T K R COLLEGE OF ENGINEERING &TECHNOLOGY

(Autonomous)

B.TECH. MECHANICAL ENGINEERING -R18

COURSE STRUCTURE& SYLLABUS

B.Tech VII Semester

S.No	Code	Course Title	L	T	P	Credit
1	**B37PC1**	Refrigeration and Air Conditioning	**3**	**1**	**0**	**3**
2	**B37PC2**	Operations Research	**3**	**1**	**0**	**3**
3	**B37PC3**	CAD/CAM	**3**	**1**	**0**	**3**
4	**B37PE4**	**Professional Elective-IV** A) Instrumentation and Control systems B)Welding Technology C) Industrial Management	**3**	**1**	**0**	**3**
5	**B37PE5**	**Professional Elective-V** A)Un-Conventional Machining Processes B) Robotics C)Nano Technology	**3**	**1**	**0**	**3**
6	**B37PC6**	CAD/CAM lab	**0**	**0**	**3**	**1.5**
7	**B37PW7**	Registration of project and completion of part of the project along with seminar.	**0**	**0**	**4**	**3**
Total						**19.5**

Note: Project work- A is registered in seventh semester and the seminar of the project-A, is conducted in the same semester. The project- A is evaluated for 100 marks, out of which 40 marks are awarded as internal marks on the basis of seminar and 60 marks for external evaluation. Soft binding of the project work- A has to be submitted for external evaluation and the same has to be extended for the project work- B of eighth semester.

B.Tech VIII Semester

S.No.	Code	Course Title	L	T	P	Credit
1	**B38PC1**	Production Planning and Control	**3**	**1**	**0**	**3**
2	**B38PE2**	**Professional Elective-VI** A) Renewable energy sources B) Jet propulsion and Rocket Engineering. C) Composite Materials D) Total Quality Management	**3**	**1**	**0**	**3**
3	**B38PW3**	Project Work – B & Final Seminar			**18**	**10.5**
4	**B38CV4**	Comprehensive Viva/MCQ Testing	**1**	**1**	**1**	**1.5**
Total Credits						**18**

Note:

1. Comprehensive Viva is for 100 marks and required credits of 1.5 can be obtained by the student on getting minimum 50 %.

2. Project B is the extension of project-A registered in the seventh semester. It is evaluated by an external evaluator for 160 marks (minimum marks to be obtained is 40 % out of 160 marks)

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B.TECH. MECHANICAL ENGINEERING -R18

REFRIGERATION AND AIR CONDITIONING-B37PC1

B.Tech. VII Semester. **L/T/P/ C**

3/1/0/3

UNIT – I:

Introduction to Refrigeration: -Basic concepts – Unit of refrigeration and C.O.P-refrigerators-heat pump- carnot refrigerator-applications of refrigerator – Vapour compression refrigeration- Ideal cycle -effect of sub cooling of liquid- super heating of vapour-deviations of practical (actual cycle) from ideal cycle- construction and use of P-H chart- problems.

UNIT – II:

Components: Compressors -classification – Working – Advantages and Disadvantages. Condensers – classification – Working Principles Evaporators – classification – Working Principles Expansion devices – Types – Working Principles.

UNIT III:

Vapor Absorption refrigeration – Description and working of ammonia – water, Li Br – water system – Calculation of HCOP, Principle and operation of three fluid vapour absorption refrigeration system.Air refrigeration- Bell Coleman cycle – open and dente air system – ideal and actual refrigeration – applications – steam jet refrigeration system -working principle – basic operation.

UNIT – IV:

Introduction to Air Conditioning:Psychometric Properties & Processes – Sensible and latent heat loads Characterisation – Need for Ventilation, Consideration of Infiltration – Load concepts of RSHF, ASHF, ESHF and ADP.Concept of human comfort and effective temperature -Comfort Air conditioning – Industrial air conditioning and Requirements – Air conditioning Load Calculations.

UNIT – V:

Air Conditioning systems: Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, deodorants, fans and blowers. Heat Pump – Heat sources – different heat pump circuits Applications.

TEXT BOOKS

1. Refrigeration and Air Conditioning / CP Arora / TMH.
2. A Course in Refrigeration and Air Conditioning I SC Arora &Domkundwar / Dhanpatrai.

REFERENCE BOOKS

1. Principles of Refrigeration /Dossat / Pearson Education.
2. Basic Refrigeration and Air-Conditioning/ Ananthanarayanan / TMH.
3. Refrigeration and Air Conditioning/ Manohar Prasadl New Age.
4. Refrigeration and Air Conditioning/Ahmadul Ameen/PHI.

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B.TECH. MECHANICAL ENGINEERING -R18

OPERATIONS RESEARCH-B37PC2

B.Tech. VII Semester. **L/T/P/ C**

3/1/0/3

COURSE OBJECTIVES:

1. To Explain optimum utilization of resources, efforts and implementation them in decision effectively.
2. To understand scientific systematic approach involved and provide a good intellectual support for decision making.
3. To discuss substantial experience in taking timely management decisions and for corrective measures.
4. To Analyze the behavior of the system for the purpose of improving its performance.
5. To Demonstrate reliability of solution obtained from a model depending on the validity of the model in representing on real systems.
6. To Generate solutions for the problems, so that the total cost is minimum or total profit is maximum.
7. To calculate the Life of the machine which helps in replacing the existing Machine with a newer machine which results in reducing maintenance cost in Replacement Model.
8. To Assign Right Job to a right kind of person so that within short time maximum benefits can be achieved in Assignment Model problem.
9. To find the sequence of jobs to be processed on a machine so as to reduce Idle time in Sequencing model.
10. To Find out the Inventory (Stock) to be maintained in the Industry
11. To enable the student in identifying, accessing, evaluating, and interpreting information and data in support of assignments, projects, or research.

COURSE OUTCOMES:

1. Applying a different linear programming problem technique which has a broad experience in finding the optimum profit.
2. Apply the knowledge of the course in solving real life problems.
3. Understand the mathematical tools that are needed to solve optimization problems and Identify areas for research-oriented work based on the course content
4. Calculate the knowledge that tries to optimize total return by maximizing the profit and minimizing the cost or loss.

5. Recognize the best (optimum) decisions relative to largest possible portion of the total organization.
6. Discuss towards the development of better working procedure and systematic approach in problem analysis, modeling and implementation of solutions at the workplace.
7. Develop a report that describes the model and the solving technique, analyse the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.

UNIT—I:

Development — Definition— Characteristics and Phases — Types of models — Operations Research models — applications.

Allocation: Linear Programming Problem Formulation — Graphical solution — Simplex method — Artificial variables techniques: Two—phase method, Big M method.

UNIT— II:

Transportation Problem — Formulation — Optimal solution, unbalanced transportation problem — Degeneracy.Assignment problem — Formulation — Optimal solution – Variants of Assignment Problem- Traveling Salesman problem.

UNIT—III:

Sequencing — Introduction — Flow —Shop sequencing — n jobs through two machines — n jobs through three machines — Job shop sequencing — two jobs through m machines

Replacement: Introduction — Replacement of items that deteriorate with time — when money value is not counted and counted — Replacement of items that fail completely- Group Replacement.

UNIT—IV:

Theory of Games: Introduction —Terminology— Solution of games with saddle points and without saddle points- 2 x 2 games — dominance principle — m x 2 & 2 x n games -graphical method.

Inventory: Introduction — Single item, Deterministic models — Purchase inventory models with one price break and multiple price breaks —Stochastic models — demand may be discrete variable or continuous variable — Single Period model and no setup cost.

UNIT—V:

Waiting Lines: Introduction —Terminology-Single Channel — Poisson arrivals and Exponential Service times — with infinite population and finite population models— Multichannel — Poisson

arrivals and exponential service times with infinite population.

Dynamic Programming: Introduction — Terminology- Bellman's Principle of Optimality — Applications of dynamic programming- shortest path problem — linear programming problem.

Simulation: Introduction, Definition, types of simulation models, Steps involved in the simulation process- Advantages and disadvantages- applications of simulation to queuing and inventory.

TEXT BOOKS

1. Operations Research /J.K.Sharma 4e. /MacMilan.
2. Introduction to O.RIHilIier&LibermannfTMH.

REFERENCE

1. Introduction to O.R /TahaIPHl.
2. Operations Research! NVS Raju/ SMS Education/3d Revised Edition.
3. Operations Research /A.M.Natarajan, P,Balasubramaniam, A Tamilarasi/Pearson Education.
4. Operations Research I Wagner! PHI Publications.
5. Operations Research/M.V. Durga Prasad, K, Vijaya Kumar Reddy, J, Suresh Kumarl Cengage Learning.

T K R COLLEGE OF ENGINEERING &TECHNOLOGY

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B.TECH. MECHANICAL ENGINEERING -R18

CAD/CAM-B37PC3

B.Tech. VII Semester. **L/T/P/ C**

3/1/0/3

PRE – REQUISITE: Engineering Mathematics, Machine Tools

COURSE OBJECTIVES:

1. To provide an overview of how computers are being used in design, development of manufacturing plans and manufacture.
2. To understand the need for integration of CAD and CAM.

COURSE OUTCOMES:

1. Understand geometric transformation techniques in CAD. Develop mathematical models to represent curves and surfaces.
2. Model engineering components using solid modeling techniques. Develop programs for CNC to manufacture industrial components.
3. To understand the application of computers in various aspects of manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

UNIT – I:

Fundamentals of CAD, CAM, Automation , design process, Application of computers for design, Benefits of CAD, Computer configuration for CAD applications, Computer peripherals for CAD, Design workstation, Graphic terminal, CAD software- definition of system software and application software ,CAD database and structure. **Geometric Modeling:** 3-D wire frame modeling, wire frame entities and their definitions, Interpolation and approximation of curves, Concept of parametric and non-parametric representation of curves, Curve fitting techniques, definitions of cubic spline, Bezier, and B-spline.

UNIT – II:

Surface modeling: Algebraic and geometric form, Parametric space of surface, Blending functions, parametrization of surface patch, Subdividing, Cylindrical surface, Ruled surface, Surface of revolution Spherical surface, Composite surface, Bezier surface. B-spline surface, Regenerative surface and pathological conditions.

Solid Modelling: Definition of cell composition and spatial occupancy enumeration, Sweep representation, Constructive solid geometry, Boundary representations.

UNIT – III:

NC Control Production Systems: Numerical control, Elements of NC system, NC part programming: Methods of NC part programming, manual part programming, Computer assisted part programming, Post Processor, Computerized part program, SPPL (A Simple Programming Language). CNC, DNC and Adaptive Control Systems.

UNIT – IV:

Group Technology: Part families, Parts classification and coding. Production flow analysis, Machine cell design.

Computer aided process planning: Difficulties in traditional process planning, Computer aided process planning: retrieval type and generative type, Machinability data systems.

Computer aided manufacturing resource planning: Material resource planning, inputs to MRP, MRP output records, Benefits of MRP, Enterprise resource planning, Capacity requirements planning

UNIT – V:

Flexible manufacturing system: F.M.S equipment, FMS layouts, Analysis methods for FMS benefits of FMS.

Computer aided quality control: Automated inspection- Off-line, On-line, contact, Noncontact; Coordinate measuring machines, Machine vision.

Computer Integrated Manufacturing: CIM system, Benefits of CIM

TEXT BOOKS

1. CAD/CAM Concepts and Applications / Alavala / PHI
2. CAD/CAM Principles and Applications / P.N.Rao / Mc Graw Hill

REFERENCE

1. CAD/CAM/ Groover M.P/ Pearson
2. CAD/CAM/CIM/ Radhakrishnan and Subramanian / New Age.

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B.TECH. MECHANICAL ENGINEERING -R18

INSTRUMENTATION AND CONTROL SYSTEMS-B37PE4A

B.Tech. VII Semester. **L/T/P/ C**

3/1/0/3

UNIT—I:

Definition — Basic principles of measurement — Measurement systems, generalized configuration and functional descriptions of measuring instruments — examples.Dynamic performance characteristics — sources of error, Classification and elimination of error.

UNIT—II:

Measurement of Displacement: Theory and construction of various transducers to measure displacement — Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

Measurement of Temperature: Classification — Ranges — Various Principles of measurement — Expansion, Electrical Resistance — Thermistor — Thermocouple — Pyrometers — Temperature Indicators..

Measurement of Pressure: Units — classification — different principles used. Manometers, Piston, Bourdon pressure gauges, Bellows — Diaphragm gauges. Low pressure measurement — Thermal conductivity gauges — ionization pressure gauges, Mcleod pressure gauge.

UNIT—III:

Measurement of Level: Direct method — Indirect methods — capacitative, ultrasonic, magnetic, cryogenic fuel level indicators — Bubbler level indicators.

Flow Measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot — wire anemometer, Laser Doppler Anemometer (LDA).

Measurement of Speed: Mechanical Tachometers — Electrical tachometers — Stroboscope, Non-contact type of tachometer.

Measurement of Acceleration and Vibration: Different simple instruments — Principles of Seismic instruments — Vibro meter and accelerator meter using this principle.

UNIT— IV:

Stress Strain Measurements: Various types of stress and strain measurements — electrical strain gauge — gauge factor — method of usage of resistance strain gauge for bending compressive and tensile strains — usage for measuring torque, Strain gauge Rosettes.

Measurement of Humidity: Moisture content of gases, sling psychrometer, Absorption psychrometer, Dew point meter.

Measurement Of Force, Torque And Power: Elastic force meters, load cells, Torsion meters, Dynamometers.

UNIT—V:

Elements of Control Systems: Introduction, Importance — Classification — Open and closed systems Servomechanisms — Examples with block diagrams — Temperature, speed and position control systems.

TEXT BOOKS

1. Measurement Systems: Applications & Design I D.S Kumar/Anuradha Agencies.
2. Instrumentation, measurement & analysis IB.C.Nakra&K.K.Choudhary/ TMH.

REFERENCE BOOKS

1. Principles of Industrial Instrumentation and Control Systems Chennakesava R Alavala/ Cengage Learning.
2. Instrumentation and Control systems! S.Bhaskar/Anuradha Agencies.
3. Experimental Methods for Engineers / Holman/McGraw Hill.
4. Mechanical and Industrial Measurements I R.K. Jain/ Khanna Publishers.
5. Mechanical Measurements / Sirohi and Radhakrishna / New Age.
6. Instrumentation & Mech. Measurements /A.K. Tayal /Galgotia Publications.

T K R COLLEGE OF ENGINEERING &TECHNOLOGY

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B.TECH. MECHANICAL ENGINEERING -R18

WELDING TECHNOLOGY-B37PE4B

B.Tech. VII Semester. **L/T/P/ C**

3/1/0/3

PRE-REQUISITE: Manufacturing Process.

COURSE OBJECTIVE:

1. To understand the basics of welding and to know about the various types of welding processes.

COURSE OUTCOMES: Upon completion of this course, the students can able

1. Understand the construction and working principles of gas and arc welding process.
2. Understand the construction and working principles of resistance welding process.
3. Understand the construction and working principles of various solid state welding process.
4. Understand the construction and working principles of various special welding processes.
5. Understand the concepts on weld joint design, weldability and testing of weldments.

UNIT I:

GAS AND ARC WELDING PROCESSES: Fundamental principles – Air Acetylene welding, Oxyacetylene welding, Carbon arc welding, Shielded metal arc welding, Submerged arc welding, TIG & MIG welding, Plasma arc welding and Electroslag welding processes - advantages, limitations and applications.

UNIT II:

RESISTANCE WELDING PROCESSES: Spot welding, Seam welding, Projection welding, Resistance Butt welding, Flash Butt welding, Percussion welding and High frequency resistance welding processes - advantages, limitations and applications.

UNIT III:

SOLID STATE WELDING PROCESSES: Cold welding, Diffusion bonding, Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and Hot pressure welding processes - advantages, limitations and applications.

UNIT IV:

OTHER WELDING PROCESSES: Thermit welding, Atomic hydrogen welding, Electron beam welding, Laser Beam welding, Friction stir welding, Under Water welding, Welding automation in aerospace, nuclear and surface transport vehicles.

UNIT V:

DESIGN OF WELD JOINTS, WELDABILITY AND TESTING OF WELDMENTS: Various weld joint designs – Welding defects – causes and remedies - Weldability of Aluminium, Copper, and Stainless steels. Destructive and non destructive testing of weldments.

TEXT BOOKS

1. Little R.L., "Welding and welding Technology", Tata McGraw Hill Publishing Co., Ltd., New Delhi, 34 th reprint, 2008.
2. Parmer R.S., "Welding Engineering and Technology", 1st Edition, Khanna Publishers, New Delhi, 2008.
3. Parmer R.S., "Welding Processes and Technology", Khanna Publishers, New Delhi, 1992.

REFERENCES

1. AWS- Welding Hand Book. 8th Edition. Vol- 2. "Welding Process".
2. Christopher Davis. "Laser Welding- Practical Guide". Jaico Publishing House.
3. Davis A.C., "The Science and Practice of Welding", Cambridge University Press, Cambridge, 1993
4. Nadkarni S.V. "Modern Arc Welding Technology", Oxford IBH Publishers, 1 Edition, 2005.
5. Schwartz M.M. "Metals Joining Manual". McGraw Hill Books, 1979.
6. Tylecote R.F. "The Solid Phase Welding of Metals". Edward Arnold Publishers Ltd. London.

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B.TECH. MECHANICAL ENGINEERING -R18

INDUSTRIAL MANAGEMENT-B37PE4C

B.Tech. VII Semester. **L/T/P/ C**

3/1/0/3

UNIT I:

Introduction to Management: Entrepreneurship and organization – Nature and Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management.

UNIT II:

Designing Organizational Structures: Departmentalization and Decentralization, Types of Organization structures – Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organization, Cellular Organization, team structure, boundary less organization, inverted pyramid structure, lean and flat organization structure and their merits, demerits and suitability.

UNIT III:

Operations Management: Objectives- product design process- Process selection-Types of production system(Job, batch and Mass Production),Plant location-factors- Urban-Rural sites comparison- Types of Plant Layouts- Design of product layout- Line balancing(RPW method) Value analysis-Definition-types of values- Objectives- Phases of value analysis- Fast diagram.

UNIT IV:

Work Study: Introduction — definition — objectives — steps in work study — Method study — definition — objectives — steps of method study. Work Measurement — purpose — types of study — stop watch methods — steps — key rating — allowances — standard time calculations — work sampling. Statistical Quality Control: variables-attributes, Shewart control charts for variables-chart, R chart, – Attributes-Defective-Defect- Charts for attributes-p-chart -c chart (simple Problems), Acceptance Sampling- Single sampling- Double sampling plans-OC curves.

UNIT V:

Job Evaluation: methods of job evaluation — simple routing objective systems — classification method — factor comparison method — point method — benefits of job evaluation and limitations. Project Management (PERTICPM): Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (simple problems).

TEXT BOOKS

1. Industrial Engineering and Management/O.P. Khanna/Khanna Publishers.
2. Industrial Engineering and Management Science/T.R. Banga and S.C.Sarma/Khanna Publishers.

REFERENCE

1. Motion and Time Study by Ralph M Barnes! John Willey &SonsWork Study by lLO.
2. Human factors in Engineering & Design/Ernest J McCormick / TMH.
3. Production & Operation Management /Paneer Selvam /PHI.
4. Industrial Engineering Management/NVS Raju/Cengage Learning.
5. Industrial Engineering Hand Book /Maynard.
6. Industrial Engineering Management I RaviShankar/ Galgotia.

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B.TECH. MECHANICAL ENGINEERING -R18

UNCONVENTIONAL MACHINING PROCESSES -B37PE5A

B.Tech. VII Semester. **L/T/P/C**

3/1/0/3

PRE-REQUISITES: None.

COURSE OBJECTIVES:

1. To teach the modeling technique for machining processes.
2. To teach interpretation of data for process selection.
3. To teach the mechanics and thermal issues associated with chip formation.
4. To teach the effects of tool geometry on machining force components and surface finish.
5. To teach the machining surface finish and material removal rate.

COURSE OUTCOMES:

1. Understand the basic techniques of machining processes modeling.
2. Understand the mechanical aspects of orthogonal cutting mechanics.
3. Understand the thermal aspects of orthogonal cutting mechanics.
4. Ability to extend, through modeling techniques, the single point, multiple point and abrasive machining processes.
5. Estimate the material removal rate and cutting force, in an industrially useful manner, for practical machining processes.

UNIT – I:

Introduction – Need for non-traditional machining methods-Classification of modern machining processes – considerations in process selection.Materials.Applications. Ultrasonic machining – Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development.

UNIT – II:

Abrasive Jet Machining, Water Jet Machining And Abrasive Water Jet Machine: Basic principles, equipments, process variables, and mechanics of metal removal, MRR, application and limitations.

Electro – Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy economic aspects of ECM – Simple problems for estimation of metal removal rate. Fundamentals of chemical, machining, advantages and applications.

UNIT – III:

Thermal Metal Removal Processes: General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM, principle, applications.

UNIT – IV:

Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes –General Principle and application of laser beam machining – thermal features, cutting speed and accuracy of cut.

UNIT – V:

Application of plasma for machining, metal removing mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries. Chemical machining – principle - maskants - applications. Magnetic abrasive finishing, Abrasive flow finishing, Electro stream drilling, shaped tube electrolyte machining.

TEXT BOOKS

1. Advanced Machining Processes / VK Jain / Allied publishers.
2. Modern Machining Processes - P. C. Pandey, H. S. Shan.

REFERENCE

1. Manufacturing Engineering and Technology by SeropeKalpakjain, Pearson Publications. 2001.
2. Manufacturing Engineering & Technology, Kalpakjain.
3. Unconventional Manufacturing Processes, Singh M.K.

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B.TECH. MECHANICAL ENGINEERING -R18

ROBOTICS-B37PE5B

B.Tech. VII Semester. **L/T/P/C**

3/1/0/3

PRE-REQUISITES: Basic principles of Kinematics and mechanics.

COURSE OBJECTIVES:

The goal of the course is to familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics and control, chose, and incorporate robotic technology in engineering systems.

1. Make the students acquainted with the theoretical aspects of Robotics.
2. Enable the students to acquire practical experience in the field of Robotics through design projects and case studies.
3. Make the students to understand the importance of robots in various fields of engineering.
4. Expose the students to various robots and their operational details.

COURSE OUTCOMES:

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

1. Understand the basic components of robots. Differentiate types of robots and robot grippers. Model forward andinverse kinematics of robot manipulators.
2. Analyze forces in links and joints of a robot.
3. Programme a robot to perform tasks in industrial applications.
4. Design intelligent robots using sensors.

UNIT – I:

Introduction: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications.

Components of the Industrial Robotics: common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, Design of end effectors, Precision of Movement: Resolution, Accuracy and Repeatability, Speed of Response and Load Carrying Capacity.

UNIT – II:

Motion Analysis: Basic Rotation Matrices, Equivalent Axis and Angle, Euler Angles, Composite Rotation Matrices. Homogeneous transformations as applicable to rotation and translation – problems.

Manipulator Kinematics-H notation-H method of Assignment of frames-H Transformation Matrix, joint coordinates and world coordinates, Forward and inverse kinematics – problems on Industrial Robotic Manipulation.

UNIT – III:

Differential transformation of manipulators, Jacobians – problems. Dynamics: Lagrange – Euler and Newton – Euler formations – Problems.Trajectory planning and avoidance of obstacles, path planning, Slew motion, joint interpolated motion – straight line motion.

UNIT IV:

Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison of Actuators, Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile and Range sensors, Force and Torque sensors.

UNIT V:

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

TEXT BOOKS

1. Industrial Robotics / Groover M P /Mc Graw Hill.
2. Introduction to Industrial Robotics / Ramachandran Nagarajan / Pearson.

REFERENCE

1. Robot Dynamics and Controls / Spony and Vidyasagar / John Wiley.
2. Robot Analysis and control / Asada ,Slotine / Wiley Inter-Science.

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B.TECH. MECHANICAL ENGINEERING -R18

NANOTECHNOLOGY -B37PE5C

B.Tech. VII Semester. **L/T/P/ C**

3/1/0/3

PRE-REQUISITES: Mathematics, Physics and chemistry.

COURSE OBJECTIVES:

1. Understand the Nanomaterials and their properties.
2. Gain knowledge of different nanostructures of carbon and their properties.
3. Know applications of carbon nanotubes.
4. Build technologies to design, realize and analyze micro and nano-scale electronic devices, materials and systems, coupled with general and technology management.

COURSE OUTCOMES:

After completion of the course the student is able to

1. Create solutions in engineering, biotechnology and manufacturing by identifying current nanotechnology.
2. Apply the fundamental knowledge of science to characterize the Nano Materials.
3. Synthesize carbon Nano tubes and nano materials.
4. Evaluate tools in nanoscience for applications in various sectors.

UNIT – I:

Introduction: History and Scope, Can Small Things Make a Big Difference, Classification of Nanostructured Materials, Fascinating Nanostructures, Applications of Nanomaterials, Nature: The Best of Nanotechnologist, Challenges, and Future Prospects.

UNIT – II:

Unique Properties of Nanomaterials: Microstructure and Defects in Nanocrystalline Materials: Dislocations, Twins, stacking faults and voids, Grain Boundaries, triple and disclinations,

Effect of Nano-dimensions on Materials Behavior: Elastic properties, Melting Point, Diffusivity, Grain growth characteristics, enhanced solid solubility. **Magnetic Properties**: Soft magnetic nanocrystalline alloy, Permanent magnetic

nanocrystalline materials, Giant Magnetic Resonance, Electrical Properties, Optical Properties, Thermal Properties, and Mechanical Properties.

UNIT- III:

Synthesis Routes: Bottom up approaches: Physical Vapor Deposition, Inert Gas Condensation, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Solgel method ,Self-assembly, **Top down approaches:** Mechanical alloying, Nano-lithography, **Consolidation of Nanopowders**: Shock wave consolidation, Hot isostatic pressing and Cold isostatic pressing Spark plasma sintering.

UNIT – IV:

Tools to Characterize nanomaterials: X-Ray Diffraction (XRD), Small Angle X-ray scattering (SAXS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscope(STM), Field Ion Microscope (FEM), Three-dimensional Atom Probe (3DAP), Nanoindentation.

UNIT – V:

Applications of Nanomaterials: Nano-electronics, Micro- and Nano-electromechanical systems (MEMS/NEMS), Nanosensors, Nanocatalysts, Food and Agricultural Industry, Cosmetic and Consumer Goods, Structure and Engineering, Automotive Industry, WaterTreatment and the environment, Nano-medical applications, Textiles, Paints, Energy, Defense and Space Applications, Concerns and challenges of Nanotechnology.

TEXT BOOKS

1. Text Book of Nano Science and Nano Technology – B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Munday, University Press-IIM.

2. Introduction to Nanotechnology – Charles P. Poole, Jr., and Frank J. Owens, Wley India Edition, 2012.

REFERENCES BOOKS

1. Nano: The Essentials by T. Pradeep, Mc Graw- Hill Education.

2. Nanomaterials, Nanotechnologies and Design by Michael F. Ashby, Paulo J. Ferreira and Daniel L. Schodek.

3. Transport in Nano structures- David Ferry, Cambridge University press 2000

4. Nanofabrication towards biomedical application: Techniques, tools, Application and impact – Ed. Challa S., S. R. Kumar, J. H. Carola.

5. Carbon Nanotubes: Properties and Applications- Michael J. O'Connell.

6. Electron Transport in Mesoscopic systems - S. Dutta, Cambridge University press.

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B.TECH. MECHANICAL ENGINEERING -R18
CAD/CAM LAB -B37PC6

B.Tech. VII Semester. **L/T/P/ C**

0/0/3/1.5

PRE REQUISITE: Machine Tools Lab, Engineering Drawing and Machine Drawing and Design

COURSE OBJECTIVES:

1. To be able to understand and handle design problems in a systematic manner.
2. To be able to apply CAD in real life applications.
3. To be understand the basic principles of different types of analysis.

COURSE OUTCOMES:

1. To understand the analysis of various aspects in of manufacturing design.

Note: conduct any TEN exercises from the list given below:

1. Drafting: Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances.
2. Part Modeling: Generation of various 3D Models through Protrusion, revolve, sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling and Assembly Modeling. Study of various standard Translators. Design of simple components.
3. Determination of deflection and stresses in 2D and 3D trusses and beams.
4. Determination of deflections, principal and Von-mises stresses in plane stress, plane strain and Axi-symmetric components.
5. Determination of stresses in 3D and shell structures (at least one example in each case)
6. Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
7. Study state heat transfer analysis of plane and axi-symmetric components.
8. Development of process sheets for various components based on Tooling and Machines.
9. Development of manufacturing defects and tool management systems.
10. Study of various post processors used in NC Machines.
11. Development of NC code for free form and sculptured surfaces using CAM software.

12. Machining of simple components on NC lathe and Mill by transferring NC Code / from CAM software.

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B.TECH. MECHANICAL ENGINEERING -R18

PRODUCTION PLANNING AND CONTROL-B38PC1

B.Tech. VIII Semester. **L/T/P/ C**

3/1/0/3

PRE-REQUISITES: None.

COURSE OBJECTIVES: Understand the importance of Production planning & control. Learning way of carrying out various functions it so as to produce right product, right quantity at right time with minimum cost.

COURSE OUTCOMES: At the end of the course, the student will be able to, Understand production systems and their characteristics. Evaluate MRP and JIT systems against traditional inventory control systems. Understand basics of variability and its role in the performance of a production system. Analyze aggregate planning strategies. Apply forecasting and scheduling techniques to production systems. Understand theory of constraints for effective management of production systems.

UNIT – I:

Introduction: Definition – Objectives of Production Planning and Control – Functions of production planning and control - Types of production systems - Organization of production planning and control department.

Forecasting – Definition- uses of forecast- factors affecting the forecast- types of forecasting- their uses - general principle of forecasting. Forecasting techniques- quantitative and qualitative techniques.Measures of forecasting errors.

UNIT – II :

Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – Basic EOQ model- Inventory control systems –continuous review systems and periodic review systems, MRP I, MRP II, ERP, JIT Systems - Basic Treatment only.

Aggregate planning – Definition – aggregate-planning strategies – aggregate planning methods – transportation model.

UNIT – III:

Line Balancing: Terminology, Methods of Line Balancing, RPW method, Largest Candidate method and Heuristic method. Routing – Definition – Routing procedure – Factors affecting routing procedure, Route Sheet.

UNIT – IV:

Scheduling –Definition – Scheduling Policies – types of scheduling methods – differences with loading – flow shop scheduling **–** job shop scheduling, line of balance (LOB) – objectives - steps involved.

UNIT – V:

Dispatching: Definition – activities of dispatcher – dispatching procedures – various forms used in dispatching.

Follow up: definition – types of follow up – expediting – definition – expediting proceduresApplications of computers in planning and control.

TEXT BOOKS

1. Operations management – Heizer- Pearson.
2. Production and Operations Management / Ajay K Garg / Mc Graw Hill.

REFERENCE BOOKS

1. Production Planning and Control- Text & cases/ SK Mukhopadhyaya /PHI.
2. Production Planning and Control- Jain & Jain – Khanna publications

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B.TECH. MECHANICAL ENGINEERING -R18

RENEWABLE ENERGY SOURCES -B38PE2A

B.Tech. VIII Semester **L/T/P/ C**

3/1/0/3

PRE-REQUISITES: None.

COURSE OBJECTIVES:

1. To explain the concepts of Non-renewable and renewable energy systems.
2. To outline utilization of renewable energy sources for both domestic and industrial applications.
3. To analyse the environmental and cost economics of renewable energy sources in comparison with fossil fuels.

COURSE OUTCOMES:

1. Understanding of renewable energy sources.
2. Knowledge of working principle of various energy systems.
3. Capability to carry out basic design of renewable energy systems

UNIT-I:

Global and National Energy Scenario: Over view of conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Renewable and Nonrenewable Energy sources, Energy for sustainable development, Potential of renewable energy sources, renewable electricity and key elements, Global climate change, CO2 reduction potential of renewable energy- concept of Hybrid systems.

UNIT-II:

Solar Energy: Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Applications Solar Photovoltaic Conversion solar photovoltaic, solar thermal, applications of solar energy systems.

UNIT-III:

Wind Energy: Wind Energy Conversion, Potential, Wind energy potential measurement, Site selection, Types of wind turbines, Wind farms, wind Generation and Control. Nature of

the wind, power in the wind, factors influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics, applications of wind turbines, offshore wind energy – Hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices. Wind mill component design, economics and demand side management, energy wheeling, and energy banking concepts. Safety and environmental aspects, wind energy potential and installation in India.

UNIT-IV:

Biogas: Properties of biogas (Calorific value and composition), biogas plant technology and status, Bio energy system, design and constructional features. Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas Plants, applications, alcohol production from biomass, bio diesel production, Urban waste to energy conversion, Biomass energy programme in India.

UNIT-V:

Ocean Energy: Ocean wave energy conversion, principle of Ocean Thermal Energy Conversion (OTEC), ocean thermal power plants, tidal energy conversion, Tidal and wave energy its scope and development, Scheme of development of tidal energy.

1. **Small hydro Power Plant:** Importance of small hydro power plants and their Elements, types of turbines for small hydro, estimation of primary and secondary power.
2. **Geothermal Energy**: Geothermal power plants, various types, hot springs and steam ejection.

REFERENCE

1. Non-Conventional Energy Sources by G.D Rai.
2. Twidell, J.W. and Weir, A., Renewable Energy Sources, EFN Spon Ltd., 1986.
3. Kishore VVN, Renewable Energy Engineering and Technology, Teri Press, New Delhi, 2012.
4. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K, 1996.

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B.TECH. MECHANICAL ENGINEERING -R18

JET PROPULSION AND ROCKET ENGINEERING -B38PE2B

B.Tech. VIII Semester. **L/T/P/ C**

3/1/0/3

UNIT-I:

Fundamentals of Gas Turbine theory-Thermo dynamic Cycles, open closed and semi-closed – parameters of performances –cycle modifications for improvement of performance.

UNIT-II:

JET PROPULSION: Historical sketch-reaction principle – essential features of propulsion devices-Thermal Engines, Classification of – Energy flow thrust, Thrust power and propulsion efficiency-Need for Thermal Jet Engines and applications.

UNIT-III:

TURBOPROP AND TURBOJET: Thermo dynamic cycles, plant layout, essential components, principles of operation – performance evaluation. Thrust Augmentation and Thrust reversal-Contrasting with piston Engine Propeller plant.

UNIT-IV:

RAMJET: Thermo dynamic Cycle, plant lay-out, essential components – principle of operation - performance evaluation – comparison among atmospheric thermal jet engines – scram jet and pulse jet, elementary treatment.

ROCKET ENGINES: Need for, applications **–** Basic principles of operation and parameters of performance – classification ,solid and liquid propellant rocket engines ,advantages, domains of application –propellants – comparison of propulsion systems.

UNIT-V:

ROCKET TECHNOLOGY: Flight mechanics, Application Thrust profiles, Acceleration –staging of Rockets, need for – Feed systems, injectors and expansion nozzles – Rocket heat transfer and ablative cooling.

TEXT BOOKS

1. Gas Turbines and propulsive systems/P.Khajuria&S.P.Dubey/ Dhanpat rai pub.
2. Gas Dynamics & Space Propulsion/ M.C.Ramaswamy / Jaico Publishing House.

Propulsion / Jock D Mattingly /Mc Grill.

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B.TECH. MECHANICAL ENGINEERING -R18

COMPOSITE MATERIALS-B38PE2C

B.Tech. VIII Semester. **L/T/P/ C**

3/1/0/3

COURSE OBJECTIVE: The prime objective of this course is to introduce, classify, and processcomposite materials which are novel and widely applied materials. The applications ofcomposite materials that would suit the requirements are also dealt in detail as an integralpart.

COURSE OUTCOME: The student will apply the concepts learnt during the course to design, and apply a composite material for a specific application.

UNIT - I:

Introduction: Definition – Classification of Composite materials based on structure andmatrix. Advantages and disadvantages application of composites based on structure –Functional requirements of reinforcement and matrix.Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT - II:

Reinforcements: Preparation, properties and applications of glass fibers, carbon fibers, Kevlarfibers and Boron fibers. Properties and applications of whiskers, particle reinforcements.Mechanical behavior of composites; Rule of mixtures, Inverse rule of mixtures.Loadingunder Isostrain and Isostress conditions.

UNIT - III:

Manufacturing of Polymer matrix composites; Preparation of Moulding compounds andprepregs – hand lay-up method – Autoclave method – Filament winding method –Compression moulding – Reaction injection moulding. Properties and applications

UNIT - IV:

Manufacturing of Metal Matrix Composites; Casting – Solid State diffusion technique,Cladding – Hot isostatic pressing. Properties and applications polymer composites

UNIT - V:

Manufacturing of Ceramic Matrix Composites; Liquid Metal Infiltration – Liquid phasesintering. Manufacturing of Carbon – Carbon composites; Knitting, Braiding, Weaving.Properties and applications

TEXT BOOKS

1. Composite Materials – K. K. Chawla
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007

REFERENCE

1. Composite Materials Science and Applications – Deborah D.L. Chung
2. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi