

NATIONAL INSTITUTE OF TECHNOLOGY, HAMIRPUR (HP) – 177 005

B.Tech. Mechanical Engineering, Fourth Year [8th Semester]

Sr. No.	Course No.	Subject	L	T	P	Hours	Credits
1.	[ME-481]	Production & Operations Management	3	0	0	3	3
2.	[ME-482]	Mechanical Vibrations	3	0	0	3	3
3.	[ME-483]	Mechatronics	3	0	0	3	3
4.	[ME-484]	Industrial Engineering	3	0	0	3	3
5.	[ME-485]	Refrigeration and Air Conditioning	3	0	0	3	3
6.	[ME-482 (P)]	Mechanical Vibration Lab.	0	0	2	2	2
7.	[ME-483 (P)]	Mechatronics Lab.	0	0	2	2	2
8.	[ME-485 (P)]	Refrigeration and A/C Lab.	0	0	2	2	2
7.	[ME-487]	Major Project – II	0	0	6	6	3
Total =						27	24

PRODUCTION AND OPERATIONS MANAGEMENT

ME – 481

L	T	P	Cr
3	0	0	3

- 1. INTRODUCTION:** Historical Evolution, A System View of Operations, and Scope and Objective of Operation Management Conceptual Model of Production / Operation System, Frame Work for Managing Operations, Operation Strategy for Competitive Advantage.
- 2. FORECASTING & FACILITIES PLANNING LAYOUT:** Features and Importance of Forecasting in Production and Operations Management. General Steps in the Forecasting Process, Phases of Forecasting, Various Forecasting Methods –(A) For Long Term Decisions (B) Medium and Short Term Decision (C) Casual Or Econometric Decisions, Facilities / Layout Planning in Production Systems – Functional / Process Layout; Product/Line Layout; And Fixed Position Layout, Computerized Layout Planning (CORELAP, ALDEP & CRAFT).
- 3. OPERATIONS CAPACITY AND PRODUCTION SCHEDULING:** Capacity planning – types and need, Capacity Planning Procedure, capacity Planning Models & their Section, Production Scheduling – Objectives, Scheduling aspects in various (Job – shop, Batch, mass) Production System, KANBAN System of Production Scheduling, scheduling Rules: FISFS - First in Shop First Served, FCFS- First Come First Served, LST- last slack time, SPT - Shortest Processing Time Master Schedule - Gantt chart.
- 4. ORGANIZATION FOR QRM ASPECTSV IN PRODUCTION SYSTEMS:** Importance of quality, reliability and Maintainability in Production Systems, Organization for QRM, Improving QRM aspects of Systems using various Tools and Techniques.
- 5. SIMULATION AND MODELLING ASPECTS IN POM:** Definition , Monte Carlo simulation, Generational random numbers. Advantages of simulation, case studies.
- 6. TIME STUDY & WORK SAMPLING:** Concept of Time Study, The equipments for Time Study, Selecting and Timing the job, calculation of basic time from observed time Rating, standard Rating and Standard performance, concept and Procedure of work sampling, Test of Hypothesis in Sampling, Type 1 and Type 2 errors in Testing of Hypothesis, Test for Number of successes, Test of Significance of a mean, Estimation of Parameters, central limit theorem, Interval estimation of small samples.
- 7. PRINCIPLES OF ERGONOMICS:** Design of display, Anthropology, Ergonomic practices

RECOMMENDED BOOKS

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| 1. Production and Operation Management | Adam, Ebert. |
| 2. Production and Operation Management | K.C. Arora |
| 3. Motion & Time Study- Design & Measurement of Work | Barnes, R. M. |
| 4. Introduction to Work Study | ILO |

MECHANICAL VIBRATIONS

ME – 482

L	T	P/D	Cr
3	0	0	3

- 1. SINGLE DEGREE FREEDOM SYSTEMS:** Free and forced vibration with non harmonic and transient excitation, fourier analysis, response to arbitrary loading (Duhamel's Integral), Impulse response, Mechanical shock, Parametric Excitation.
- 2. TWO DEGREE FREEDOM SYSTEM:** Free Vibration – General solution and method of influence coefficient, Damped –free vibration, undamped forced vibrations with application to dynamic vibration Absorber, Technical applications.
- 3. MULTI-DEGREE FREEDOM SYSTEMS:** Generalized coordinates, Derivation of Lagrange's equations, Lagrange's equation for non-conservative systems.
- 4. COMPUTING TECHNIQUES FOR FREQUENCY AND MODE SHAPE CALCULATION:** Matrix iteration Method, Transfer matrix Method, Myklestad Prohl Method for flexural vibration, Myklestad Method for rotating beams, Rayleigh's minimum principle, Stodola's Method, Hoizer's Method.
- 5. VIBRATIONS OF CONTINUOUS SYSTEMS:** Transverse vibration of strings, Vibration of membranes, longitudinal vibration of rods, Flexural vibration of beams.
- 6. MEASUREMENTS TECHNIQUES:** Vibration Monitoring, Vibration parameters, Vibration Instrumentation for its Measurement

RECOMMENDED BOOKS

1. Mechanical Vibration Analysis P. Srinivasan – 2nd Ed.,
2. Vibration & Noise for Engineers K. Pujara and R.S. Pujara,
3. Introduction Course on Theory and Practice of Mechanical Vibration J.G. Rao & Gupta,
4. Machinery Noise & Diagnostics R.H. Lyon

REFERENCE BOOKS

1. Mechanical Vibration W.T.Thompson
2. Mechanical Vibration Theory and Applications Francis S.Tse, Ivan E. Morse, Rolliand T. Hinkle,
3. Mechanical Vibrations S.S.Rao

MECHATRONICS

ME- 483

L	T	P	Cr
3	0	0	3

- 1. FUNDAMENTAL OF MECHATRONICS:** Definition and concepts of Mechatronics, Conventional system vs. mechatronic system, Need and Role of Mechatronics in Design, Manufacturing and Factory Automation. Hardware components for Mechatronics Number systems in Mechatronics, Ninary Logic, Karnaugh Map Minimization, and Transducer signal conditioning and Devices for Data conversion programmable controllers.
- 2. SENSORS AND TRANSDUCERS:** An introduction to sensors and Transducers, use of sensor and transducer for specific purpose in mechatronic.
- 3. SIGNALS, SYSTEMS AND ACTUATING DEVICES:** Introduction to signals, Systems and control System, representation, linearization of nonlinear systems, time Delays, measures of system performance, types of actuating devices selection.
- 4. REAL TIME INTERFACING:** Introduction, Element of a Data Acquisition and Control system in overview of the I/O process. Installation of the I/O card and software.
- 5. USE AND APPLICATION OF MECHATRONICS:** The Mechatronics of the Robots, Micro/Nano-Mechatronics for Nanotechnology, Institutional Implications, Other applications of mechatronics: Washing machine, Disk drive, The Mix of Computation, MEMS and Regular Materials.
- 6. APPLICATION OF SOFTWARE IN MECHATRONICS:** Advance application in Mechatronics. Sensors for conditioning Monitoring, Mechatronics Control in Automated Manufacturing, Micro sensors in Mechatronics. Case studies and examples in Data Acquisition and control. Automated manufacturing etc.

RECOMMENDED BOOKS

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| 1. Mechatronics | HMT Ltd |
| 2. Mechatronics | Bolton |
| 3. Introduction to Mechatronics | MB Histaad |
| 4. Introduction to Mechatronics & Measurement Systems Alciatore, | David & Michael B. Histan |

INDUSTRIAL ENGINEERING

ME – 484

L	T	P/D	Cr
3	1	0	3

- 1. INTRODUCTION:** Concept of I E; Functions of I.E.; Role of Industrial Engineer in the plant; Principles and types of organization; Organization Chart.
- 2. PRODUCTION PLANNING AND CONTROL:** Concept of production, planning and control; functions of production, planning and control; factors determining the need of P.P.C. in an organization; type of production, size of the plant, type of industry; production cycle; coordination of production decisions; short and long term planning, product analysis; role of sales forecasting; computer assisted production control.[CAPP].
- 3. SALES FORECASTING:** Introduction; importance; method of sales forecasting; time series analysis for sales forecasting; forecasting of new and established products, Use of I.T.
- 4. INVENTORY CONTROL:** Functions and types of inventories; zero inventory economic lot size; ABC analysis; material requirement and planning (M.R.P.) , Role of JIT (just in time) & Kanban system.
- 5. PRODUCT DEVELOPEMENT AND DESIGN:** Concept of product development and design; steps of new product development; product design considerations; standardization, simplification and specialization; ergonomic considerations in product design; concept, advantages, applications and procedure of value engineering.
- 6. INSPECTION AND QUALITY CONTROL:** Types of inspection; statistical quality control (SQC); control charts; Acceptance sampling.
- 7. INTRODUCTION TO MODERN PRODUCTION MANAGEMENT TOOLS:** Work study; method study's steps; time study; methodology; total quality management [TQM]; concept of ISO 9000; benefits; scope. Business Process Re-engineering (BPR); concept; principles; methodology; tools; scope.

BOOKS RECOMMENDED

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| 1. Production Planning and Control | Samuel Eilon. |
| 2. Production and Operations Management | Adam Ebert. |
| 3. Industrial Engineering | O.P. Khanna. |
| 4. Production Management | Buffa. |
| 5. Production Planning & Inventory Control | Narsimhan. |
| 6. Inspection Quality Control & Reliability | S.C.Sharma. |

REFRIGERATION AND AIR CONDITIONING

ME – 485

L	T	P/D	Cr
3	1	0	4

- 1. REFRIGERATION:** Departure of actual vapour compression cycle from theoretical cycle, compressor volumetric efficiency, analysis of actual cycle, second law analysis of, vapour compression cycle, effect of suction and discharge pressure, sub cooling and super heating on performance, compound vapour compression system with intercooling for single and multiple evaporators, cascading, manufacturing of dry ice, important refrigerant and their properties, secondary refrigerants, leak detection, charging of refrigerants. Aqua-amonia absorption refrigeration system, lithium bromide-water absorption system, electrolux system, properties of aqua-ammonia solution, Pt-X chart, heat of solution, enthalpy concentration diagram. Actual air refrigeration cycle, air craft cooling, liquefaction of gases, minimum work cycle. Linde and claude cycle. Engineering application of cryogenics.
- 2. AIR CONDITIONING:** Industrial and comfort air conditioning, physiological principle, comfort indices, comfort chart, ventilation requirements. Psychrometry, air washer, evaporative cooling, humidifier efficiency, cooling tower and their performance cooling and dehumidification by chilled water spray and cooling coils equivalent by pass factor chemical dehumidification, sensible heat factor and apparatus dew points.
- 3. EQUIPMENT:** Description of refrigeration and air conditioning equipment, compressors, condensers, evaporators, air washer and expansion devices, central air conditioning plants.
- 4. APPLICATIONS:** Manufacturing of ice, cold storage and food freezing, air conditioning of building, design aspects.

RECOMMENDED BOOKS

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| 1. Refrigeration and Air Conditioning | Jordan Priester |
| 2. Elementary Refrigeration and Air Conditioning | Stoecker |
| 3. Environmental Engg. Analysis and Practice | Jennings |
| 4. Mechanical Refrigeration | Sparks & Dillio |
| 5. Refrigeration and Air Conditioning | C.P. Arora |
| 6. Refrigeration and Air Conditioning | M.Prasad |
