Department of Mechanical Engineering
S. V. University College of Engineering:: TIRUPATI

MECHANICAL ENGINEERING

B.TECH. HONOURS DEGREE COURSE

SCHEME AND SYLLABUS 2020 – 2021

Requirements to be fulfilled for the award of degree in B.Tech(Honours) in Mechanical Engineering
Credits offered = 180 and Credits to be earned = 180

Curricular Framework for Honours Degree Programme in Mechanical Engineering

- A student shall be permitted to register for Honors program at the beginning of 4th semester provided that the student must have acquired a minimum of 8.0 SGPA upto the end of 2nd semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4th semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme.

- Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.

- In addition to fulfilling all the requisites of a Regular B.Tech Programme, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).

- Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12weeks as recommended by the Board of studies.

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R – 20 Scheme for B.Tech (Honours) Programme in Mechanical Engineering Branch

Sl. No	Course Code	Name of the Course	Category	Scheme of Instructions Hours per week				Credits
				Lecture	Tutorial	Practical	Drawing	
01	ME401HN	Alternative Energy Sources for Automobiles	HNC	04				4
02	ME502HN	Robotics: Modelling, Analysis and Control	HNC	04				4
03	ME603HN	Design for Manufacturing	HNC	04				4
04	ME704HN	Advanced thermodynamics	HNC	04				4
05	MOOCS1		HNC	02				2
06	MOOCS2		HNC	02				2
	Total			**20**				**20**

HNC – Honour Degree Courses

Note 1: A student shall be permitted to register for Honors program at the beginning of 4th semester provided that the student must have acquired a minimum of 8.0 SGPA upto the end of 2nd semester without any backlogs.

Note 2: Honour programme starts at the beginning of 4th Semester

Total credits to be earned for the award of B. Tech (Honours) Degree in Mechanical Engineering are

160(from conventional degree programme) plus 20(from HNC) = 180 (Total)

Curricular Framework for Minor Degree Programme in Mechanical Engineering

- For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme, he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.

- The BoS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE,CE,ME etc or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, Robotics, VLSI etc.

- The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BoS. There shall be no limit on the number of programs offered under Minor. The University/Institution can offer minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.

- The concerned BoS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

- A student shall be permitted to register for Minors program at the beginning of 4th semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 8 SGPA (Semester Grade point average) up to the end of 2nd semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4th semester. If a student fails to acquire 8 SGPA up to 3rd semester or failed in any of the courses, his registration for Minors program shall stand cancelled. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.

- A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).

- Out of the 20 Credits, 16 credits shall be earned by undergoing specified courses listed by the concerned BoS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared separately. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

- In addition to the 16 credits, students must pursue at least 2 courses through MOOCs. The courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the university/academic council.

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R – 20 Scheme for B.Tech (Mechanical Engg.) with Minor Degree

Sl. No	Course Code	Name of the Course	Category	Scheme of Instructions Hours per week				Credits
				Lecture	Tutorial	Practical	Drawing	
01	ME401MN		MNC	04				4
02	ME502MN		MNC	04				4
03	ME603MN		MNC	04				4
04	ME704MN		MNC	04				4
05	MOOCS1		MNC	02				2
06	MOOCS2		MNC	02				2
	Total			**20**				**20**

MNC – Minor Degree Courses

Note 1: The guidelines applicable for the Minor Degree in Mechanical Engineering are akin to the one drafted for B.Tech(Honours) in Mechanical Engineering Programme

Note 2 : Students registered for Minors Programme have to select ***four courses*** from the given tracks as given below:

Sl.No.	Tracks
1	Fundamentals of Engineering Design
2	Thermal Engineering
3	Production Technology
4	Production Planning and Control
5	Statistical Process Control and Six – sigma
6	Alternative Energy Sources

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ME401HN ALTERNATIVE ENERGY SOURCES FOR AUTOMOBILES

Credits : 4

Lectures/week: 4 Hrs.

Sessional Marks: 20+20

End Examination Marks: 60

UNIT I

Introduction: Types of energy sources, need of alternative energy sources, non-conventional energy sources, Classification of alternative fuels and drive trains. Fuel quality aspects related to emissions. Road map for alternative fuels.

Solar energy: Solar energy geometry, solar radiation measurement devices, Solar energy collectors, types of collectors, Direct application of solar energy, solar energy storage system. P. V. effect solar cells and characteristics. Application of solar energy for automobiles.

UNIT II

Biogas: History, properties and production of Biogas, classification of biogas plants, biogas storage and dispensing system. Advantages of biogas, hazards and emissions of biogas. Production, properties, Engine performance, advantages and disadvantages of Methanol, Ethanol, Butanol, Straight vegetable oil, Biodiesel for internal combustion engine application.

UNIT III

Hydrogen: Properties and production of hydrogen, Storage, Advantages and disadvantages of hydrogen, use of Hydrogen in SI and CI engines. Hazards and safety systems for hydrogen, hydrogen combustion, Emission from hydrogen.

Gaseous fuels: Production, properties, Engine performance, advantages and disadvantages of CNG, LNG, ANG, LPG and LFG.

UNIT IV

Reformulated Conventional Fuels: Introduction, Production of coal water slurry, properties, as an engine fuel, emissions of CWS, RFG, Emulsified fuels, Hydrogen-enriched gasoline.

Future Alternative Fuels: Production, properties, Engine performance, advantages and disadvantages of PMF, Ammonia, Liquid-Nitrogen, Boron, Compressed Air, Water as fuel for Internal combustion Engine.

UNIT V

Alternative Power Trains: Components of an EV, EV batteries, chargers, drives, transmission and power devices. Advantages and disadvantages of EVs. Hybrid electric vehicles, HEV drive train components, advantages of HV. History of dual fuel technology, Applications of DFT, Dual fuel engine operation. Advantages and disadvantages of dual fuel technology.

TEXT BOOKS:

1. Alternative Fuels - S.S. Thipse. JAICO Publishing House.
2. Non-Conventional Energy Sources - G. D. RaiKhanna Publishing New Delhi

REFERENCE:

1. Alternative fuels for Vehicle - M. Poulton
2. Alternative fuels guide - R. Bechtold. SAE
3. Alternative energy sources - T.N Veziroglu, McGraw Hill
4. Automotive Fuels Guide - Richard L. Bechtold, SAE Publications, 1997

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ME502HN ROBOTICS: MODELLING, ANALYSIS AND CONTROL

Credits : 4

Lectures/week: 4 Hrs. Sessional Marks: 20+20

End Examination Marks: 60

UNIT –I

Introduction – Mathematical Modelling of Robots – Symbolic representation of robots – Configuration, State and Workspaces – Robots as Mechanical Devices – Classification of Robotic Manipulators – Robotic Systems – Common Kinematic Arrangements – Accuracy and Repeatability

UNIT-II

Rigid Body Motions and Homogeneous Transformations – Representing Rotations – Rotations in Plane and Three Dimensions – Rotational Transformations – Euler Angles – Homogeneous Transformations(HT) – Utility of HT matrices in the kinematic analysis of robots

UNIT-III

Forward and Inverse Robot Kinematics – Kinematic Chains – The Denavit – Hartenberg (DH) Convention – DH frame assignment – DH parameters – Two – link planar and Three Link Cylindrical Robots – Spherical Wrist – SCARA Manipulator – Inverse Kinematics – Inverse Kinematic Analysis of Two and three degrees – of – freedom (DOF) planar robots by Geometric and DH conventions Approaches.

UNIT-IV

Velocity Kinematics – The Jacobian Analysis – The Analytical Jacobian of Two – link planar manipulators including R – P manipulator – Singularities of Planar Robot Manipulators –

Manipulability – Force and Torque Relationships –Dynamic Analysis of single link and R – P manipulators

UNIT-V

Mathematical Modelling and Control of a Single axis robot – Trajectory planning – Open and Closed – loop Control – The robot control problem – Linear Control Schemes – P, D, PD and PID controllers – Joint Actuators – Hydraulic, Pneumatic and Electric – Application of Control Systems – Transfer Functions and System response

TEXT BOOKS

1. John J. Craig, Introduction to Robotics Mechanics and Control, Second Edition, Addison Wesly Longman Inc. International Student edition, 1999
2. Mark W. Sponge & Vidya Sagar M.,"Robot Dynamics and Control" ,Wiley; 1st edition (1989)
3. Tsuneo Yohikwa, Foundations of Robotics Analysis and Control, Prentice Hall of India Pvt. Ltd., 2001
4. Paul R.P," Robot Manipulators: Mathematics, Programming and Control "The MIT Press November 2, 1981.

REFERENCES:

1) Mikell P. Groover, Mitchell Weiss, Roger N. Nagel and Nicholas G. Odrey, 'Industrial Robotics Technology, Programming and Applications', Mc Graw Hill Book company, 1986
2) Bernard Hodges, 'Industrial Robotics', Second Edition, Jaico Publishing House, 1993
3) Gonzalez K.S.F.U.R.C. and Lee C.S.G., "Robotics- Control, Sensing, Vision, and Intelligence" Mcgraw-Hill Book Company (July 1987)

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ME603HN DESIGN FOR MANUFACTURING

Credits : 4
Lectures/week: 4 Hrs. Sessional Marks: 20+20
End Examination Marks: 60

UNIT-I

Introduction: Design philosophy-steps in design process-general design rules for manufacturability-basic principles of designing for economical production-creativity in design.

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

Plastics: Visco elastic and creep behavior in plastics-design guidelines for plastic components-design considerations for injection moulding – design guidelines for machining and joining of plastics.

References:

1. Design for manufacture, John cobert, Adisson Wesley. 1995
2. Design for Manufacture by Boothroyd,
3. Design for manufacture, James Bralla
4. ASM Hand book Vol.20

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ME704HN ADVANCED THERMODYNAMICS

Credits : 4

Lectures/week: 4 Hrs. Sessional Marks: 20+20

End Examination Marks: 60

UNIT – I

Revision of Thermodynamics:

Law of Thermodynamics, I Law of Thermodynamics, II Law of Thermodynamics, Zeroth Law of Thermodynamics, Enthalpy and Entropy for an ideal gas, Equations of state for a real gas, Virial Expansions, Law of Corresponding States, Generalized Compressibility Chart, Dalton's Law of Partial Pressures, Internal Energy, Enthalpy and Entropy and Specific Heats of Gas Mixtures, Gibbs Function of a Mixture.

UNIT – II

Thermodynamic Relations:

Some Mathematical Theorems; Maxwell's Relations, T-ds Equations, Difference in Heat Capacities, Ratio of Heat Capacities. Energy Equation, Clausius-Clapeyron Equation, Joule-Thomson Coefficient, Evaluation of Thermodynamic Properties from Equation of State, Mixtures of Variable Composition, Conditions of Equilibrium for a Heterogeneous System, Gibbs Phase Rule, Types of Equilibrium, Conditions of Stability, Third Law of Thermodynamics

UNIT – III

Reactive Mixtures:

Degree of Reaction, Reaction Equilibrium, Equilibrium Constant, Law of Mass Action, Thermal Ionization of Monatomic Gas, Gibbs Function Change, Enthalpy of Formation, Enthalpy of Combustion, Heating Values, Adiabatic Flame Temperature, Second Law Analysis of reactive Systems, Chemical Exergy, Second Law Efficiency.

UNIT – IV

Statistical Thermodynamics:

Fundamentals of Quantum Mechanics, Atomic Structure, Molecular Structure, Introduction to Statistical Models: Fermi-Dirac Statistics, Bose-Einstein Statistics, Maxwell-Boltzmann Statistics, The Partition Function, Entropy and Probability, Monatomic Ideal Gas, Principle of Equi-Partition of Energy, Molecular Distributions, Gas Mixtures, Statistics of a Photon gas, Electron Gas.

UNIT – V

Kinetic Theory of Gases:

Molecular Model, Distribution of Molecular Velocities, Molecular Collisions with a Stationary Wall, Maxwell-Boltzmann Velocity Distribution, Average, Root-Mean Square and Most Probable Speeds, Molecules in a Certain Speed Range, Energy Distribution Function, Specific Heat of a Gas, Specific Heat of a Solid. Transport Processes in Gases: Mean Free Path and Collision Cross-section, Distribution of Free Paths, Transport Properties.

TEXT BOOKS:

1. Engineering Thermodynamics : Nag. P.K.
2. Heat Engineering : Vasandani V.P. and Kumar D.S.
3. Heat Engines : Ballaney P.L.
4. Engineering Thermodynamics - Fundamentals and Applications : Natarajan. E, Anuragam Publications.
5. Engineering Thermodynamics : Chattopadhyay. P
6. Thermodynamics : C.P. Arora
7. Basic Engineering Thermodynamics : A. Venkatesh
8. Engineering Thermodynamics : Gordon Rogers and Yon Mayhew
9. Engineering Thermodynamics : Jones and Dugan

REFERENCE:

1. Applied Thermodynamics : Eastop and Mckankey.
2. Thermodynamics : J.P. Holman – McGraw-Hill
3. Fundamentals of Engineering Thermodynamics : E. Rathkrishnan
4. Thermodynamics for Engineers : Kau – Fui Vincent Wong.

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ME---- MN FUNDAMENTALS OF ENGINEERING DESIGN

Lectures/week: 4 Hrs. Sessional Marks: 20+20

End Examination Marks: 60

UNIT-I

Design fundamentals: Design philosophy steps in Design process – General Design rules for manufacturability – basic principles of designing 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.

UNIT-II

Engineering Design process: Preliminary needs, Preparation of design specification-performance specification, product design specification, manufacturing specification, sales specification.

UNIT-III

Design concepts: Design techniques, principles of modern design, Elements of graphical representation, Design by evolution, alter-techniques and design review, Artificial intelligence in design, design through morphological analysis, brain storming, and detailed design.

UNIT-IV

Design for manufacturing: Introduction, manufacturing requirements, manufacturing process selection-shape consideration, property consideration, service consideration, manufacturing consideration and cost consideration.

UNIT-V

Product Design and development: Introduction, Classification/ Specifications of Products, Product life cycle, Product mix. Introduction to product design, Modern product development process, Innovative thinking, Morphology of design.

TEXT BOOKS:

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.
3. G K lala, vijay gupta and N venkat reddy " Fundamentals of Design and manufacturing" Narosa publishing house, New Delhi.
4. The institute of Engineers (India) study material series" Fundamentals of Design and manufacturing.
5. Karl T Ulrich, Steven D Eppinger , " Product Design & Development." Tata McGrawhill New Delhi 2003.
6. Gavin Ambrose, Paul harris " The fundamentals of Graphic Design" Published by AVA Publishing SA.

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ME-----MN THERMAL ENGINEERING

Credits : 4

Lectures/week: 4 Hrs. Sessional Marks: 20+20

End Examination Marks: 60

UNIT – I

Fundamental Concepts and Definitions:

Concept of continuum, microscopic and macroscopic approach, system, control volume, dimensions and units, State, path, process, isolated system, adiabatic system, thermodynamic equilibrium, illustrative problems, thermodynamic definition of work, different forms of work, path function, illustrative problems.

First Law and Second Law of Thermodynamics:

Definitions, concept of energy, first law applied to a control volume, General Energy Equation, Steady Flow Energy Equation on unit mass and time basis, Limitations of the first law, Kelvin-Planck and Clausius Statements of the second law, Reversible Heat Engine, Carnot Theorems and Corollaries. Reversible Process, Irreversible Process, Third law of Thermodynamics.

UNIT – II

Introduction: Basic Engine components and Nomenclature, Classification of Engines, The working principles of 2-stroke and 4-stroke SI and CI engines, Comparison of 2-Stroke and 4- Stroke Engines; CI and SI Engines, Ideal and Actual Working Cycles and their analysis, Valve timing Diagrams and Port timing diagrams.

Combustion in SI Engine: Normal and abnormal combustion, Theory and effect of detonation, Knocking Concept, combustion chamber requirements, types of combustion chamber, Octane number.

Combustion of CI Engine: Stages of combustion in CI engines, Delay Period Concept, CI engine combustion chamber requirements and types, Cetane number.

**UNIT – III **

Gas Turbines: Introduction to Gas Turbines, Development, Classification and Application of Gas Turbines, Ideal and Actual Cycles; Effect of Inter cooling, Reheating, Regeneration, Combined cycle.

Steam:

Behaviour of Pure Substance (Steam) with reference to T-V, P-T, P-V, P-H & T-S Diagrams, Triple and Critical Points, Properties of Steam, Mollier Chart, Carnot Cycle, Rankine Cycle, Modified Rankine Cycle.

UNIT – IV

Steam Properties:

Properties of Steam, Use of Steam Tables, PV, TS, HS diagrams, Steam Processes, Constant Volume, Constant Pressure, Isothermal, Adiabatic and Hyperbolic Processes, Throttling Expansion.

Steam Generators:

Classification of Fire Tube and Water Tube Boilers, Introduction to High Pressure Boilers, Boiler Mounting and Accessories, Boiler Performance, Boiler Draught.

UNIT – V

Steam Engines:

Principles of operation of Steam Engine Condensing, Non-Condensing, Single and Double Acting, Valve Events, Hypothetical and Actual Indicator Diagrams, Diagram factor determination of Cylinder Dimensions, Performance of Steam Engine, Governing of Steam Engines.

Steam Turbines: Principles of Operation – Classification - Impulse and Reaction Turbines -Velocity Diagrams - Work Done - Diagram Efficiency - Effect of Blade Friction - Stage Efficiency Turbine Reheats Factor - Height of Turbine Blade - Axial Thrust - Losses in Steam Turbine -Governing of Turbines - Reheat and Regenerative Cycles.

TEXT BOOKS:

1. Heat Engineering : Vasandani V.P and Kumar D.S.
2. Heat Engines : Ballaney P.L.
3. A course in Thermal Engineering : Domukundwar & Kothandaraman
4. Thermal Engineering : R.K. Rajput
5. Thermal Engineering : R. Rudramoorthy
6. Thermal Engineering : K.K. Ramalingam
7. Engineering Thermodynamics : P.K.Nag
8. Fundamentals of Classical Thermodynamics : G.J.Vanwylen and R.E.Sonntag
9. Basic Engineering Thermodynamics : A.Venkatesh

REFERENCE:

1. Applied Thermodynamics : Eastop and Mckankey.
2. Thermal Engineering : B.K. Sarkar
3. Thermodynamics: An Engineering Approach : Yonus A Cengel & Michale A Boles

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ME-------MN PRODUCTION TECHNOLOGY

Credits : 4

Lectures/week: 4 Hrs. Sessional Marks: 20+20

End Examination Marks: 60

UNIT - I

Introduction: Classification of Manufacturing processes – various kinds of production. Casting processes – sand-mould casting – patterns – Moulding materials – cores – Gates and Risers – Different types of casting processes.

UNIT - II

Metal working processes - Rolling- Principle – Rolling stand arrangement – Roll passes – Breakdown passes – Roll pass sequences. **Forging**- Forging operations – Smith forging – Drop forging – Press forging – Machine forging.
Extrusion – Extrusion principle – Hot extrusion processes – Cold extrusion – Extruding tubes – Wire drawing – Rod and tube drawing.

Unit – III

Machine Tools and Machining

Lathes: Types-operations done on Lathe. Tool and Work holding devices – Shaper, Planer, Slotter and Quick return mechanisms

Drilling Machines: Up right and Radial drilling machines – Constructional details-operations performed on them. Twist drill-elements. Milling methods- up cut and down cut milling. Milling machines-classification- constructional details of various types. Operations performed on milling machines.

UNIT – IV

Grinding- Grinding wheels-manufacturing, specification-wheel selection. Wheel dressing and truing. Different types of grinding machines. Use of magnetic chucks, precision grinding processes lapping, honing and super finishing. Brief introduction to capstan and turret lathes.

UNIT – V

Welding methods – Gas welding – Oxy – acetylene flames and torches – Electric arc welding – DC and AC power sources – Reverse polarity and Straight polarity – TIG and MIG welding processes.

TEXT BOOKS:

1. **R.S. Khurmi and J.K. Gupta**: A Textbook of Workshop Technology: Manufacturing
2. Processes Seventh Edition, S. Chand & Company Limited, 2008
3. **Hajra Choudhury SK:** Elements of Workshop Technology Volume – 1 and II, Indian Book Distributing Co. Calcutta
4. **Raghuvamshi**: Work shop technology vol.II,

5. **Haslehurst M.:** Manufacturing Technology, Third Edition, Viva Books Pvt. Ltd., 1998
6. **Gupta S.C. and Jain.R.K:** Production Technology, Ninth Edition, Khanna Publishers, 2002

REFERENCES:

1. **Rao P.N:** Manufacturing Technology, Second Edition, Tata McGraw – Hill, 2007
2. **Sharma P.C**.: A Textbook of Production Technology: Manufacturing Processes, Seventh Edition, S. Chand & Company Limited, 2007
3. **HMT**: Production Technology, McGraw-Hill Education (India) Pvt Ltd, 28th reprint, 2008

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ME-----MN PRODUCTION PLANNING AND CONTROL

Credits : 4
Lectures/week: 4 Hrs. Sessional Marks: 20+20
End Examination Marks: 60

UNIT – I

Introduction to Production Systems: Production Systems: Classification & Characterization, Overview of Production Planning and Control issues, Review of EOQ & inventory control systems.

UNIT – II

Material Requirement Planning: Dependent Demand & Material Requirement Planning, Structure of MRP system, MRP Calculations, Planning Issues, Implementation Issues.

Just in Time Production Systems: Just-in-Time System: Evolution, Characteristics of JIT Systems, Continuous Improvement, The Kanban System, Strategic Implications of JIT System.

Factory Physics: Basic factory dynamics, Variability basics, Push and pull production systems.

UNIT – III

Aggregate Planning: Aggregate Planning: Purpose & Methods, Reactive and Aggressive Alternatives, Planning Strategies, LP Formulation, Master Production Scheduling.

UNIT – IV

Scheduling: Scheduling in Manufacturing, Sequencing Operations for One Machine, Sequencing Operations for a two-station Flow Shop, Job Shop Dispatching.

Forecasting Methods: Demand Forecasting: Principles and Methods, Judgment methods, Causal methods, Time-series methods.

UNIT – V

Issues in PPC: Special features in Planning & Control of Product-focused Systems and Process focused Systems, Theory of Constraints.

Textbooks

1. Krajewski L.J. and Ritzmen L.P., Operations Management: Strategy and Analysis, 9th Edition, Pearson Education, 2010.

2. Chase, R.B., Jacobs, F.R. and Aquilano, N.J., Operations Management for Competitive Advantage, 11th Edition, Tata McGraw Hill Book Company, New Delhi, 2010.

3. Hopp, WJ and Spearman, ML, Factory Physics: Foundations of Manufacturing Management, McGraw Hill International Edition, Third Edition, 2008.

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ME-----MN STATISTICAL PROCESS CONTROL AND SIX SIGMA

Credits : 4
Lectures/week: 4 Hrs. Sessional Marks: 20+20
End Examination Marks: 60

Course Objectives:

1. To learn the statistical and economical design issues associated with the monitoring tools.
2. Develop a broad understanding of Six Sigma principles and practices
3. Build capability to implement Six Sigma tools, especially in manufacturing operations

Unit 1: Statistical Process Control – control charts – X, R bar Charts, U, p, & C charts, Six Sigma control plans.

Unit 2: Basic statistics, probability distributions, normal distribution, central limit theorem, measurement system analysis – precision, accuracy, bias, linearity, guage repeatability & reproducibility. Process capability analysis.

Unit 3: Multi-Variable analysis, sampling techniques, Hypothesis testing, testing with normal data, One Way ANOVA, non-parametric tests for non-normal data. Chi-square tests (contingency tables).

Unit 4: Regression and correlation, linear, non-linear, and multiple linear, confidence intervals, residual analysis. Lean controls – 5S, Kanban, Poka-Yoke (Mistake Proofing).

Unit 5: Introduction, the DMAIC methodology, deliverables of a lean Six Sigma project, basic Six Sigma metrics, developing project metrics. Lean and Six Sigma, the seven elements of waste, 5S. Cause and effect diagrams, Pareto analysis, process mapping, SIPOC, value stream, scatter diagram, failure modes and effect analysis (FMEA).

Course Outcomes

After going through this course, the students will be able to:
1. Apply basic quality tools in manufacturing operations.
2. Calculate process capability and gage capability in a manufacturing process.
3. Perform statistical analysis to test hypotheses.
4. Perform regression and correlation analysis.
5. Build and analyse control charts for monitoring processes.

Text Books:

1) *Introduction to Statistical Process Control By Muhammad Aslam, Aamir Saghir, Liaquat Ahmad · 2020*

2) Statistical Quality Control by Eugene L. Grant, Richard S. Leavenworth (Author), Tata McGraw Hill Education (Publisher)

3) The Six Sigma Handbook, 5E Book by Paul Keller and Thomas Pyzdek

4) The Certified Six Sigma Green Belt Handbook (2nd edition). By Dr. David Cook

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ME ---- MN ALTERNATIVE ENERGY SOURCES

Lectures/Week: 4 periods | Credits: 4

Sessional marks: 20 +20

End Examination Marks: 60

UNIT – I

Introduction:

The solar energy option – Energy Scenario – Survey of Energy Resources – Classification – Need for Role and potential of new and renewable sources.

Principles of Solar Radiation:

Physics of the sun – The solar constant – Solar radiation on tilted surface – Instruments for measuring solar radiation and sunshine – Solar radiation data.

UNIT – II

Solar Energy Collection:

Flat plate and concentrating collectors – Classification of concentrating collectors – Orientation and Thermal analysis – Advanced collectors.

Solar Energy Storage:

Different methods – Sensible, Latent heat and Stratified storage – Solar Ponds

Solar Applications:

Solar heating/cooling techniques – Solar distillation and drying - Photovoltaic energy conversion.

UNIT – III

Wind Energy:

Sources and potentials – Horizontal and Vertical axis windmills – Performance characteristics.

Biogas and Bio-Mass:

Principles of Bio-conversion – Anaerobic/Aerobic digestion – Types of Bio-gas digesters – Gas yield – Combustion characteristics of bio-gas – Utilization for cooking, I.C. engine operation – Economic aspects.

UNIT – IV

Geothermal Energy:

Resources – Types of wells – Methods of harnessing the energy – Potential in India.

OTEC:

Principles – Utilization – Setting of OTEC plants - Thermodynamic cycles.

Tidal and Wave Energy:

Potential and Conversion techniques – Mini-hydel power plants – Their economics.

UNIT – V

Direct Energy Conversion:

Need for DEC – Carnot cycle – Limitations – Principles of DEC – Thermo-electric generators – Seebeck, Peltier and Joule Thompson effects – Figure of merit – Materials – Applications – MHD generators – Principles –

Dissociation and Ionization – Hall effect – Magnetic flux – MHD accelerator – MHD engine – Power generation systems – Electron gas dynamic conversion – Economic aspects

Fuel Cells:

Principle – Faraday's laws – Thermodynamic aspects – Selection of fuels and Operating conditions.

TEXT BOOKS:

1. Non conventional Energy sources - G.D.Rai (Khanna Publication)
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