD/CAM system evaluation criteria, brief treatment of input and output devices. Graphics standard, functional areas of CAD, Modeling and viewing, software documentation, efficient use of CAD software.
GEOMETRICMODELLING: Types of mathematical representation of curves, wire frame models wire frame entities parametric representation of synthetic curves her mite cubic sp lines Bezier curves B-sp lines rational curves.

UNIT - III	SURFACE MODELING	Lecture Hrs:09

Mathematical representation surfaces, Surface model, Surface entities surface representation, Parametric representation of surfaces, plane surface, rule surface, surface of revolution, Tabulated Cylinder

UNIT - IV	PARAMETRIC REPRESENTATION OF SYNTHETIC SURFACES	Lecture Hrs:09

HermiteBicubic surface, **Bezier** surface, **B-** Spline surface, COONs surface, Blending surface Sculptured surface, Surface manipulation — Displaying, Segmentation, Trimming, Intersection, Transformations (both 2D and 3D).

UNIT - V	GEOMETRICMODELLING	Lecture Hrs:09

GEOMETRICMODELLING: Solid modeling, Solid Representation, BoundaryRepresentation (13-rep), Constructive Solid Geometry (CSG).
CAD/CAM Exchange : Evaluation of data - exchange format, IGES data representations and

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COURSE STRUCTURE & SYLLABI

structure,STEP Architecture, implementation, ACIS & DXF. Design Applications: Mechanical tolerances, Mass property calculations, Finite Element Modeling and Analysis and Mechanical Assembly. **Collaborative Engineering:** Collaborative Design, Principles, Approaches, Tools, Design Systems.
Textbooks:
1. Mastering CAD/CAM / IbrhimZeid / McGraw Hill International. 2. CAD/CAM Principles and Applications/ P.N.Rao/TMH/3rd Edition
Reference Books:
3. CAD/CAM /Groover M.P./ Pearson education 4. CAD/CAM Concepts and Applications/ Alavala/ PHI 5. CAD / CAM / CIM, Radhakrishnan and Subramanian/ New Age 6. Principles of Computer Aided Design and Manufacturing/ FaridAmirouche/ Pearson 7. Computer Numerical Control Concepts and programming/ Warren S Seames/ Thomson
Online Learning Resources:
1. https://nptel.ac.in/courses/112/102/112102101/ 2. https://nptel.ac.in/courses/112/102/112102102/ 3. https://www.youtube.com/watch?v=EgKc9L7cbKc 4. https://www.youtube.com/watch?v=0IgOapAtauM

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M.TECH. IN ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABI

Course Code	**ADVANCED MECHATRONICS**	**L**	**T**	**P**	**C**
21D87104c	**Program Elective Course – II**	**3**	**0**	**0**	**3**
Semester		**I**			

Course Objectives: Student will be able to

- Develop skills and confidence to create your own custom microcontroller-based electronics projects via:
- A review basic electronics (e.g., filters, op. amps, transistors.
- Interface electrical peripherals (e.g., A/D, D/A, Sensors, Motors, Timers, Interrupts, Serial Communication) with a microcontroller through focused lab exercises and a term project.
- Knowledge of feature in mechatronics and related technology innovation.

Course Outcomes (CO): Student will be able to

- Select and apply the knowledge, skills and modern tools in mechatronics engineering.
- Apply concepts of circuit analysis, automation and controls, motor, electronic drives, paper systems, instrumentation and trouble shooting and mechatronic systems.

UNIT - I	**PRINCIPLES OF COMPUTER GRAPHICS**	Lecture Hrs:09

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	**CAD TOOLS & GEOMETRICMODELLING**	Lecture Hrs:09

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

UNIT - III	**SURFACE MODELING**	Lecture Hrs:09

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	**PARAMETRIC REPRESENTATION OF SYNTHETIC SURFACES**	Lecture Hrs:09

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

UNIT - V	**GEOMETRICMODELLING**	Lecture Hrs:09

System and interfacing and data acquisition, DAQS , SCADA, A to D and D to A conversions; Dynamic models and analogies, System response. Design of mechatronics systems & future trends.

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.

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COURSE STRUCTURE & SYLLABI

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

Online Learning Resources:

1. https://nptel.ac.in/courses/112/103/112103174/
2. https://onlinecourses.nptel.ac.in/noc21_me129/preview
3. https://www.zapmeta.ws/ws?q=learn%20mechatronics%20online&asid=ws_gc2_01&mt=b&nw=g&de=c&ap=&ac=2043&cid=12107643587&aid=116602233036&locale=en_US&gclid=Cj0KCQjw8p2MBhCiARIsADDUFVGgBfWYs6C2leVaRqLcALInigZNXhDJGfoXp4kpVGHqWDKZk9nwkzcaAheoEALw_wcB
4. https://studyres.com/doc/2857370/mechatronics-and-manufacturing-automation-nptel

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M.TECH. IN ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABI

Course Code	AUTOMATION LABORATORY	L	T	P	C
21D87105		0	0	4	2
	Semester	I			

Course Objectives:

- To train the students in writing programs for robot movements
- To train the students in handling FMS cell for different sequences.
- To design the hydraulic and pneumatic circuits by using automation studio software.
- To design the automated manufacturing systems by using workspace software.

Course Outcomes (CO):

- Demonstrate the pick and place Aristo Robot.
- Demonstrate the working of workspace software.
- Check the circuit designs whether working properly or not by using Automation studio software.

List of Experiments:

1. Aristo XT Six axis Robot
a. Introduction to Robot programming.
b.Robot programming exercises (Point-to-Point and continuous path task).
2. WORKSPACE software.
a. Simulation of a manufacturing system for increasing production rate.
b. Simulation of a simple automation system.
3. AUTOMATION STUDIO software. I.Hydraulic Circuits
a. Introduction to Automation studio & its control.
b. Draw & Simulate the Hydraulic circuit for series & parallel cylinders connection.
c. Draw & Simulate Meter-in, Meter-out and hydraulic press and clamping.
d. Sequencing circuits in hydraulics.
e. Synchronizing circuits in hydraulics.
II. Pneumatic circuits
a. Sequencing circuits in Pneumatics.
b. Synchronizing circuits in Pneumatics.
c. Design and Simulation of simple pneumatic circuit by using Cascade Method.
d. Design and Simulation of simple pneumatic circuit by using step counter method.
4. Additive manufacturing machine
a. Introduction to Additive manufacturing Machine.
b. Design and fabrication of simple symmetrical and unsymmetrical components.

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COURSE STRUCTURE & SYLLABI

Course Code	METAL CUTTING LABORATORY	L	T	P	C
21D87106		0	0	4	2
	Semester	I			

Course Objectives: Students able to

- Understand the different machining processes
- Understand the and material technologies
- Study the different cutting operations

Course Outcomes (CO):

- Demonstrate the machining processes
- Check the MRR in different processes

List of Experiments:

1. Study of the morphology of chips produced from different materials and machining processes.
2. Effect of tool geometry on chip flow direction in simulated orthogonal cutting conditions. 3. Study of cutting ratio/chip thickness ratio in simulated orthogonal cutting with different materials and tool geometry.
4. Evaluations of tool face temperature with thermocouple method.
5. Roughness of machined surface. Influence of tool geometry and feed rate.
6. Extrusion of cylindrical billets through dies of different included angles and exit diameters and their effect on extrusion pressure.
7. Practice and study of blanking and punching process and their characteristic features on mechanical press with existing dies.
8. Study of operation of tool and cutter grinder, twist drill grinder, Centreless grinder
9. Determination of cutting forces in turning
10. Inspection of parts using tool makers microscope, roughness and form tester
11.Experimental Study of MRR on EDM
12 .Experimental Study of TWR on EDM
13 .Experimental Study of Surface Roughness on EDM
14 .Experimental Study on ECM
15 .Experimental Study on 3D Printing

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COURSE STRUCTURE & SYLLABI

Course Code	**RESEARCH METHODOLOGY AND IPR**	**L**	**T**	**P**	**C**
21DRM101		**2**	**0**	**0**	**2**
	Semester	**I**			

Course Objectives:

- Identify an appropriate research problem in their interesting domain.
- Understand ethical issues understand the Preparation of a research project thesis report.
- Understand the Preparation of a research project thesis report
- Understand the law of patent and copyrights.
- Understand the Adequate knowledge on IPR

Course Outcomes (CO): Student will be able to

- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT - I		Lecture Hrs:

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		Lecture Hrs:

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.

UNIT - III		Lecture Hrs:

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		Lecture Hrs:

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 and IITs.

Textbooks:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

Reference Books:

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COURSE STRUCTURE & SYLLABI

1. 1. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for
2. beginners”
3. 2. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
4. 3. Mayall, “Industrial Design”, McGraw Hill, 1992.
5. 4. Niebel, “Product Design”, McGraw Hill, 1974.
6. 5. Asimov, “Introduction to Design”, Prentice Hall, 1962.
7. 6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New
8. Technological Age”, 2016.

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M.TECH. IN ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABI

Course Code	SIMULATION OF MANUFACTURING SYSTEMS	L	T	P	C
21D87201		3	0	0	3
	Semester	**II**			

Course Objectives:

- To provide knowledge simulation and simulation steps
- To provide knowledge on parameter estimation and hypothesis
- To provide knowledge on building simulation model how to validation and verification is done
- To provide knowledge on generation of random variants and variables
- To provide knowledge on some simulation languages
- To provide knowledge on some Applications of Simulation

Course Outcomes (CO): Student will be able to

- Students gain knowledge on various types of simulation and simulation languages steps in simulation and applications of simulation.
- Students gain knowledge on parameter estimation and hypothesis.
- Students can build simulation model and also can validation and verify model.
- Can Generation of random variants and variables.

UNIT - I — Lecture Hrs:09

System - ways to analyze the system - Model - types of models - Simulation - Definition - Types of simulation models - steps involved in simulation - Advantages & Disadvantages. Parameter estimation - estimator - properties - estimate - point estimate - confidence interval estimates - independent - dependent - hypothesis - types of hypothesis- step - types l& 2 errors - Framing - string law of large numbers.

UNIT - II — Lecture Hrs:09

Building of Simulation model validation - verification - credibility - their timing - principles of valid simulation Modeling - Techniques for verification - statistical procedures for developing credible model.Modeling of stochastic input elements - importance - various procedures - theoretical distribution - continuous - discrete their suitability in modeling.

UNIT - III — Lecture Hrs:09

Generation of random variables - factors for selection methods - inverse transform - composition - convolution - acceptance - rejection - generation of random variables - exponential - uniform - weibull - normal Bernoullie - Binomial uniform - poisson - Simulation languages - comparison of simulation languages with general purpose languages Simulation languages vs Simulators - software features - statistical capabilities - G P S S - S1MAN- SIMSCRIPT - Simulation of WMJI queue - comparison of simulation languages.

UNIT - IV — Lecture Hrs:09

Output data analysis - Types of Simulation w. r. t output data analysis – warm up period- Welch algorithm - Approaches for Steady - State Analysis - replication - Batch means methods - corn pan Sons.

UNIT - V — Lecture Hrs:09

Applications of Simulation - flow shop system - job shop system - M/MI1 queues with infinite and finite capacities - Simple fixed period inventory system – New boy paper problem.

Textbooks:

1. Simulation Modelling and Analysis / Law, A.M.&Kelton / McGraw Hill, Edition/ New York, 1991.
2. Discrete Event System Simulation *I* Banks J. & Carson J.S., PH *I* Englewood Cliffs N/ 1984.

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COURSE STRUCTURE & SYLLABI

Reference Books:
3. Simulation of Manufacturing Systems / Carrie A. / Wiley, NY, 1990. 4. A Course in Simulation / Ross, S.M., McMillan, NY, 1990. 5. Simulation Modelling and S1MNET/ Taha HA. / PH, Englewood Cliffs, NJ, 1987
Online Learning Resources:
1. https://nptel.ac.in/courses/112/107/112107220/ 2. https://www.youtube.com/watch?v=wbLItIE-78E 3. https://www.youtube.com/watch?v=tiarT1YS-lM

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M.TECH. IN ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABI

Course Code	**QUALITY ENGINEERING IN MANUFACTURING**	**L**	**T**	**P**	**C**
21D87202		**3**	**0**	**0**	**3**
	Semester	**II**			

Course Objectives:

- Explore knowledge of basic sciences engineering and manufacturing process.
- Manage projects in various sectors of economy which facing on conceptual , technological and human aspects.
- Identify the bottle ends and production process.
- Similarity of the manufacturing process to analyze the overall performance

Course Outcomes (CO): Student will be able to

- Applications of the user friendly software packages to simulate the manufacturing entities.
- Analyze the data by using different performance analysis techniques.
- Modelling various operators in manufacturing systems

UNIT - I	**QUALITY VALUE AND ENGINEERING**	Lecture Hrs:09

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 quadratile 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**	Lecture Hrs:09

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)**	Lecture Hrs:09

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**	Lecture Hrs:09

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**	Lecture Hrs:09

Six sigma DMAIC methodology, tools for process improvement, six sigma in services and small organizations, statistical foundations, statistical methodology.

Textbooks:

1. Taguchi Techniques for Quality Engineering / Phillip J. Ross / McGraw Hill/ Intl. II Edition, 1995.
2. Quality Engineering in Production systems *I* G. Taguchi, A. Elsayed et al /Mc.Graw Hill Intl. Edition, 1989.

Reference Books:

1. Taguchi Methods explained: Practical steps to Robust Design /Papan P. Bagchi*I* Prentice Hall Pvt. Ltd., New Delhi.

Online Learning Resources:

1. https://nptel.ac.in/courses/112/107/112107259/
2. https://onlinecourses.nptel.ac.in/noc20_me27/preview
3. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-me27/
4. https://nptel.ac.in/courses/110/101/110101010/
5. https://onlinecourses.nptel.ac.in/noc20_mg18/preview

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M.TECH. IN ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABI

Course Code	MATERIAL SCIENCE & TECHNOLOGY	L	T	P	C
21D87203a	Program Elective Course – III	3	0	0	3
	Semester	II			

Course Objectives: Student will be able to

- To gain and understanding of the relationship between the structure, properties, processing, testing and applications of strengthening mechanism, modern metallic, smart, non-metallic, advanced structural ceramic and composite materials so as to identify and select suitable materials for various engineering applications.

Course Outcomes (CO):

- Students will get knowledge on mechanism of plastic deformation and strengthening mechanism.
- Students will be able to learn the structure, properties and applications of modern metallic materials, smart materials non-metallic materials and advanced structural ceramics.
- Students will be able to understand the importance of advanced composite materials in application to sophisticated machine and structure of components.

UNIT - I — Lecture Hrs:09

Elasticity in metals and polymers, mechanism of plastic deformation, role of dislocations, yield stress, shear strength of perfect and real crystals, strengthening mechanism, work hardening, solid solution, grain boundary strengthening. Poly phase mixture, precipitation, particle, fiber and dispersion strengthening, effect of temperature, strain and strain rate on plastic behavior, super plasticity, deformation of non crystalline material.

UNIT - II — Lecture Hrs:09

Griffth's Theory, stress intensity factor and fracture Toughness, Toughening Mechanisms, Ductile and Brittle transition in steel, High Temperature Fracture, Creep, Larson – Miller parameter, Deformation and Fracture mechanism maps.

UNIT - III — Lecture Hrs:09

Fatigue, Low and High cycle fatigue test, Crack Initiation and Propagation mechanism and paris Law, Effect of surface and metallurgical parameters on Fatigue, Fracture of non-metallic materials, fatigue analysis, Sources of failure, procedure of failure analysis.

MODELING AND SIMULATION IN MATERIALS ENGINEERING:
Importance of modeling and simulation in materials engineering and numerical approaches, Numerical solutions of ODEs and PDEs, implicit methods, simple models for simulating microstructures, FE modeling of 1D, variation approach.

UNIT - IV — Lecture Hrs:09

Motivation for selection, cost basis and service requirements, Selection for Mechanical Properties, Strength, Toughness, Fatigue and Creep. Selection for Surface durability, Corrosion and Wear resistance, Relationship between Materials Selection and Processing, Case studies in Materials Selection with relevance to Aero, Auto , Marine, Machinery and Nuclear Applications.

UNIT - V — Lecture Hrs:09

MODERN METALLIC MATERIALS: Dual Steels, Micro alloyed, High Strength Low alloy (HSLA) Steel, Transformation induced plasticity (TRIP) Steel, Maraging Steel, Inter metallics, Ni and Ti Aluminides, Smart Materials, Shape Memory alloys, Metallic Glass Quasi Crystal and Nano Crystalline Materials.

NONMETALLIC MATERIALS: Polymeric materials and their molecular structures, Production Techniquesfor Fibers, Foams, Adhesives and Coatings, structure, Properties and Applications of Engineering Polymers, Advanced Structural Ceramics WC, TiC, TaC, A12 O3, SiC, Si3 N4, CBN and Diamond – properties, Processing and applications.

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COURSE STRUCTURE & SYLLABI

Textbooks:
1. Mechanical Behavior of Materials/Thomas H. Courtney/ McGraw Hill/2 nd Edition/2000 2. Mechanical Metallurgy/George E. Dicter/McGraw Hill, 1998.
Reference Books:
3. Selection and use of Engineering Materials 3e/Charles J.A/Butterworth Heiremann. 4. Engineering Materials Technology/James A Jacob Thomas F Kilduff/Pearson 5. Material Science and Engineering/William D Callister/John Wiley and Sons
Online Learning Resources:
1. https://nptel.ac.in/courses/113/106/113106032/ 2. https://nptel.ac.in/courses/113/107/113107078/ 3. https://www.digimat.in/nptel/courses/video/113107078/L01.html

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COURSE STRUCTURE & SYLLABI

Course Code	INDUSTRIAL ROBOTICS	L	T	P	C
21D87203b	Program Elective Course – III	3	0	0	3
Semester		II			

Course Objectives: Student will be able

- To be familiar with the automation and brief history of robot and applications
- To give the student familiarities with the kinematics of robots.
- To give knowledge about robot end effectors and their design.
- To learn about Robot Programming methods & Languages of robot
- To give knowledge about various Sensors and their applications in robots.

Course Outcomes (CO): Student will be able to

- Equipped with the automation and brief history of robot and applications
- Familiarized with the kinematic motions of robot
- Get knowledge about robot end effectors and their design concepts.
- Equipped with the Programming methods & various Languages of robots.
- Equipped with the principles of various Sensors and their applications in robots

UNIT - I	INTRODUCTION	Lecture Hrs:09

INTRODUCTION: Automation and Robotics, Robot anatomy, robot configuration, motions joint notation work volume, robot drive system, control system and dynamic performance, precision of movement.

CONTROL SYSTEM AND COMPONENTS: basic concept and modais controllers control system analysis, robot activation and feedback components. Positions sensors, velocity sensors, actuators sensors, power transmission system

UNIT - II	MOTION ANALYSIS AND CONTROL	Lecture Hrs:09

Manipulator kinematics, position representation forward transformation, homogeneous transformation, manipulator path control, robot dynamics, configuration of robot controller.

UNIT - III	END EFFECTORS	Lecture Hrs:09

Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design. SENSORS: Desirable features, tactile, proximity and range sensors, uses sensors in robotics.

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, Robotics application.

UNIT - IV	ROBOT PROGRAMMING	Lecture Hrs:09

Lead through programming, Robot programming as a path in space, Motion interpolation, WAIT, SINONAL AND DELAY commands, Branching capabilities and Limitations.

ROBOT LANGUAGES: Textual robot Languages, Generation, Robot language structures, Elements in function.

UNIT - V	**ROBOT CELL** DESGIN AND CONTROL	Lecture Hrs:09

Robot cell layouts-Robot cantered cell, In-line robot cell, Considerations in work design, Work and control, Inter locks, Error detect ion, Work wheel controller. **ROBOT APPLICATION**: Material transfer, Machine loading/unloading. Processing operation, Assembly and Inspection, Feature Application

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Textbooks:
1. Industrial Robotics / Groover M P /Pearson Edu. 2. Introduction to Robotic Mechanics and Control by JJ Craig, Pearson, 3rd edition
Reference Books:
3. Robotics / Fu K S/ McGraw Hill. 4. Robotic Engineering / Richard D. Klafter, Prentice Hall 5. Robot Analysis and Intelligence / Asada and Slotine / Wiley Inter-Science. 6. Robot Dynamics & Control – Mark W. Spong and M. Vidyasagar / John Wiley & Sons (ASIA) Pte Ltd. 7. Robotics and Control / Mittal R K &Nagrath I J / TMH
Online Learning Resources:
1. https://nptel.ac.in/courses/112/105/112105249/ 2. https://nptel.ac.in/content/storage2/courses/112101098/download/lecture-3.pdf 3. https://onlinecourses.nptel.ac.in/noc19_me74/preview

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M.TECH. IN ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABI

Course Code	ADVANCED TOOL DESIGN	L	T	P	C
21D87203c	Program Elective Course – III	3	0	0	3
	Semester	II			

Course Objectives: Student will be able to

- To describe tool design methods and punch and die making/manufacturing techniques.
- To understand the principles of clamping, drill jigs.
- To understand the principles of dies and moulds design

Course Outcomes (CO): Student will be able to

- Familiar with cutting tools and cutting fluids, machine tools, metal forming etc,.
- Understand the applications of different techniques learned above in the real world.

UNIT - I	TOOL MATERIALS	Lecture Hrs:09

Prosperities of materials: Tools steels, Cast Iron, Mild or low carbon steels, Non metallic and nonferrous materials, Heat treating

UNIT - II	DESIGN OF CUTTING TOOLS	Lecture Hrs:09

Single Point cutting tools: Milling cutters, Drills, Selection of carbide steels – Determination of shank size for single point carbide tools, Determining the insert thickness for carbide tools.

UNIT - III	DESIGN OF JIGS AND FIXTURES	Lecture Hrs:09

Basic principles of location and clamping: Locating methods and devices, Jigs-Definition Types, General considerations in the design of Drill jigs, Drill bushing, Methods of Construction. Fixtures-Vice fixtures, Milling, Boring Lathe Grinding fixtures.

UNIT - IV	DESIGN OF SHEET METAL BLANKING AND PIERCING DIES	Lecture Hrs:09

Fundamentals of Die cutting operation, Power press types, General press information, Materials Handling equipment. Cutting action in Punch and die operations. Die clearance, Types of Die construction. Die design fundamentals-Banking and piercing die construction, pilots, stripper and pressure pads presswork material, Strip layout, Short run tooling for piercing.

UNIT - V	DESIGN OF SHEET METAL BENDING, FORMING AND DRAWING DIES:	Lecture Hrs:09

Bending dies, Drawing dies, Forming dies, Drawing operations, Variables that effect metal flow during drawing. Determination of blank size, Drawing force, Single and double action draw dies.

Textbooks:

1. Donaldson “Tool Design”/ Tata McGraw Hill
2. Production Technology/HMT/Tata McGraw Hill/

Reference Books:

1. Production Technology by R.K. Jain and S.C. Gupta.
2 Mechanical Metallurgy/ George F Dieter/ Tata McGraw Hill
3. Machine Tools/C Elanchezhian& M. Vijayan/Anuradha Publications
4. Principles of Machine Tools, Bhattacharya A and Sen.G.C. New Central Book Agency
5. Hand Book of Metal forming/ Kurt Lange/ Mc Graw-Hill,.1987

Online Learning Resources:

1. https://nptel.ac.in/courses/112/105/112105233/
2. https://nptel.ac.in/courses/112/107/112107078/

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COURSE STRUCTURE & SYLLABI

Course Code	PRODUCTION & OPERATIONS MANAGEMENT	L	T	P	C
21D87204a	Program Elective Course – IV	3	0	0	3
Semester		II			

Course Objectives: Student will be able to

- Understand the objective is to introduce concepts and techniques related to the design, planning, control and improvement of businesses in both manufacturing and service sectors.
- Understand this course aims at developing a focus and critical thinking important to solve problems in the operations of business. The students will be required to understand and apply the tools of management learned in the course to practical situations.
- Understand how to produce the desired product this has marketability at the most affordable price by properly planning the manpower, material and processes.
- Know to achieve the objective of delivering the right goods of right quantity as well as quality, at right place and at right time one needs to understand and apply the concepts of Production and operations management.
- Know Efficient Advanced Production and operations management, give benefits to various sections including consumers, investors, employees, suppliers and community in different ways.

Course Outcomes (CO): Student will be able to

- Understand the principles of production and operations Management
- Understand the operations process, be able to analyze and solve problems pertaining to operations.
- Understand some of the mathematical models of production management.
- Appraise how other functional areas of business are integrated with Operations Management.

UNIT - I	OPERATION MANAGEMENT	Lecture Hrs:09

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	Lecture Hrs:09

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	Lecture Hrs:09

Definition – Different Strategies – Various models of Aggregate Planning –Transportation and graphical models.
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.

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UNIT - IV	**SCHEDULING**	Lecture Hrs:09
Policies – Types of scheduling – Forward and Backward Scheduling – Gantt Charts – Flowshop Scheduling – n jobs and 2 machines, n jobs and 3 machines – job shop Scheduling – 2 jobs and n machines – Line of Balance.		
UNIT - V	**PROJECT MANAGEMENT**	Lecture Hrs:09
Programming Evaluation Review Techniques (PERT) – three times estimation – critical path – probability of completion of project – critical path method – crashing of simple nature.		
Textbooks:		
1. Operations Management/ E.S. Buffs/ John Wiley & Sons / 2007 2. Operations Management Theory and Problems/ Joseph G. Monks / Macmillan / McGraw Hill / 3rd Edition.		
Reference Books:		
3. Production Systems Management/ James I. Riggs / John Wiley & Sons. 4. Production and Operations Management/ Chary/ McGraw Hill/2004 5. Operations Management/ Richard Chase/ McGraw Hill/2006 6. Production and Operation Management / PannerSelvam / PHI. 7. Production and Operation Analysis/ Nahima/ McGraw Hill/2004		
Online Learning Resources:		
1. https://nptel.ac.in/courses/110/107/110107141/ 2. https://nptel.ac.in/courses/111/107/111107128/ 3. https://nptel.ac.in/courses/112/106/112106131/ 4. https://nptel.ac.in/courses/112/106/112106134/		

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COURSE STRUCTURE & SYLLABI

Course Code	MODELLING OF MANUFACTURING SYSTEMS	L	T	P	C
21D87204b	PROGRAM ELECTIVE COURSE – IV	3	0	0	3
Semester		II			

Course Objectives: Student will be able to

- To impart the basic ideas to enable the modelling, simulation and analysis of advanced manufacturing systems

Course Outcomes (CO): Student will be able to

- Learn how to formulate and solve computational problems analysis in the flow of fluids.
- Familiar with the differential equations for flow phenomena and numerical methods for their solutions.

UNIT – I	MANUFACTURING SYSTEMS & CONTROL	Lecture Hrs:09

Automated Manufacturing Systems – Modeling – Role of performance modeling – simulation models-Analytical models.Product cycle – Manufacturing automation – Economics of scale and scope – input/output model – plant configurations. Performance measures – Manufacturing lead time – Work in process – Machine utilization – Throughput – Capacity – Flexibility – Performability – Quality Control Systems – Control system architecture – Factory communications – Local area network interconnections – Manufacturing automation protocol – Database management system.

UNIT – II	MANUFACTURING PROCESSES	Lecture Hrs:09

Examples of stochastics processes – Poisson process - Discrete time Markov chain models – Definition and notation – Sojourn times in states – Examples of DTMCs in manufacturing – Chapman – Kolmogorov equation – Steady-state analysis. Continuous Time Markov Chain Models – Definitions and notation – Sojourn times in states – examples of CTMCs in manufacturing – Equations for CTMC evolution – Markov model of a transfer line Birth and Death Processes in Manufacturing – Steady state analysis of BD Processes – Typical BD processes in manufacturing.

UNIT – III	QUEUING MODEL	Lecture Hrs:09

Notation for queues – Examples of queues in manufacturing systems – Performance measures – Little's result – Steady state analysis of M/M/m queue, queues with general distributions and queues with breakdowns – Analysis of a flexible machine center.

UNIT – IV	QUEUING NETWORKS	Lecture Hrs:09

Examples of QN models in manufacturing – Little's law in queuing networks – Tandem queue – An open queuing network with feedback – An open central server model for FMS – Closed transfer line – Closed server model – Garden Newell networks.

UNIT – V	PETRINETS	Lecture Hrs:09

Classical Petri Nets – Definitions – Transition firing and reach ability – Representational power – properties – Manufacturing models.
Stochastic Petri Nets – Exponential timed Petri Nets – Generalized Stochastic Petri Nets – modeling of KANBAN systems – Manufacturing models.

Textbooks:

1. Performance Modelling of Automated Manufacturing Systems/ Viswanadham, N and Narahari, Y/ Prentice Hall of India, New Delhi, 1994
2. Probability and Statistics with Reliability, Queuing and Computer Science Applications/ Trivedi, K.S./ Prentice Hall, New Jersey, 1982.

Reference Books:

1.Fundamentals of Mathematical Statistics/ Gupta S.C. &Kapoor V.K./ 3rd Edition, Delhi, 1988

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Online Learning Resources:
1. https://nptel.ac.in/courses/112/107/112107220/
2. https://nptel.ac.in/courses/110/106/110106044/
3. https://nptel.ac.in/courses/112/103/112103273/

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M.TECH. IN ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABI

Course Code	COMPUTATIONAL FLUID DYNAMICS	L	T	P	C
21D11204a	PROGRAM ELECTIVE COURSE – IV	3	0	0	3
	Semester	II			

Course Objectives: Student will be able

- To understand the mathematics, numerical analysis, statistics, and computer information science.
- FLUENT application of engineering technology tools, and resources.

Course Outcomes (CO): Student will be able to

- Learn how to formulate and solve computational problem are using in flow of fluids.
- Familiar with the differential equations for flow phenomena and numerical methods for that solution.

UNIT - I	INTRODUCTION	Lecture Hrs:09

Finite difference method, finite volume method, finite element method, governing equations and boundary conditions, Derivation of finite difference equations.

Solution methods: Solution methods of elliptical equations — finite difference formulations, interactive solution methods, direct method with Gaussian elimination.

Parabolic equations-explicit schemes and Von Neumann stability analysis, implicit schemes, alternating direction implicit schemes, approximate factorization, fractional step methods, direct method with tridiagonal matrix algorithm

UNIT - II		Lecture Hrs:09

Hyperbolic equations: explicit schemes and Von Neumann stability analysis, implicit schemes, multi step methods, nonlinear problems, second order one-dimensional wave equations. Burgers equations: Explicit and implicit schemes, Runge-Kutta method

UNIT - III	FORMULATIONS OF INCOMPRESSIBLE VISCOUS FLOWS	Lecture Hrs:09

Formulations of incompressible viscous flows by finite difference methods, pressure correction methods, vortex methods.

Treatment of compressible flows: potential equation, Euler equations, Navier-stokes system of equations, flow field-dependent variation methods, boundary conditions, example problems.

UNIT - IV	FINITE VOLUME METHOD	Lecture Hrs:09

Finite volume method via finite difference method, formulations for two andthree-dimensional problems.

UNIT - V	STANDARD VARIATIONAL METHODS	Lecture Hrs:09

Linear fluid flow problems, steady state problems, Transient problems.

Textbooks:

1. Computational fluid dynamics/ T. J.C'hung/ Cambridge University press,2002.
2. Text book of fluid dynamics/ Frank Choriton/ CBS Publishers & distributors, 1985

Reference Books:

1 Numerical heat transfer and fluid flow / Suhas V. Patankar/ Hemashava Publishers corporation&McGraw Hill.
2. . Computational Fluid Flow and Heat Transfer/ Muralidaran/ Narosa Publications
3. Computational Fluid Dynamics: Basics with applications/John D. Anderson/ McGraw Hill.
4. Fundamentals of Computational Fluid Dynamics/Tapan K. Sengupta / Universities Press.

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7. Introduction to Theoretical and Computational Fluid Dynamics/C. Pozrikidis /Oxford University Press/2nd Edition

Online Learning Resources:

1. https://nptel.ac.in/courses/112/105/112105254/
2. https://nptel.ac.in/courses/112/105/112105045/
3. https://nptel.ac.in/courses/112/104/112104030/
4. https://nptel.ac.in/courses/112/107/112107080/
5. https://nptel.ac.in/courses/103/106/103106073/
6. https://nptel.ac.in/courses/112/107/112107079/
7. https://nptel.ac.in/courses/103/106/103106119/
8. https://nptel.ac.in/courses/112/103/112103289/
9. https://nptel.ac.in/courses/112/106/112106294/
10. https://nptel.ac.in/courses/112/104/112104302

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M.TECH. IN ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABI

Course Code	MANUFACTURING SIMULATION LABORATORY	L	T	P	C
21D87205		0	0	4	2
	Semester	II			

Course Objectives: Student will be able

- To understand the various manufacturing processes
- To understand the various Simulation Processes

Course Outcomes (CO): Student will be able

- To learn various softwares to design.

List of Experiments:

A. MANUFACTURING SIMULATION :

The students will be given training on the use and application of the following software to manufacturing problems:

1. Auto MOD Software.
2. PROMODEL
3. SLAM-II
4. CAFIMS
5. Flexsim

They also learn how to write sub routines in C-language and interlinking with the above packages. Problems for modelling and simulation experiments:

1. AGV planning
2. ASRS simulation and performance evaluation
3. Machines, AGVs and AS/RS integrated problems
4. JIT system
5. Kanban flow
6. Material handling systems
7. M.R.P. Problems
8. Shop floor scheduling etc.

B**. PRECISION ENGINEERING**

1. Hydraulic and Pneumatic circuits
2. Closed loop control systems
3. Study of the chip formation in turning process
4. Study of operation of tool and cutter grinder, twist drill grinder, Centreless grinder
5. Determination of cutting forces in turning
6. Experiments in unconventional manufacturing processes-AJM and study of USM, EDM, Laser Machining and Plasma spraying
7. Inspection of parts using tool makers microscope, roughness and form tester
8. Study of micro-controllers, programming on various CNC machine tools and also controllers
9. Studies on PLC programming
10. Study and programming of robots
11. Condition monitoring in machining process using acoustic emission.

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COURSE STRUCTURE & SYLLABI

Course Code	ADVANCED CAD/CAM LABORATORY	L	T	P	C
21D87206		0	0	4	2
	Semester	II			

Course Objectives: Student will be able to

- Model the 3D geometric information of machine components including assemblies, and automatically generate 2- D production drawings, understand the basic analytical fundamentals that are used to create and manipulate geometric models in a computer program.
- Improve visualization ability of machine components and assemblies before their actual fabrication through modeling, animation, shading, rendering, lighting and coloring.
- Model complex shapes including freeform curves and surfaces,
- Integrate the CAD system and the CAM system by using the CAD system for modeling design Information and converting the CAD model into a CAM model for modeling the manufacturing Information.
- Use full scale CAD/CAM software systems designed for geometric modeling of machine Components and automatic generation of manufacturing information

Course Outcomes (CO): Student will be able

- Understand the concepts of wire frame, surface and modeling
- Understand part modeling and part data exchange standars (VDA,IGES and STEP)
- Develop knowledge in 2D-Transformations, 3D Transformations.
- Understand the Assembly Modeling, Assembly tree, and Assembly Methods.
- The Students become experts on Visualization and computer animation Techniques. Note: Conduct at least any10 exercises from the list given below

List of Experiments:

1. Features and selection of CNC turning and milling centers.
2. Practice in part programming and operation of CNC turning machines, subroutine techniques and use of cycles.
3. Practice in part programming and operating a machining center, tool panning and selection of sequences of operations, tool setting on machine, practice in APT based NC programming.
4. Practice in Robot programming and its languages.
5. Robotic simulation using software. Robo path control, preparation of various reports and route sheets, Simulation of manufacturing system using CAM software, controller operating system commands

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COURSE STRUCTURE & SYLLABI

Course Code	TOTAL QUALITY MANAGEMENT	L	T	P	C
21D87301a	Program Elective Course – V	3	0	0	3
Semester		III			

Course Objectives: Student will be able to

- Implement the principles and concepts inherent in a Total Quality Management (TQM)
- Approach to managing a manufacturing or service organization.
- Explain the system of documentation, implementation and assessment of quality
- Assess exactly where an organization stands on quality management with respect to the ISO 9000 quality management standard.
- Develop a strategy for implementing TQM in an organization

Course Outcomes (CO): Student will be able to

- Develop an understanding on quality management philosophies and framework
- Develop in-depth knowledge on various tools and techniques of quality management.
- Learn the applications of quality tools and techniques.
- Develop analytical skills for investigating and analyzing quality management issues in the industry and suggest implement able solutions to those.

UNIT - I	INTRODUCTION	Lecture Hrs:09

The concept of TQM, Quality and Business performance, attitude and 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	Lecture Hrs:09

The importance of customer satisfaction and loyalty- Cratingsatisfied 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	Lecture Hrs:09

The systems approach, Organizing for quality implementation, making thetransition 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	Lecture Hrs:09

Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use ofQuality Cost Information, Accounting Systems and Quality Management.

UNIT - V	ISO9000	Lecture Hrs:09

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.

Textbooks:

1. Total Quality Management / Joel E.Ross/Taylor and Franscis Limited
2. Total Quality Management/P.N.Mukherjee/PHI

Reference Books:

3. Beyond TQM / Robert L.Flood
4. Statistical Quality Control / E.L. Grant / McGraw Hill.
5. Total Quality Management- A Practical Approach/H. Lal

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6. Quality Management/KanishkaBedi/Oxford University Press/2011 7. Total Engineering Quality Management/Sunil Sharma/Macmillan
Online Learning Resources:
1. https://nptel.ac.in/courses/110/104/110104080/ 2. https://onlinecourses.nptel.ac.in/noc21_mg03/preview 3. https://nptel.ac.in/courses/110/104/110104085/ 4. https://nptel.ac.in/content/syllabus_pdf/110104080.pdf

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COURSE STRUCTURE & SYLLABI

Course Code	THEORY OF ELASTICITY AND PLASTICITY	L	T	P	C
21D87301b	Program Elective Course – V	3	0	0	3
Semester		III			

Course Objectives: Student will be able

- To impart knowledge of engineering application of plasticity.
- To know the classical theory of elasticity.
- To recognize typical plastic yield criteria.

Course Outcomes (CO): Student will be able to

- To understand the physical interpretation of material constraints in mathematical formulation of constitutive relationships.
- Solve analytically the simple boundary value problems with elasto-plastic properties.
- Develop constitutive models based on experimental results.

UNIT - I	ELASTICITY	Lecture Hrs:

Two dimensional stress analysis - Plane stress - Plane strain - Equations of compatibility -Stress function - Boundary conditions.

PROBLEM IN RECTANGULAR COORDINATES - Solution by polynomials - Saint Venent's principles -Determination of displacement - Simple beam problems.

PROBLEMS IN POLAR COORDINATES - General equations in polar coordinates - Stress distribution symmetrical about axis - Strain components in polar coordinates - Simple and symmetric problems.

UNIT - II	ANALYSIS OF STRESS AND STRAIN IN THREE DIMENSIONS	Lecture Hrs:09

Principle stresses – Homogeneous deformations - Strain spherical and deviatoric stress - Hydrostatic strain.

General theorems: Differential equations of equilibrium and compatibility - Displacement - Uniqueness of solution - Reciprocal theorem.

UNIT - III	BENDING OF PRISMATIC BARS	Lecture Hrs:09

Stress function - Bending of cantilever beam - Beam of rectangular cross-section - Beams of circular cross-section.

UNIT - IV	PLASTICITY	Lecture Hrs:09

Plastic deformation of metals - Structure of metals - Deformation - Creep stress relaxation of deformation - Strain rate condition of constant maximum shear stress - Condition of constant strain energy - Approximate equation of plasticity.

UNIT - V	METHODS OF SOLVING PRACTICAL PROBLEMS:	Lecture Hrs:09

The characteristic method - Engineering method -Compression of metal under press - Theoretical and experimental data drawing.

Textbooks:

1. Theory of Elasticity/Timoshenko S.P. and Goodier J.N./Koakusha Publishers
2. An Engineering Theory of Plasticity/E.P. Unksov/Butterworths

Reference Books:

3. Applied Elasticity/W.T. Wang/TMH
4. Theory of Plasticity for Engineers/Hoffman and Sacks/TMH
5. Theory of Elasticity and Plasticity/Sadhu Singh/ Khanna Publishers
6. Theory of Elasticity and Plasticity/Harold Malcolm Westergaard/Harvard University Press

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M.TECH. IN ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABI

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc20_ce42/preview
2. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ce18/
3. https://www.cet.edu.in/noticefiles/260_Lecturer%20Notes%20on%20AEP-ilovepdf-compressed.pdf
4. https://easyengineering.net/theory-of-elasticity-and-plasticity-by-jane-helena/

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COURSE STRUCTURE & SYLLABI

Course Code	DESIGN AND MANUFACTURING OF MEMS AND MICRO SYSTEMS (PE-V)	L	T	P	C
21D87301c		3	0	0	3
	Semester	III			

Course Objectives: Student will be able

- To learn about electrochemical design and packaging of micro devices and system
- To learn of the basic design principles for MEMS and Microsystems
- To learn the basic principles of micro fabrication technique s for micro devices and micro systems, as well as integrated circuits.
- To learn the basic principles involved in micro systems packaging
- To learn the basic principle of nano technology and nano scale engineering analysis

Course Outcomes (CO): Student will be able to

- To be able to explain what micro systems
- To explain the working principles of many MEMS and micro systems in the market place
- To understand the relevant engineering science topics relating to MEMS and micro systems.
- To be able to distinguish the design, manufacture and packaging techniques applicable to micro systems from those for integrated circuits.
- To become familiar with the materials, in particular, silicon and its compounds for MEMS.
- To be able to explain the basic and relevant design principles of MEMS and micro systems.
- To learn the scaling laws for miniaturization.
- To be able to identify the optimal micro fabrication and packaging techniques for micro devices and systems.
- To be able to handle mechanical systems engineering design of micro scale devices.
- To learn the fundamentals of nanotechnology.

UNIT - I	OVERVIEW AND WORKING PRINCIPLES OF MEMS AND MICROSYSTEMS	Lecture Hrs:09

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 fluids.

UNIT - II	ENGINEERING SCIENCE FOR MICROSYSTEMS DESIGN AND FABRICATION	Lecture Hrs:09

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

UNIT - III	ENGINEERING MECHANICS FOR MICROSYSTEMS DESIGN	Lecture Hrs:09

Static Bending of thin Plates, Mechanical Vibration, Thermo mechanics Fracture Mechanics, Thin-Film Mechanics, Overview of Finite Element Stress Analysis

UNIT - IV	THERMO FLUID ENGINEERING & MICROSYSTEMS DESIGN	Lecture Hrs:09

Overview of Basics of Fluid Mechanics in Macro and Meso scales, Basic equations in Continuum Fluid dynamics, Laminar Fluid Flow in Circular Conduits, Computational Fluid Dynamics, Incompressible Fluid Flow in Micro conduits, Fluid Flow in Sub micrometer and Nano scale,
Overview of Heat conduction in Solids, Heat Conduction in Multilayered Thin films and in solids in sub micrometer scale, Design Considerations, Process Design Mechanical Design, Mechanical Design using FEM, Design of a Silicon Die for a Micro pressure Sensor

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UNIT - V	**MATERIALS FOR MEMS & MICROSYSTEMS AND THEIR FABRICATION**	Lecture Hrs:09
Substrates and Wafers, Active substrate materials, Silicon as a substrate material, Silicon Compounds, Silicon Piezoresistors, Gallium Arsenide, Quartz, Piezoelectric Crystals and Polymers, Photolithography, Ion implantation, Diffusion and oxidation, chemical and physical vapor deposition, Etching, Bulk micro manufacturing, Surface Micromachining, The LIGA Process		
Textbooks:		
1. MEMs & Microsystems: Design & Manufacture/ Tai-Ran Hsu/Tata Mc-Graw Hill., ed./2002 2. An Introduction to Micro electromechanical Systems Engineering/ Maluf, M./ Artech House, Boston, 2000		
Reference Books:		
3. Micro robots and Micromechanical Systems/ Trimmer, W.S.N/ Sensors & Actuators, vol19, no.1989. 4. Applied Partial Differential Equations/ Trim, D.W/ PWS-Kent Publishing/ Boston 1990. 5. Fundamentals of Micro fabrication. Madou, M/ CRC Press, Boca Raton, 1997. 6. The Finite Element Method in Thermomechanics/ Hsu, T.R / Alien &Unwin, London		
Online Learning Resources:		
1. https://nptel.ac.in/courses/117/105/117105082/ 2. https://nptel.ac.in/courses/112/107/112107298/ 3. https://nptel.ac.in/courses/112/103/112103174/ 4. https://www.youtube.com/watch?v=gzgMWRIl-Fg 5. https://www.youtube.com/watch?v=27GSZFjk1ZQ 6. https://www.youtube.com/watch?v=hCGaiFgmkfg 7. https://www.youtube.com/watch?v=j9y0gfN9WMg		

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COURSE STRUCTURE & SYLLABI

AUDIT COURSE-I

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M.TECH. IN ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABI

Course Code	**ENGLISH FOR RESEARCH PAPER WRITING**	**L**	**T**	**P**	**C**
21DAC101a		**2**	**0**	**0**	**0**
	Semester	I			

Course Objectives: This course will enable students:

- Understand the essentials of writing skills and their level of readability
- Learn about what to write in each section
- Ensure qualitative presentation with linguistic accuracy

Course Outcomes (CO): Student will be able to

- Understand the significance of writing skills and the level of readability
- Analyze and write title, abstract, different sections in research paper
- Develop the skills needed while writing a research paper

UNIT - I	Lecture Hrs:10
1Overview of a Research Paper- Planning and Preparation- Word Order- Useful Phrases - Breaking up Long Sentences-Structuring Paragraphs and Sentences-Being Concise and Removing Redundancy -Avoiding Ambiguity	
UNIT - II	Lecture Hrs:10
Essential Components of a Research Paper- Abstracts- Building Hypothesis-Research Problem - Highlight Findings- Hedging and Criticizing, Paraphrasing and Plagiarism, Cauterization	
UNIT - III	Lecture Hrs:10
Introducing Review of the Literature – Methodology - Analysis of the Data-Findings - Discussion-Conclusions-Recommendations.	
UNIT - IV	Lecture Hrs:9
Key skills needed for writing a Title, Abstract, and Introduction	
UNIT - V	Lecture Hrs:9
Appropriate language to formulate Methodology, incorporate Results, put forth Arguments and draw Conclusions	

Suggested Reading

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books) Model Curriculum of Engineering & Technology PG Courses [Volume-I]
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

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M.TECH. IN ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABI

Course Code	DISASTER MANAGEMENT	L	T	P	C
21DAC101b		2	0	0	0
	Semester	I			

Course Objectives: This course will enable students:

- Learn to demonstrate critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluatedisasterriskreduction and humanitarian response policy and practice from
- Multiple perspectives.
- Developanunderstandingofstandardsofhumanitarianresponseandpracticalrelevanceinspecific types of disasters and conflict situations
- Criticallyunderstandthestrengthsandweaknessesofdisastermanagementapproaches,planningand programming in different countries, particularly their home country or the countries they work in

UNIT - I

Introduction:
Disaster:Definition,FactorsandSignificance;DifferenceBetweenHazardandDisaster;Naturaland Manmade Disasters: Difference, Nature, Types and Magnitude.
Disaster Prone Areas in India:
Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post- Disaster Diseases and Epidemics

UNIT - II

Repercussions of Disasters and Hazards:
Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes,Volcanisms,Cyclones,Tsunamis,Floods,DroughtsandFamines,Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT - III

Disaster Preparedness and Management:
Preparedness: Monitoring of Phenomena Triggering ADisasteror Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT - IV

Risk Assessment Disaster Risk:
Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. TechniquesofRiskAssessment,GlobalCo-OperationinRiskAssessmentand Warning, People's Participation in Risk Assessment. Strategies for Survival.

UNIT - V

Disaster Mitigation:
Meaning,ConceptandStrategiesofDisasterMitigation,EmergingTrendsInMitigation.Structural Mitigationand Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Suggested Reading

1. R.Nishith,SinghAK,"DisasterManagementinIndia:Perspectives,issuesandstrategies
2. "'New Royal book Company..Sahni,PardeepEt.Al.(Eds.),"DisasterMitigationExperiencesAndReflections",PrenticeHall OfIndia, New Delhi.

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COURSE STRUCTURE & SYLLABI

3. GoelS.L.,DisasterAdministrationAndManagementTextAndCaseStudies",Deep&Deep Publication Pvt. Ltd., New Delhi

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COURSE STRUCTURE & SYLLABI

Course Code	**SANSKRITFOR TECHNICAL KNOWLEDGE**	**L**	**T**	**P**	**C**
21DAC101c		**2**	**0**	**0**	**0**
	Semester	**I**			

Course Objectives: This course will enable students:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- LearningofSanskrittodevelopthelogicinmathematics,science&othersubjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge
- Knowledge from ancientliterature

Course Outcomes (CO): Student will be able to

- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science &technology can be understood
- Being a logical language will help to develop logic in students

UNIT - I
Alphabets in Sanskrit,
UNIT - II
Past/Present/Future Tense, Simple Sentences
UNIT - III
Order, Introduction of roots
UNIT - IV
Technical information about Sanskrit Literature
UNIT - V
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Suggested Reading

1.“Abhyaspustakam” –Dr.Vishwas, Sanskrit-Bharti Publication, New Delhi
2.“Teach Yourself Sanskrit” Prathama Deeksha- VempatiKutumbshastri, RashtriyaSanskrit Sansthanam, New Delhi Publication
3.“India’s Glorious ScientificTradition” Suresh Soni, Ocean books (P) Ltd.,New Delhi

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COURSE STRUCTURE & SYLLABI

AUDIT COURSE-II

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COURSE STRUCTURE & SYLLABI

Course Code	PEDAGOGY STUDIES	L	T	P	C
21DAC201a		2	0	0	0
	Semester	II			

Course Objectives: This course will enable students:

- Reviewexistingevidenceonthereviewtopictoinformprogrammedesignandpolicy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Course Outcomes (CO): Student will be able to

- Students will be able to understand:
- Whatpedagogicalpracticesarebeingusedbyteachersinformalandinformalclassrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what
- conditions, and with what population of learners?
- Howcanteachereducation(curriculumandpracticum)andtheschoolcurriculumand guidance materials best support effective pedagogy?

UNIT - I

Introduction and Methodology: Aims and rationale, Policy back ground, Conceptual frame work and terminology Theories oflearning,Curriculum,Teachereducation.Conceptualframework,Research questions. Overview of methodology and Searching.

UNIT - II

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT - III

Evidence on theeffectivenessofpedagogicalpractices,Methodologyfortheindepthstage:quality assessmen t of included studies. How can teacher education (curriculumandpracticum) andthescho curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of th body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT - IV

Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head
teacherandthecommunity.Curriculumandassessment,Barrierstolearning:limitedresourcesand large class sizes

UNIT - V

Researchgapsandfuturedirections:Researchdesign,Contexts,Pedagogy,Teachereducation, Curriculum and assessment, Dissemination and research impact.

Suggested Reading

1. AckersJ,HardmanF(2001)ClassroominteractioninKenyanprimaryschools,Compare, 31 (2): 245-261.
2. AgrawalM(2004)Curricularreforminschools:Theimportanceofevaluation,Journalof
3. Curriculum Studies, 36 (3): 361-379.
4. AkyeampongK(2003) Teacher training in Ghana - does it count? Multi-site teachereducation research project (MUSTER) country report 1. London: DFID.

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5. Akyeampong K, LussierK, PryorJ, Westbrook J (2013)Improving teaching and learning of basic maths and reading in Africa: Does teacherpreparation count?International Journal Educational Development, 33 (3): 272–282.
6. Alexander RJ(2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
   Chavan M (2003)ReadIndia: A mass scale, rapid, 'learning to read'campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

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COURSE STRUCTURE & SYLLABI

Course Code	**STRESSMANAGEMENT BY YOGA**	**L**	**T**	**P**	**C**
21DAC201b		**2**	**0**	**0**	**0**
	Semester	**II**			

Course Objectives: This course will enable students:

- To achieve overall health of body and mind
- To overcome stres

Course Outcomes (CO): Student will be able to

- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

UNIT - I		
Definitions of Eight parts of yog.(Ashtanga)		
UNIT - II		
Yam and Niyam.		
UNIT - III		
Do`sand Don't'sin life. i) Ahinsa,satya,astheya,bramhacharyaand aparigrahaii) Shaucha,santosh,tapa,swadhyay,ishwarpranidhan		
UNIT - IV		
Asan and Pranayam		
UNIT - V		
i)Variousyogposesand theirbenefitsformind &body ii)Regularizationofbreathingtechniques and its effects-Types ofpranayam		

Suggested Reading

1.'Yogic Asanas forGroupTarining-Part-I": Janardan SwamiYogabhyasiMandal, Nagpur
2."Rajayogaor conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

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COURSE STRUCTURE & SYLLABI

Course Code	PERSONALITY DEVELOPMENT THROUGHLIFE	L	T	P	C
21DAC201c	ENLIGHTENMENTSKILLS	2	0	0	0
	Semester	II			

Course Objectives: This course will enable students:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Course Outcomes (CO): Student will be able to

- StudyofShrimad-Bhagwad-Geetawillhelpthestudentindevelopinghispersonalityand achieve the highest goal in life
- The person who has studied Geetawilllead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students

UNIT - I

Neetisatakam- Holistic development of personality
Verses-19,20,21,22(wisdom)
Verses-29,31,32(pride &heroism)
Verses-26,28,63,65(virtue)

UNIT - II

Neetisatakam- Holistic development of personality
Verses-52,53,59(dont's)
Verses-71,73,75,78(do's)

UNIT - III

Approach to day to day work and duties.
ShrimadBhagwadGeeta:Chapter2-Verses41,47,48,
Chapter3-Verses13,21,27,35,Chapter6-Verses5,13,17,23,35,
Chapter18-Verses45,46,48.

UNIT - IV

Statements of basic knowledge.
ShrimadBhagwadGeeta:Chapter2-Verses 56,62,68
Chapter12 -Verses13,14,15,16,17,18
Personality of Rolemodel. Shrimad Bhagwad Geeta:

UNIT - V

Chapter2-Verses 17,Chapter3-Verses36,37,42,
Chapter4-Verses18,38,39
Chapter18– Verses37,38,63

Suggested Reading

1."SrimadBhagavadGita"bySwamiSwarupanandaAdvaitaAshram(PublicationDepartment), Kolkata
2.Bhartrihari'sThree Satakam (Niti-sringar-vairagya) by P.Gopinath, RashtriyaSanskrit Sansthanam, New Delhi.

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COURSE STRUCTURE & SYLLABI

OPEN ELECTIVE

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M.TECH. IN ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABI

Course Code	BUSINESS ANALYTICS	L	T	P	C
21DOE301c		3	0	0	3
Semester		III			

Course Objectives:

- The main objective of this course is to give the student a comprehensive understanding of business analytics methods.

Course Outcomes (CO): Student will be able to

- Students will demonstrate knowledge of data analytics.
- Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
- Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
- Students will demonstrate the ability to translate data into clear, actionable insights.

UNIT - I — Lecture Hrs:

Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst.
Stakeholders: the project team, management, and the front line, Handling Stakeholder Conflicts.

UNIT - II — Lecture Hrs:

Life Cycles: Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.

UNIT - III — Lecture Hrs:

Forming Requirements: Overview of Requirements, Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents.Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

UNIT - IV — Lecture Hrs:

Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements. Managing Requirements Assets: Change Control, Requirements Tools

UNIT - V — Lecture Hrs:

Recent Trands in: Embedded and colleborative business intelligence, Visual data recovery, Data Storytelling and Data Journalism.

Textbooks:

1. Business Analysis by James Cadle et al.
2. Project Management: The Managerial Process by Erik Larson and, Clifford Gray

Reference Books:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

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COURSE STRUCTURE & SYLLABI

Course Code	**INTERNET OF THINGS (IOT)**	**L**	**T**	**P**	**C**
21DOE301g		**3**	**-**	**-**	**3**
	Semester	**III**			

Course Objectives: Student will be able

- To study fundamental concepts of IoT
- To understand roles of sensors in IoT
- To Learn different protocols used for IoT design
- To be familiar with data handling and analytics tools in IoT
- Appreciate the role of big data, cloud computing and data analytics in a typical IoT system

Course Outcomes (CO): Student will be able to

- Understand the various concepts, terminologies and architecture of IoT systems.
- Use sensors and actuators for design of IoT.
- Understand and apply various protocols for design of IoT systems
- Use various techniques of data storage and analytics in IoT
- Understand various applications of IoT
- Understand APIs to connect IoT related technologies

UNIT – I	Lecture Hrs:09

Fundamentals of IoT: Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M

UNIT – II	Lecture Hrs: 09

Sensors Networks : Definition, Types of Sensors, Types of Actuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit, RFID Principles and components, Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.

UNIT – III	Lecture Hrs: 09

Wireless Technologies for IoT: WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus.
IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT. Edge connectivity and protocols

UNIT – IV	Lecture Hrs: 09

Data Handling& Analytics: Introduction, Bigdata, Types of data, Characteristics of Big data, Data handling Technologies, Flow of data, Data acquisition, Data Storage, Introduction to Hadoop. Introduction to data Analytics, Types of Data analytics, Local Analytics, Cloud analytics and applications

UNIT - V	Lecture Hrs: 09

Applications of IoT: Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection.

Textbooks:

1.Hakima Chaouchi, — "The Internet of Things Connecting Objects to the Web" ISBN : 978-1-84821-140-7, Wiley Publications
2.Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", WileyPublications
3.Vijay Madisetti and ArshdeepBahga, — "Internet of Things (A Hands-on-Approach)", 1st Edition,

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COURSE STRUCTURE & SYLLABI

VPT, 2014. 4.J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016. 5.Keysight Technologies, "The Internet of Things: Enabling Technologies and Solutions for Design and Test", Application Note, 2016.
Reference Books:
1.Daniel Minoli, — "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publication 2.Pethuru Raj and Anupama C. Raman, "The Internet of Things: EnablingTechnologies, Platforms, and Use Cases", CRC Press
Online Learning Resources:
https://onlinecourses.nptel.ac.in/noc17_cs22/course http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

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COURSE STRUCTURE & SYLLABI

Course Code	**MECHATRONICS**	**L**	**T**	**P**	**C**
21DOE301h		**3**	**0**	**0**	**3**
	Semester	**III**			

Course Objectives: Student will be able

- To study fundamental concepts of Signal condition
- To understand the concepts of precision mechanical systems
- To Learn different electronic interface subsystems
- To be familiar with microcontrollers overview.
- To understand the concepts of programmable logic controllers

Course Outcomes (CO): Student will be able to

- Understand the various concepts, terminologies of Signal condition
- Understand the basics electronic interface subsystems
- Understand and apply various precision mechanical systems
- Understand various applications of microcontrollers overview
- Understand the controlling of programmable logic and programmable motion.

UNIT – I	Lecture Hrs:09

INTRODUCTION : Definition – Trends - Control Methods: Standalone , PC Based (Real Time Operating Systems, Graphical User Interface , Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

SIGNAL CONDITIONING : Introduction – Hardware - Digital I/O, Analog input – ADC, resolution , speed channels Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps – Software - Digital Signal Processing – Low pass , high pass , notch filtering.

UNIT – II	Lecture Hrs: 09

PRECISION MECHANICAL SYSTEMS : Pneumatic Actuation Systems - Electro-pneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts – Ball Screw and Nut - Linear Motion Guides - Linear Bearings - Harmonic Transmission - Bearings- Motor / Drive Selection.

UNIT – III	Lecture Hrs: 09

ELECTRONIC INTERFACE SUBSYSTEMS : TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids , motors Isoation schemes- opto coupling, buffer IC's - Protection schemes – circuit breakers , over current sensing , resetable fuses , thermal dissipation - Power Supply - Bipolar transistors / mosfets

ELECTROMECHANICAL DRIVES : Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation

UNIT – IV	Lecture Hrs: 09

MICROCONTROLLERS OVERVIEW: 8051 Microcontroller , micro processor structure - DigitalInterfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming –Assembly , C (LED Blinking , Voltage measurement using ADC).

UNIT - V	Lecture Hrs: 09

PROGRAMMABLE LOGIC CONTROLLERS : Basic Structure - Programming : Ladder diagram -Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection - Application.

PROGRAMMABLE MOTION CONTROLLERS : Introduction - System Transfer Function –

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(Established by Govt. of A.P., ACT No.30 of 2008)
ANANTHAPURAMU – 515 002 (A.P) INDIA

M.TECH. IN ADVANCED MANUFACTURING SYSTEMS

COURSE STRUCTURE & SYLLABI

Laplace transform and its application in analysing differential equation of a control system - Feedback Devices :Position , Velocity Sensors - Optical Incremental encoders - Proximity Sensors : Inductive , Capacitive ,
Textbooks:
1. A text book of Mechatronics by Er.R.K. RAJPUT ., S.CHAND publications 2. A text book of Mechatronics by Nitalgour Premchand Mahalik ., McGraw Hill publications
Reference Books:
1. A text book of Mechatronics by W.Bolton ., Pearson Publications