DEPARTMENT OF MECHANICAL ENGINEERING
PUNJABI UNIVERSITY, PATIALA

SCHEME AND SYLLABI
FOR

MASTER OF TECHNOLOGY (MECHANICAL ENGINEERING)

REGULAR / PART TIME

(SEMESTER SYSTEM)

BATCH 2016

DEPARTMENT OF MECHANICAL ENGINEERING
PUNJABI UNIVERSITY, PATIALA

MASTER OF TECHNOLOGY (MECHANICAL ENGINEERING) (REGULAR)

SCHEME OF COURSES
BATCH 2016

Sr. No.	Subject Title	Teaching			Sessional Awards	Theory Exam	Exam Hrs.	Total Marks
SEMESTER-I		L	T	P				
1.	Core Course-I	3	1	0	50	50	3 hrs.	100
2.	Core Course-II	3	1	0	50	50	3 hrs.	100
3.	Elective Course -I	3	1	0	50	50	3 hrs.	100
4.	Elective Course -II	3	1	0	50	50	3 hrs.	100
5.	MME 251 Mechanical Engineering Lab.	0	0	4	100	---	---	100
						TOTAL MARKS		**500**
SEMESTER-II		L	T	P				
1.	Core Course-III	3	1	0	50	50	3 hrs.	100
2.	Core Course-IV	3	1	0	50	50	3 hrs.	100
3.	Elective Course -III	3	1	0	50	50	3 hrs.	100
4.	Elective Course -IV	3	1	0	50	50	3 hrs.	100
5.	MME 252 Self Study & Seminar	0	0	6	100	---	---	100
						TOTAL MARKS		**500**
SEMESTER-III		L	T	P				
1.	Core Course-V	3	1	0	50	50	3 hrs.	100
2.	Core Course-VI	3	1	0	50	50	3 hrs.	100
3.	Elective Course –V	3	1	0	50	50	3 hrs.	100
4.	Elective Course -VI	3	1	0	50	50	3 hrs.	100
5.	MME 253 Project	0	0	6	100	----	---	100
6.	Open Elective *	-	-	-	---	---	---	---
						TOTAL MARKS		**500**
SEMESTER-IV		L	T	P				
1.	MME 254 DISSERTATION	0	0	0	---	---	---	---

*** Student can opt any number of courses from list of open elective subject.**

*** Open Elective**

1. 103 Business Environment (M.B.A. 2 Year Regular)
2. 104 Managerial Economics (M.B.A. 2 Year Regular)
3. 304 Marketing Research (M.B.A. 2 Year Regular)
4. 305 Management of Industrial Relations (M.B.A. 2 Year Regular)
5. 306 Human Resource Planning and Development (M.B.A. 2 Year Regular)
6. MCE 101 Computer Network Technologies (M. Tech. Computer Engineering)
7. MCE 104 Software Engineering Concepts And Methodologies (M. Tech. Computer Engineering)
8. MCE 204 Web Services (M. Tech. Computer Engineering)
9. MCE 212 Software Project Management (M. Tech. Computer Engineering)
10. MCE 217 Data Warehousing & Data Mining (M. Tech. Computer Engineering)
11. MEC 101 Wireless and Mobile Data Communication (M.Tech. Electronics and Communication Engineering)
12. MEC 205 Semiconductor Devices and Modeling (M.Tech. Electronics and Communication Engineering)
13. MEC 213 Computer System Architecture (M.Tech. Electronics and Communication Engineering)

In addition to above open elective subjects, student can opt any subject offered by university departments with the consent of ACD of ME department.

DEPARTMENT OF MECHANICAL ENGINEERING
PUNJABI UNIVERSITY, PATIALA

MASTER OF TECHNOLOGY (MECHANICAL ENGINEERING)
(PART TIME)

SCHEME OF COURSES
BATCH 2016

Sr. No.	Subject Title	Teaching			Sessional Awards	Theory Exam	Exam Hrs.	Total Marks
SEMESTER-I		L	T	P				
1	Core Course-I	3	1	0	50	50	3hr	100
2	Core Course-II	3	1	0	50	50	3hr	100
3	Elective Course -I	3	1	0	50	50	3hr	100
							Total Marks	300
SEMESTER-II		L	T	P				
1	Core Course-III	3	1	0	50	50	3hr	100
2	Core Course-IV	3	1	0	50	50	3hr	100
3	Elective Course -II	3	1	0	50	50	3hr	100
							Total Marks	300
SEMESTER-III		L	T	P				
1	Core Course-V	3	1	0	50	50	3hr	100
2	Elective Course -III.	3	1	0	50	50	3hr	100
3	MME 251 Mechanical Engineering Lab	0	0	4	100	---	---	100
4	Open Elective *	-	-	-	---	---	---	---
							Total Marks	300
SEMESTER-IV		L	T	P				
1	Core Course-VI	3	1	0	50	50	3hr	100
2	Elective Course -IV	3	1	0	50	50	3hr	100
3	MME 252 Self Study & Seminar	0	0	6	100	---	---	100
							Total Marks	300
SEMESTER-V		L	T	P				
1	Elective Course -V	3	1	0	50	50	3hr	100
2	Elective Course -VI	3	1	0	50	50	3hr	100
3	MME 253 Project	0	0	6	100	---	---	100
							Total Marks	300
SEMESTER-VI		L	T	P				
1	MME 254 Dissertation	0	0	0	---	---	---	---

*** Student can opt any number of courses from list of open elective subject.**

*** Open Elective**

1. 103 Business Environment (M.B.A. 2 Year Regular)
2. 104 Managerial Economics (M.B.A. 2 Year Regular)
3. 304 Marketing Research (M.B.A. 2 Year Regular)
4. 305 Management of Industrial Relations (M.B.A. 2 Year Regular)
5. 306 Human Resource Planning and Development (M.B.A. 2 Year Regular)
6. MCE 101 Computer Network Technologies (M. Tech. Computer Engineering)
7. MCE 104 Software Engineering Concepts And Methodologies (M. Tech. Computer Engineering)
8. MCE 204 Web Services (M. Tech. Computer Engineering)
9. MCE 212 Software Project Management (M. Tech. Computer Engineering)
10. MCE 217 Data Warehousing & Data Mining (M. Tech. Computer Engineering)
11. MEC 101 Wireless and Mobile Data Communication (M.Tech. Electronics and Communication Engineering)
12. MEC 205 Semiconductor Devices and Modeling (M.Tech. Electronics and Communication Engineering)
13. MEC 213 Computer System Architecture (M.Tech. Electronics and Communication Engineering)

In addition to above open elective subjects, student can opt any subject offered by university departments with the consent of ACD of ME department.

LIST OF CORE COURSES

MME 101 Materials Technology
MME 102 Computer Aided Design & Manufacturing
MME 103 Non Traditional Machining Processes
MME 104 Industrial Automation & Robotics
MME 105 Welding Technology
MME 106 Research Methodology

LIST OF ELECTIVES

MME 201 Computer Aided Manufacturing
MME 202 Computer Aided Machine Design
MME 203 Computer Aided Process Planning
MME 204 Neural Networks & Fuzzy logic
MME 205 Finite Element Analysis
MME 206 Mechatronics
MME 207 Simulation & Modelling
MME 208 Artificial Intelligence
MME 209 Design of Experiments
MME 210 Automotive Design
MME 211 System Design
MME 212 Vibration Analysis
MME 213 Product Design & Development
MME 214 Theory of Cutting & Machine Tool Design
MME 215 Foundry Technology
MME 216 Management of Production Systems
MME 217 Operations Research
MME 218 Advanced Engineering Mathematics
MME 219 Gear Design
MME 220 Facilities Planning & Design
MME 221 Total Quality Management
MME 222 Business Intelligence

SEMINAR AND MINOR PROJECT

MME 251 Mechanical Engineering Lab.
MME 252 Self Study & Seminar
MME 253 Project

DISSERTATION

MME 254 Dissertation

List of Core Courses

MME 101 Materials Technology
MME 102 Computer Aided Design & Manufacturing
MME 103 Non Traditional Machining Processes
MME 104 Industrial Automation & Robotics
MME 105 Welding Technology
MME 106 Research Methodology

Electives for specialization in Machine Design

MME 202 Computer Aided Machine Design
MME 205 Finite Element Analysis
MME 207 Simulation & Modelling
MME 209 Design of Experiments
MME 210 Automotive Design
MME 211 System Design
MME 212 Vibration Analysis
MME 219 Gear Design

Electives for specialization in Production

MME 201 Computer Aided Manufacturing
MME 203 Computer Aided Process Planning
MME 206 Mechatronics
MME 213 Product Design & Development
MME 214 Theory of Cutting & Machine Tool Design
MME 215 Foundry Technology
MME 216 Management of Production Systems
MME 217 Operations Research
MME 220 Facilities Planning & Design
MME 221 Total Quality Management
MME 222 Business Intelligence

Electives for specialization in CAD/CAM

MME 201 Computer Aided Manufacturing
MME 202 Computer Aided Machine Design
MME 203 Computer Aided Process Planning
MME 204 Neural Networks & Fuzzy logic
MME 205 Finite Element Analysis
MME 206 Mechatronics
MME 207 Simulation & Modelling
MME 208 Artificial Intelligence

DEPARTMENT OF MECHANICAL ENGINEERING
PUNJABI UNIVERSITY, PATIALA

General Instructions to the Paper Setters

M.Tech. in Mechanical Engineering Regular/Part Time
BATCH 2016

(Common for M.Tech. in Computer Engineering, Electronics and Communication Engineering, Mechanical Engineering Branches)

The M. Tech paper structure will be as shown below:

Pattern of Question Paper for End Semester Exam

TITLE OF SUBJECT (CODE----)

Master of Technology (Branch) Section: …….. TIME ALLOWED: 3 Hour
Roll. No……. Maximum Marks: 50

Note: - Section C is compulsory. Attempt any six questions selecting three questions from each of Sections A & B.

Section-A (From Section A of the syllabus)

Q1.... .....
Q2.... .....
Q3.... .....
Q4.... .....
Q5.... ..... 3x5

(From Section B of the syllabus)

Q6.... .....
Q7.... .....
Q8.... .....
Q9.... .....
Q10.... ..... 3x5

Section-B (From Whole Syllabus)

Q11.
a).....
b)... .....
c)... .....
d)... .....
e)... .....
f)... .....
g)... .....
h)... .....
i)... .....
j)... ..... 10x2

Note for the paper setter:

1. The maximum duration to attempt the paper is 3 Hours.
2. Numbers of questions to be set are nine (9) as per the above format.
3. Section A and B contain four questions of 5 marks each. However these questions may be divided into subparts.
4. Section C is compulsory and contains ten (10) sub-parts of two (2) mark each.
5. The maximum limit on numerical questions to be set in the paper is 35% while minimum limit is 20% except for theoretical papers.
6. The paper setter shall provide detailed marking instructions and solution to numerical problems for evaluation purpose in the separate white envelopes provided for solutions.
7. The paper setters should seal the internal & external envelope properly with signatures & cello tape at proper place.
8. Log tables, charts, graphs, design data tables etc. should be specified, whenever needed. Use of Scientific calculator should be clearly specified.

MME 101 MATERIALS TECHNOLOGY

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. INTRODUCTION: Introduction to material science & engineering, Classification of engineering materials, Determination of Crystal geometry through X-ray diffraction technique.

2. MECHANICAL PROPERTIES & TESTING OF MATERIALS: Fundamental mechanical properties, creep, fatigue and fracture processes, Factors effecting mechanical properties, destructive and non-destructive testing of materials.

3. METALS AND ALLOYS: Introduction to ferrous and non-ferrous metals and alloys, Solid solutions, Phase diagrams (One and two component systems), Iron-carbon phase diagram, Phase transformation in Fe-C system, TTT and CCT diagrams, Heat treatment of plain carbons steels, Low alloy steels, Stainless steel, Aluminum and Copper alloys (Composition and Applications of salient alloys).

SECTION-B

4. CERAMIC MATERIALS: Introduction, Classification, Structures of Simple ceramic crystal, Silicate sheet and chain structures, Mechanical properties of ceramics.

5. POLYMER MATERIALS: Introduction, Broad classification, Salient Thermoplastics and Thermosetting Plastics (Properties and Applications), Processing of polymers.

6. NANO STRUCTURAL MATERIALS: Introduction to Carbon Nano Tube (CNT), Classification of CNT, Production methods for CNT, Applications of CNT.

7. COMPOSITE MATERIALS: Introduction, Classifications, Metal matrix composites, Polymer matrix composites, Carbon-carbon composites, Ceramic matrix composites, Hybrid composites, Sandwich composite, Laminated Composite, Rule of mixtures and Inverse rule of mixtures.

8. DETERIORATION OF MATERIALS: Corrosion and its control, Oxidation, Mechanism of Oxidation, Oxidation kinetics, Wear and its Types, Prevention of Wear.

REFERENCES:

1. William D. Callister, Materials Science and Engineering-An Introduction, John Wiley & Sons, Inc., New York,
2. William F. Smith, Principles of Materials Science and Engineering, Mc-Graw Hill.
3. V. Raghavan, Material Science & Engineering., Prentice-Hall of India (P), New Delhi
4. Sidney H. Avner, Introduction to Physical Metallurgy, Mc-GrawHill, N. York.
5. Charles P. Poole, Frank J. Owens, Introduction to Nanotechnology, John Wiley & Sons, New Jersey.
6. Ravi Prakash, Nondestructive Testing Techniques, New Age International (P) Ltd., New Delhi.

MME 102 COMPUTER AIDED DESIGN & MANUFACTURING

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. INTRODUCTION: Overview of Conventional Design & Manufacturing Process, Computer's role in Design & Manufacturing. Structure and working of the computer. Introduction to the working of display devices (Stroke CRT, Raster CRT and TFT), hardcopy output devices and graphics input devices (mouse, light-pen and digitizer). Scan Conversion of line through DDA algorithm. Anti-aliasing.
2. COMPUTER NETWORKING: Application of common database and need for networking. Network topologies – (i) Physical Bus & Logical Bus, (ii) Physical Star & Logical Token Ring (iii) Physical Star and Logical Bus. Introduction to Ethernet standards and hardware components, CSMA/CD.
3. NUMERICAL CONTROL: Principle of operation of a numerical controlled machine. Operation of NC motion control servo system. Coding of information in NC Machines. Manual NC Part programming for 2-Dimensional motion. Software-assisted part programming for multi-axis milling.
4. COMPUTER CONTROL IN N.C.: Historical development and types of CNC Machines. Direct and Distributed Numerical Control. Features and functions available in a typical CNC system. Adaptive control. Latest developments.

SECTION-B

5. GROUP TECHNOLOGY AND PROCESS PLANNING: Part family formation and GT cell. Methods for forming part families: Visual, Production Flow Analysis, Classification & Coding Systems. Steps in process planning activity. Computer Aided Process Planning: Retrieval & Generative Process Planning. Structure & operation of a typical process planning software. Computer-generated time standards.
6. COMPUTER-INTEGRATED PRODUCTION MANAGEMENT SYSTEM: Introduction. Control of production and materials. Capacity Planning. Scheduling. Computer aided inventory management & material requirements planning.
7. SHOP FLOOR CONTROL: Shop Floor Control: Order release, order scheduling and order progress. Online and offline factory data collection systems. Data input techniques, Automatic data collection systems, viz. Bar Code, OCR, MICR, Voice Recognition, Magnetic Strip Technology, Smart Cards. Data acquisition systems for computer process monitoring.
8. PROCESS INTERFACING & CONTROL: Basic types and operating principles of industrial control devices: (i) Sensors: bimetallic switch, colour sensors, ultrasonic distance sensors, light section sensors, LVDT, limit switches, photoelectric devices, proximity sensors, scan sensors, force and load sensors. (ii) Actuators: Electric, Pneumatic, Hydraulic Piezoelectric (iii) Valves: Control, Self-actuated, solenoid, Float and Flow Valves. Actuator-sensor interface strategies and architecture.

REFERENCES:

1. Groover & Zimmer, CAD/ CAM, Prentice Hall of India, New Delhi.
2. Groover, Automation, Production System and CIMS, Prentice Hall of India, New Delhi.
3. C.B. Beasanat & C.W.K. Lui, CAD/ CAM, East West Press, New Delhi.
4. Ibrahim Zeid, CAD-CAM Theory and Practice, Tata McGraw-Hill Publishing Company.
5. P. Radhakrishnan, S. Subramanyan, V. Raju, CAD/CAM/CIM, New Age International Publishers.
6. Peter Smid, CNC Programming Handbook Industrial Press Inc., New York.
7. M. Sarfraz, Interactive Curve Modeling With Application to Computer Graphics, Vision and Image Processing, Springer.
8. Peng Zhang, Industrial Control Technology – A Handbook for Engineers and Researchers, William Andrew, Norwich, NY, USA.
9. Inyong Ham, Katsundo Hitomi, Teruhiko Yoshida, Group Technology – Applications to Production Management, Kluwer-Nijhoff Publishing.
10. Jack M. Walker, Handbook of Manufacturing Engineering, Marcel Dekker Inc.

MME 103 NON TRADITIONAL MACHINING PROCESSES

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. Modern Machining Processes: An Overview, trends in Manufacturing machining, need for non traditional machining, classification of non traditional machining, distinction between traditional and non traditional machining, features of various non traditional machining processes, applications of non traditional machining processes.

2. Advanced Mechanical Processes: Abrasive jet machining, Ultrasonic machining, Water jet machining, Abrasive Water Jet Machining,– elements of process, equipment, process parameters, Applications and limitations

3. Electrochemical & Chemical Removal Processes: Principle of operation, elements and applications of Electrochemical Machining, process parameters, Applications and limitations, ectrochemical grinding, electrochemical deburring, Electrochemical honing, Chemical Machining - elements, Applications and limitations

SECTION-B

4. Electric Discharge Machining: Mechanism of metal removal, electrode feed control, die electric fluids flushing, selection of electrode material, applications.
Plasma Arc Machining- Mechanism of metal removal, PAM parameters, Equipment's for unit, safety precautions and applications.

5. Laser Beam machining: types of lasers, gas laser and solid laser, limitations and advantages.
Electron Beam Machining- Generation and control of electon beam, construction of electron beam gun and diffusion pump, process capabilities, advantages and limitations

6. Hybrid Machining Processes: concept, classification, applications and Advantages.

REFERENCES:

1. P.C. Panday and H.S. Shan, Modern Machining Processes, Tata Mc-Graw Hill.
2. G.F. Benedict, Non traditional Manufacturing Processes, Marcel Dekker Inc.
3. G. Boothroyd and W.A. Knight, Fundamentals of Machining and Machine Tools, Marcel Dekker Inc.
4. P.K. Mishra, Nonconventional Machining, Narosa Publishing House, New Delhi

MME 104 INDUSTRIAL AUTOMATION & ROBOTICS

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. Concept of automation in industry, mechanization and automation, classification of automation systems. Difference between hard automation and robotic automation.
2. Air cylinders –their design and mounting; pneumatic and hydraulic valves- flow control valves, metering valves, direction control valves, hydraulic servo systems; pneumatic safely and remote control circuits.

3. Basis of automated work piece handling- working principles and techniques, job orienting and feeding devices. Transfer mechanisms- automated feed cut of components, performance analysis.
4. Assembly automation, automated packaging and automatic inspection.

SECTION-B

5.. **Introduction to robot technology-** robot physical configuration and basic robot motions
6. Types of manipulators- constructional features, servo and non servo manipulators.
7.. **Feedback systems and sensors-** encoders and other feed back systems, vision, ranging systems, tactile sensors

8. Concept of spatial desecrations and transformations, manipulator kinematics, Inverse manipulator, Kinematics Jacobians, Velocity and static forces, manipulator dynamics

REFERENCES:

1. Johon. J. Craig, :Introduction to Robotics PearsonEducation.
2. Saeed. B. Niku. :Introduction to Robotics PearsonEducation Asia..
3. Andrew Parr, Hydraulics and Pnematics (HB), Jaico Publishing House, 1999.
4. Dudleyt, A. Pease and John J. Pippenger, Basic Fluid Power, Prentice Hall,
5. Anthony Esposite, Fluid Power with Applications, Prentice Hall, 1980.
6. K.S.Fu, R.CGonzalez and C.S.G. Lee, Robotics control,Sensing,Vision and intelligence,McGrawHill,1987
7. Yoram Koren, Robotics for Engineers, Mc-Graw Hill.
8. Tunnel, Industrial Robots Vol. I, SME.
9. Deb, S.R.Robotics Technology and Flexible Automation,Tata McGraw Hill,1994
10. S. R. Majumdar, pneumatic system Principles and Maintenance, Tata Mc Graw Hill, 1995.

MME 105 WELDING TECHNOLOGY

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. INTRODUCTION:, Basic classification of welding processes, weldability, weld thermal cycle, metallurgy of fusion welds, solidification mechanism and micro structural products in weld metal, epitaxial, cellular and dendritic solidification, metallurgical changes in weld metal, phase transformation during cooling of weld metal in carbon and low alloy steel, prediction of microstructures and properties of weld metal. Heat affected zone, re-crystallization and grain growth of HAZ, gas metal reaction, effects of alloying elements on welding of ferrous metals.
2. WELDING POWER SOURCES: Arc welding power sources, basic characteristics of power sources for various arc welding processes, duty cycles, AC/DC welding power source, DC rectifiers, thyristor controlled rectifiers, transistorized units, inverter systems.
3. WELDING ARC: Arc efficiency, temperature distribution in the arc, arc forces, arc blow, electrical characteristics of an arc, mechanism of arc initiation and maintenance, role of electrode polarity on arc behaviour and arc stability, analysis of the arc. Arc length regulation in mechanised welding processes.

4. FUSION WELDING REVIEWS: Critical reviews of manual metal arc welding (MMAW) GTAW, GMAW, FCAW and CO welding processes, plasma arc, submerged arc welding, electro gas and electro slag welding, analysis of the process.

SECTION-B

5. COATED ELECTRODES: Electrode coatings, classification of coatings of electrodes for SMAW, SAW fluxes, role of flux ingradients and shielding gases, classification of solid and flux code wires.
6. METAL TRANSFER & MELTING RATE: Mechanism and types of metal transfer, forces affecting metal transfer, modes of metal transfer, metal transfer in various welding processes, effective of polarity on metal transfer and melting rate.
7. SOLID STATE WELDING: Theory and mechanism of solid sate welding. Techniques and scope of friction welding, diffusion welding, cold pressure welding and ultrasonic welding. High energy rate welding. Analysis of the Process.
8. WELDING TECHNIQUES: Technique, scope and application of the electron beam and laser welding processes. Under water welding - process & problem.

REFERENCES:

1. R.S.Parmar, Welding processes & Technology, Khanna Publishers.
2. S.V. Nandkarni, Modern Arc Welding Technology, Oxford & IDH publishing Co.
3. L.M.Gourd, Principles of Welding Technology, ELBS/ Edward Arnold.
4. Richard L. Little, Welding & Welding Technology, Mc-Graw Hill.
5. Rossi, Welding Technology, Mc-Graw Hill.

MME 106 RESEARCH METHODOLOGY

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. Nature and objectives of research.

2. Methods of Research: historical, descriptive and experimental

3. Alternative approaches to the study of the research problem and problem formulation. Formulation of hypotheses, Feasibility, prepration and presentation of research proposal

4. Introduction to statistical analysis : Probability and probability distributions; binomial, Poisson, exponential and normal distributions and their applications.

5. Sampling: Primary and secondary data, their collection and validation, methods of sampling: Simple random sampling, stratified random sampling and systematic sampling, Attitude Measurement land Scales: Issues, Scaling of attitude, deterministic attitudes, measurement models, summative models, multidimensional scaling.

SECTION-B

6. Regression and correlation analysis. Tests of significance based on normal., t and chisquare distributions. Analysis of variance.

7. Basic Principles of design of experiments, completely randomized and randomized block designs. Edition, tabulation & testing of hypotheses, interpolation of results, presentation, styles for figures, tables, text, quoting of reference and bibliography. Use of software for statistical analysis like SPSS, Mini Tab or MAT Lab, Report writing, preparation of thesis, use of software like MS Office.

REFERENCES:

1. C.R Kothari, Research Methodology, Wishwa Prakashan
2. P.G Triphati, Research Methodology, Sultan Chand & Sons, New Delhi
3. Fisher, Design of Experiments, Hafner
4. Sadhu Singh, Research Methodology in Social Sciences, Himalya Publishers
5. Stoufferetal, Measurement & Prediction, Wiley, N.York
6. J.W Bames, Statistical Analysis for Engineers & Scientists, McGraw Hill, N.York
7. Donald Cooper, Business Research Methods, Tata McGraw Hill, New Delhi

MME 201 COMPUTER AIDED MANUFACTURING

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. INTRODUCTION: Historical Background, Role of Computers in Manufacturing, automation, Types of Automation, Automation Strategies.

2. FUNDAMENTALS OF CNC MACHINES: CNC Technology, functions of CNC Control in Machine Tools, Classification of CNC Systems, Contouring System, Interpolators, Open loop and Closed loop CNC System, CNC Controllers, Hardware Features, Direct Numerical Control(DNC Systems) and Adaptive Control.

3. CONSTRUCTIONAL FEATURES OF CNC MACHINES: Design considerations of CNC machines for improving machining accuracy, Structural Members, Slide ways, Slides linear bearings, Ball Screws, Spindle drives and feed drives, Work holding devices and tool holding devices, Automatic tool changers. Feedback devices, Principles of Operation, Machining Centres, Tooling for CNC machines.

4. PART PROGRAMMING FOR CNC MACHINES: Numerical control codes, Standards, Manual Programming, Canned cycles and subroutines, Computer Assisted Programming, CAD/CAM approach to NC part programming, APT language, machining from 3D models.

SECTION-B

5. INTRODUCTION TO ROBOT TECHNOLOGY IN CAM: Group Technology and Cellular manufacturing: Introduction, Part families, parts classification and coding, production flow analysis, machine cell design. Computer Aided Process Planning(CAPP) : Types of Process planning system, Advantages of CAPP.

6. PRODUCTION PLANNING AND CONTROL: Introduction to production planning and control, Shop Floor Control Systems, Just-in –time approach, Engineering Challenges in CAD/CAM, Product Data Management, Product Modeling, Assemble and Tolerance Modeling.

7. INTEGRATED MANUFACTURING SYSTEM: Introduction to Flexible Manufacturing Systems(FMS), different types of flexibilities in FMS, type of FMS, machining system fo FMS, Tool Management systems, work piece handling system, FMS Control, Lay out considerations in FMS, Advantages of FMS. Introduction to Computer Aided Manufacturing Systems (CIMS), the future automated factory, trends in manufacturing, human factors in future automated factory, the social impact. Rapid Prototyping, Artificial Intelligence and Expert system in CIM.

REFERENCES:

1. Mikell P. Groover, Automation, Production System and CIMS, Prentice Hall of India, New Delhi.
2. Ibrahim Zeid, CAD-CAM Theory and Practice, Tata McGraw-Hill Publishing Company.
3. Yoram Koren, Computer Control of Manufacturing Systems, McGraw Hill Book Company.
4. G.T.Smith, CNC-Machining Techniques-Vol. 1, 2 & 3, Verlag.
5. Paul G. Ranky, Computer Integrated Manufacturing, Prentice Hall.
6. Chang.T.C. & Wysk, An Introduction to Automated Process Planning, Prentice Hall Inc.

MME 202 COMPUTER AIDED MACHINE DESIGN

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. Fundamentals of CAD: Introduction, Design Process, Application of computers in design, Creating manufacturing database, Benefits of CAD. Computer Hardware, Graphic input devices, display devices, Graphics output devices, Central processing unit (CPU).

2. CAD software and Database: Software configuration of a graphics system: functions of a graphics package, geometric modeling, Database structure and control.

3. Geometric Transformations: Mathematics preliminaries, matrix representation of 2 and 3 dimensional transformation, Concatenation of transformation matrices, Application of geometric transformations.

SECTION-B

4. Introduction to Design and Engineering Applications- geometry and mass property formulations. Introduction to Reverse Engineering Tools.

5. Design projects with CAE focus – Design of Transmission Belts, Journal Bearing, Knuckle Joint. Computer aided design & drafting of spur gear using C++/VC.

REFERENCES:

1. Ibrahim Zeid, CAD/CAM., McGraw Hill
2. J Rooney and P Steadman, Principles of Computer Aided Design., CRC Press
3. Daniel L Rayan, Computer Aided Graphical Design., CRC Press
4. P Radhakrishnan and Kothandaraman, Computer Graphics and Design, Dhanpat Rai Publications (P) Ltd.

MME 203 COMPUTER AIDED PROCESS PLANNING

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. Introduction: Traditional process planning; process planning elements; product design evaluation; selection of tooling and process parameters; operation sequence evaluation.

2. Group Technology: Introduction; advantages; part families; classification and coding systems; production flow analysis; design of machine cells.

3. Production Systems at Operation Level: Manufacturing support systems and concepts at the level of production processes; computer generated time standards; machinability data system; cutting condition optimization.

4. Production Systems at Plant Level: Communication oriented production information and control system (COPICS); material requirements planning; capacity planning; shop floor control and operation scheduling.

SECTION-B

5. Automated Process Planning: Advantages of automated process planning; standardization of manufacturing process plans; variant process planning; its features; and different stages; different variant systems; advantages and limitations of variant process planning

6. Generative process planning; its features; design strategies; planning modelling and coding scheme; decision mechanism for software; decision trees for process; process information.
7. Artificial intelligence; overview & application; search strategies for AI production systems; resolution and reduction systems; knowledge acquisition; machine selection, cutting tool selection; software; various generative process planning systems; advantages of generative process planning systems; case studies.

REFERENCES:

1. Chang & Wysk, An Introduction to the Automated Process Planning, Prentice Hall.
2. Groover & Zimmers, Computer Aided Design & Manufacturing, Prentice Hall.
3. Gallagher & Knight, Group Technology; Prod. Method in Manufacturing, Ellis Hosewood.
4. Groover, Automation; Production System & Computer Integrated Manufacturing, Prentice Hall.

MME 204 NEURAL NETWORKS & FUZZY LOGIC

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. Neural Networks characteristics, History of development in Neural Networks Principles, Artificial Neural Net terminology, Model of a neuron, topology, learning, types of learning, supervised, unsupervised, re-enforcement learning.

2. Basic Hopfield Model, the perceptron, linear separability, Basic learning laws, Hebb's rule, Delta rule, Windrow & Hoff LMS learning rule, correlation learning rule, instars and outstar learning rules.

3. Unsupervised learning, competitive learning, K-means clustering algorithm, Kohonen's feature maps.

SECTION-B

4. Fuzzy Logic: Basic concepts of Fuzzy Logic, Fuzzy Vs Crisp Set, Linguistic Variables, membership functions, Operations on Fuzzy sets, Fuzzy IF-THEN rules, variable inference techniques, defuzzification techniques, Fuzzy rule-based systems, Fuzzy Decision making, multi objective decision making, Fuzzy classification, fuzzy multi-feature pattern recognition,, Fuzzy system design, Implementation of Fuzzy system, Useful tools supporting design.

5. Applications of neural nets such as pattern recognition, optimization, associative memories, vector quantization, control, Applications in speech and decision-making.

6. Applications of Fuzzy Logic

REFERENCES:

1. Riza C.Berkin & Trubatch., Jeepers, Fuzzy Systems Design Principles, Building Fuzzy IF-THEN rules bases
2. YegnaNarayanan, Artificial Neutral Networks., Prentice-Hall of India Pvt Ltd
3. Bart Kosko, Nural Networks & Fuzzy logic., Prentice Hall Inc.
4. Simon Haykin, Neutrak Networks., Prentice Hall Inc.
5. Jack M. Zurada, Introduction to Artificial Neural systems., PWS Publishing Co. Boston, MA
6. Timothy J. Ross, Fuzzy logic with engineering Applications, Prentice Hall, Englewood Cliffs.

MME 205 FINITE ELEMENT ANALYSIS

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. INTRODUCTION: finite element methods, history and range of applications.

2. FINITE ELEMENTS: Definition and properties, assembly rules and general assembly procedure, features of assembled matrix, boundary conditions.

3. CONTINUUM PROBLEMS: Classification of differential equations, variational formulation approach, Ritz method, element equations from variations. Galerkin's weighted residual approach, energy balance methods.

SECTION-B

4. ELEMENT SHAPES AND INTERPOLATION FUNCTIONS: Basic element shapes, generalized coordinates, polynomials, natural coordinates in one-, two- and three-dimensions, Lagrange and Hermite polynomials, two-D and three-D elements for C^o and C^1 problems, Coordinate transformation, iso-parametric elements and numerical integration.

5. APPLICATIONS & CASE STUDIES: Application of finite element methods to elasticity and structural, heat transfer, fluid-flow, lubrication and general field problems.

REFERENCES:

1. K.H. Huebner, The Finite Element Method for Engineers, John Wiley, New York.
2. Jeffery M. Steche, Applied Finite Element Modeling, Marcel Dekker, New York.
3. O.C. Zienkiewicz, The Finite Element Method, Tata McGraw Hill, New Delhi.
4. Desai & Abel, Introduction to the FEM, (CBS)-affiliated to East West Press, New Delhi.
5. George R. Buchanan, Finite Element Analysis, Schaum MGH, New York.
6. Chandrupatla & Belgundu, Introduction to Finite Elements in Engineering, Prentice Hall of India, New Delhi.
7. J.N. Reddy, An Introduction to the Finite Element Method, McGraw Hill, New York.
8. Cheung Y.K, Lo.S.H.,Leung A.Y.T Finite Element Implementation, Blackwell Science Ltd, London.

MME 206 MECHATRONICS

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. INTRODUCTION: What is Mechatronics, Systems, Measurement Systems, Control Systems, Microprocessor- based controllers, The Mechatronics Approach.

2. SENSORS & TRANSDUCERS: Sensors and Transducers, Performance Terminology, (Displacement, Position & Proximity Sensors),(Velocity & Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature & Light Sensors), Selection of Sensors.

3. ELECTRONIC FUNDAMENTALS: Signal Conditioning Process, Operational Amplifier, Digital Logic, Logic Gates, Boolean Algebra, Data Acquisition Systems, Measurement Systems, Testing and Calibration.

4. ACTUATORS: Mechanical Actuation Systems, Hydraulic & Pneumatic Actuation Systems, Electrical Actuation Systems, A.C. Motor, D.C. Motor, Stepper Motor.

SECTION-B

5. SYSTEM MODELLING & CONTROL: Mathematical Models, Engineering Systems, Electromechanical & Hydraulic- mechanical Systems, Modeling Dynamic Systems, Transfer Functions, Introduction to MATLAB & SIMULINK, Control Modes, PID Controller.

6. MICROPROCESSOR & COMPUTER: Computer and Interfacing, AD and DA converters, Microcomputer Structure, Microcontrollers, Application of Microcontrollers, PLC.

7. DESIGN & MECHATRONICS: Designing, Possible Design Solutions, Case Studies of Mechatronic Systems.

REFERENCES:

1. W. Bolton, Mechatronics, Pearson Education Asia, New Delhi
2. Wolfram Stadler, Analytical Robotics and Mechatronics, Mc-Graw Hill.
3. Dan Necsulescu, Mechatronics, Pearson Education Asia, New Delhi
4. A.P. Mahind, Introduction to Digital Computer Electronics, TMH, New Delhi
5. E.O. Doeblin, Measurement Systems, Mc-Graw Hill.
6. B.C. Kuo, Ogata, Automatic Control Systems, PHI, New Delhi

MME 207 SIMULATION & MODELLING

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. Introduction and overview:, concept of system, system environment, elements of system, Monte Carlo method, system simulation, simulation, a management laboratory, advantages limitations or system simulation, continuous and discrete systems.

2. Technique of Simulation:, Monte-Carlo method, System simulation, comparison of simulation with analytical methods, experimental nature of simulation, advantages, limitations and application of system simulation.

3. Numerical computational techniques-for continuous and discrete models. Distributed lag models. Cobwals models, examples involving numerical methods of analysis.

4. Simulation of continuous systems: characteristics of a continuous system, comparison of numerical integration with continuous simulation system. Simulation of an integration formula. Simulation of trajectories, pure pursuit, serial pursuit, chemical reaction and auto pilot. Analog methods, digital-analog simulation time simulation, hybrid simulation.

SECTION-B

5. Simulation of discrete system: Time flow mechanisms, Discrete and continuous probability density functions. Generation of random numbers, testing of random numbers for randomness and for auto correlation, generation of random variates for discrete distribution, generation of random variates for continuous probability distributions-binomial, normal, exponential and beta distributions; combination of discrete event and continuous models. The rejection method. Simulation of reliability, queuing and inventory problems.

6. Design of Simulation experiment: Length of run, elimination of initial bias. Variance reduction techniques, stratified sampling, antipathetic sampling, common random numbers, time series analysis, spectral analysis, model validation, optimisation procedures, search methods, single variable deterministic case search, single variable non-deterministic case search, regenerative technique.

7. Simulation of PERT: Simulation of- maintenance and replacement problems, capacity planning production system, reliability problems, computer time sharing problem, the elevator system.

8. Simulation Languages: Continuous and discrete simulation languages, block structured continuous languages, special purpose simulation languages, SIMSCRIPT, GESS SIMULA importance and limitations of special purpose languages.

REFERENCES:

1. Loffick, Simulation and Modelling, Tata Mc-Graw Hill.
2. Deo Narsingh, System Simulation with Digital Compute, PHI, New Delhi
3. D.S. Hira, System Simulation, S. Chand & Co., New Delhi
4. Meeiamkavil, Computer Simulation and Modelling, John Willey.
5. Gerden, System Simulation PHI, New Delhi

MME 208 ARTIFICIAL INTELLIGENCE

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. Introduction to AI: Definitions, Basic concepts of AI. Problem formulation and solution techniques.

2. Expert systems. Knowledge representation, Knowledge acquisition, inference mechanisms. Logic Programming.

SECTION-B

3. Introduction to machine learning, Natural language processing, Intelligence for manufacturing tools, manufacturing brain, eye and hand. Trends in robot intelligence.

4. Case studies in the application of AI in manufacturing.

REFERENCES:

1. E.Rich, Artificial Intelligence, Tata McGraw Hills, New Delhi.
2. G.F Luger and W.A. Stubblefield, AI and the design of Expert Systems, Bengamin/Cummins.
3. Dan W. Patterson, AI and Expert Systems, Prentice Hall of India, New Delhi.
4. Omidvar.O and Smagt.P., Neural Systems for Robotics, Academic Press, San Diego.
5. P. Radhakrishnan, S. Subramanyam, CAD/CAM/CIM, New Age International Pub, New Delhi.

MME 209 DESIGN OF EXPERIMENTS

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. **INTRODUCTION**: Strategy of experimentation, some typical applications of experimental design, Basic principles, Guidelines for designing experiments, A brief history of statistical design, Using statistical design in experimentation.

2. **SIMPLE COMPARATIVE EXPERIMENTS**: Introduction, Basic statistical concepts, Inferences about the Differences in means, randomized designs, Inferences about the Differences in means, Paired comparison Designs, Correlation, Regression

3. **RANDOMIZED BLOCK DESIGNS**: Randomized complete block design, Latin square design, Balanced incomplete block design.

4. **INTRODUCTION TO FACTORIAL DESIGN**: Basic definition and principles, Advantages of factorials, The two factor factorial design, General factorial design, Fitting response curves and surfaces, Blocking in a factorial design.

SECTION-B

5. **FITTING REGRESSION MODELS**: Introduction, Linear regression models, Estimate of parameters in linear regression models, Hypothesis testing in multiple regression, Confidence intervals in multiple regression, Prediction of new response observations, Regression model diagnostics, testing for lack of fit

6. **RESPONSE SURFACE METHODOLOGY**: Introduction to RSM, Response Surface Design, Analysis of data from RSM Design.

7. **TAGUCHI METHOD OF DESIGN OF EXPERIMENTS**: Concept design, Parameter design, Tolerance design, Quality loss function, Signal-to- Noise ratio, Orthogonal array experiments, Analysis of Mean (ANOM), Quality characteristics (noise and control factors)

8. **QUALITATIVE TECHNIQUES**: AHP, Brief introduction of FUZZY, Brief introduction of Structural Equation Modelling (SEM), Brief introduction of TOPSIS Introduction to SPSS (PASW).

REFERENCES:

1. Douglas C Montgomery, “Design and Analysis of Experiments”, John Wiley.
2. John P.W.M., “Statistical Design and Analysis of Experiments”, Macmillan.
3. Myres R.H., Montgomery D. C., “Response Surface Methodology: Process And Product Optimisation Using Designed Experiments”, Wiley, New York
5. K. Krishnaiah & P. Shahabudeen, “Applied Design of Experiments & Taguchi Methods”, PHI
6. Taguchi, “Introduction to Quality Engineering”, Asian Productivity Organisation, G. UNIPUB, White Plains, New York.
7. Taguchi, “System of Experimental Design: Engineering Methods to Optimize Quality and Minimize Cost”, G. UNIPUB, White Plains, New York

MME 210 AUTOMOTIVE DESIGN

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. Automotive Engineering Development: Innovations and Inventions, Engine Developments, (Transmission, Steering, Suspension, Brake) system development, Interior Refinement, Safety Design.

2. Modern Materials and Manufacturing Challenge: Structure, Properties and Manufacturing technology of automotive materials, Material selection, Design to manufacture as a single process and IPPD

3. Body Design: Styling process, Aerodynamics, Chassis Design & Analysis.

4. Crashworthiness and its Influence on Vehicle Design: Accident and injurt analysis, Vehicle impact (General dynamics & crush characteristics), Structural collapse and its Influence upon Safety.

5. Noise, Vibration and Harshness: Vibration control, Fundamentals of acoustics, Sound measurement, General noise control Principles.

6. Occupant Accommodation: An Ergonomics Approach: Eight fundamental Fallacies, Ergonomics in the automotive industry, Strategies for improving occupant accommodation and comfort.

SECTION-B

7. Suspension System and Components: Factors effecting design, Mobility of suspension mechanisms, Kinematic analysis, Roll center analysis, Force analysis, Vehicle ride analysis, Controllable suspensions.

8. The design of engine Characteristics for Vehicle Use

9. Transmissions and Driveline: Manual gearbox, Automatic transmission, Continuously variable transmission.

10. Braking Systems: Fundamentals of braking, Brake proportioning and adhesion utilization, Materials design.

11. Control Systems in Automobiles: Automotive application of sensors, EMS, Electronic Transmission control, Integration of EMS and TCS, Chassis control system, Multiplex wiring system, Vehicle safety and security system, On-board navigation system.

12. Failure Prevention: Important aspects of failures in real engineering world, Testing and Failure prediction, Automotive technology and the importance of avoiding failures.

13. Future Trends in Automobile Design: Mechanical possibilities, Electronic and Electrical Possibilities.

REFERENCES:

1. Julian Happian-Smith, Butterworth, An Introduction to Modern Vehicle Design., A Butterworth-Heinemann
2. Heisler, Advanced Vehicle Technology, ISBN.
3. R. and Harding, Automobile Design: Twelve Great Designers and Their Work, SAE.
4. Barnard, R.H., Road Vehicle Aerodynamic Design, Longman.
5. Peacock, B. and Karwowski, Taylor & Francis., Automotive Ergonomics., CRC Press
6. Nwagboso, C.O., Chapman and Hall, Automotive Sensory Systems., Chapman & Hall

MME 211 SYSTEM DESIGN

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. System Theory and Concepts: Engineering and engineering profession, Engineer, Science and Scientist. Engineering and society, Social responsibility and engineering, new challenges to engineers in the present socio-political-economic environment.

2. System Design: Design, designer, qualities in a designer. System, its characteristics and system design cycle. Features and steps of inventiveness, obstacles and aids to creativity. Systematic search for new ideas. Information and information resources. Procedure to obtain information and information handling.

3. Engineering analysis and Decision making: Methods of engineering analysis. Decision making and its requirements. Methods for decision making. Steps in Engineering Design Process.

4. Problem Formulation: Need Analysis, identification of surrounding problems, problem formulation criterion, feasibility study, physical principles, concept formation, checking, estimations & bidding, subjective and quantitative analysis.

SECTION-B

5. Preliminary Design: Consideration of alternative models, sensitivity analysis, compatibility analysis, optimization, rechecking.

6. Detail Design: Steps in detailed Design, Factors affecting detailed design. Importance of technical knowledge and manufacture processes, detailed design and Production drawings.

7. Revision: Prototype testing and technique, evaluation of predicted performance and generalization. Revision and report writing.

8. Case studies to be discussed involving Systems Design process

REFERENCES:

1. J.B. Dixon, An introduction to System Design., Mc-Graw Hill.
2. D. K. Aggarwal and S.L. Singla, Systems Design.
3. M. Asimow, Introduction to Design, PHI, New Delhi

MME 212 VIBRATION ANALYSIS

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. Fundamentals: Introduction of Vibrations, Harmonic motion. Vector representation. Beats phenomenon. Complex method of representing harmonic vibrations. Fourier series and harmonic analysis. Analytical and Numerical methods of harmonic analysis.

2. Free Vibrations: Undamped free vibrations of single degree of freedom systems. Viscously damped free vibrations of single degree of freedom systems. Energy method for natural frequency. Equivalent stiffness of spring combinations.

3. Forced Vibrations of Damped 1 DoF Systems: Forced vibrations of single degree of freedom system with constant harmonic excitation. Forced vibrations due to excitation of support – absolute amplitude and relative amplitude.

4. Vibration Isolation, transmissibility & measurement: Force transmissibility. Motion transmissibility. Vibration isolation. Vibration measuring instruments for displacement, velocity, acceleration and frequency measurement.

SECTION-B

5. Two Degrees of Freedom Systems: Principal modes of vibration of a 2-DoF system. Systems with damping. Undamped forced vibrations under harmonic excitation. Vibration absorbers: Undamped dynamic absorber, centrifugal pendulum absorber, dry friction damper, untuned viscous damper.

6. Multi Degree of Freedom Systems – Exact Analysis: Governing equations. Influence coefficients, flexibility coefficients and stiffness coefficients. Maxwell's reciprocal theorem. Generalized coordinates and coordinate coupling. Natural frequencies and mode shapes. Orthogonal properties of normal modes. Modal analysis. Forced vibrations by matrix inversion.

7. Numerical Techniques for Multi Degree of Freedom Systems: Rayleigh's method for finding the first natural frequency. Dunkerley's method. Stodola's Method. Method of matrix iterations. Holzer's tabulation method. Critical speed of shaft with single and multiple unbalanced discs without damping.

8. Transient Vibrations: Laplace transformation. System response to different inputs, viz. impulsive, step and pulse inputs. Phase plane method. Shock spectrum.

REFERENCES:

1. S. Timoshenko, Vibration Problems in Engineerng, D. Van Nostrand Company Inc., New York.
2. W. Weaver and D.H. Young, Fundamentals of Mechanical Vibrations.
3. P. Srinivasan, Mechanical Vibration Analysis, McGraw-Hill Companies
4. S. Graham Kelly, Fundamentals of Mechanical Vibrations, McGraw-Hill.
5. William W. Seto, Theory and Problems of Mechanical Vibrations
6. G.K. Grover, Mechanical Vibrations, Roorkee Press.
7. S. S. Rao, Mechanical Vibrations, Addison Wesley

MME 213 PRODUCT DESIGN & DEVELOPMENT

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. INTRODUCTION: Introduction to Product Design, Design by Evolution and Innovation, Essential factors of product design, Production consumption cycle, Introduction to various stages in design process, Generation of alternatives, Evaluation.

2. FUNCTIONAL & AESTHETICS CONSIDERATION: Basic design considerations, Role of Aesthetics in product design, Basic concept and elements of Visual design, Patents, Liability and Ethics.

3. MATERIAL & PROCESS SELECTION: Materials in design, Design tools and material data, material selection strategy, selection process, computer aided material selection, Process classification, systematic process selection, Process cost, computer aided process selection.

4. **LIFE CYCLE MANAGEMENT**: Product Life Cycle, early introduction, increased product life, System Integration, QFD, House of Quality, Pugh's and Beitz method

SECTION-B

5. VALUE ENGINEERING: Value, Nature and measurement of value, Maximum value, Normal degree of value, Importance of value, The value Analysis Job Plan, Value Engg., Idea generation check list, Cost reduction, materials and process selection in value engineering, Concurrent Engineering, Reverse Engineering.

6. **DESIGN FOR MANUFACTURE AND ASSEMBLY**: Design for manufacture & Assembly, Reasons for not implementing DFMA, Design features and requirements with regard to assembly and production, Design for quality, reliability, maintenance, recyclability & disposal.

7. LEGAL & ECONOMIC CONSIDERATIONS: Product value, Design for safety, reliability and Environmental considerations, Economic analysis, profit and competitiveness, break even analysis, Economics of a new product design,

8. PRODUCT DEVELOPMENT: Definition and Objective, Role of designer in product development, Manufacturing & economic aspects of product development, Product promotion & development.

REFERENCES:

1. Kail T Ulrich and Steven D Eppinger, "Product Design and Development.", Mcgraw-hill
2. AK Chitale and Gupta, "Product Design and Engineering", Prentice-Hall of India Pvt Ltd
3. Niebel & Draper, "Product Design and Process Engineering", McGraw-Hill New York
4. William H. Middendorf, Richard H. Engelmann , "Design of Systems and Devices", Marcel Dekker

MME 214 THEORY OF CUTTING & MACHINE TOOL DESIGN

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. THEORY OF METAL CUTTING: Mechanism of metal cutting, Cutting forces, Chip formation, Merchant's circle diagram, Calculations, System of Tool nomenclature, Tool geometry, Machinability, Tool life, Cutting tool materials, Cutting fluids. Abrasive Machining- Mechanism of grinding, lapping and honing.

2. INTRODUCTION TO MACHINE TOOL DESIGN: Introduction to Metal Cutting Machine Tools, Kinematics of machine tools, Basic Principles of machine Tool Design,

3. DESIGN OF DRIVES: Design considerations of electrical, mechanical and hydraulic drives in machine tool, Selection of speeds and feeds, stepped and stepless regulation of speed, Estimation of power requirements and selection of motor for metal cutting machine tool spindles, design of gear box.

SECTION-B

4. DESIGN OF MACHINE TOOL STRUCTURES : Principles, materials, static & dynamic stiffness, Shapes of Machine tool Structures. Design of beds, columns, housings, tables, ram etc.

5. DESIGN OF SPINDLES, GUIDEWAYS AND SLIDEWAYS: Design of Machine tool Spindles- Materials of Spindles, machine tool Compliance. Design of Bearings- Anti friction bearings, sliding bearings. Design of guide ways and slideways.

6. DESIGN OF CONTROL MECHANISMS: Basic principles of control, mechanical, electrical, hydraulic, numeric and fluid controls, Selection of standard components, Dynamic measurement of forces and vibrations in machine tools, Stability against chatter, Use of vibration dampers.

7. AUTOMATION, TESTING AND STANDARDISATION: Automation drives for machine tools, Degree of automation, Semi-automation, analysis of collet action, design of collet, bar feeding mechanism, tooling layout, single spindle mechanism, analysis, Swiss type automatic machine. Loading and unloading. Transfer-deices, Modulator-design concept, in process gauging. Acceptance tests and standardization of machine tools.

REFERENCES:

1. Juneja.B.L. and Sekhon.G.S, Fundamentals of metal cutting and machine tools, New Age International (P) Ltd., New Delhi
2. M.C.Shaw, Metal Cutting Principles, Oxford Clarendon Press.
3. A.Bhattacharya, Metal Cutting Theory and Practice, New Central Book Agency(P) Ltd, Calcutta.
4. Arshinov & Alelrev, Metal Cutting Theory and Cutting Tool Design, MIR Publishers, Moscow.
5. N.K.Mehta, Machine Tool Design, Tata Mc-Graw Hill, New Delhi
6. G.C.Sen and A.Bhattacharyya, Principles of Machine Tools, New Central Book Agency (P) Ltd.
7. Ackerkan, Machine Tool Design Vol 1-4, MIR Publishers, Moscow.
8. Koenigsberger, Design Principles of Metal Cutting Machine Tools, Pergamon Press.
9. Tobias, Machine Tool Vibration, Blackie Oxford London.

MME 215 FOUNDRY TECHNOLOGY

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. Foundry Metallurgy: Oxidation of liquid metals, gas dissolution in liquid metals, inoculation practice for grey and ductile cast iron, degassing, types of ladles, fluidity, factors affecting fluidity, hot tearing, shrinkage of liquid metals, directional solidification.

2. Solidification of Castings: Solidification of metals and alloys**,** nucleation, growth and dendritic growth. Structure of castings, Concept of progressive and directional solidification, solidification time, Chvorinov's equation, temperature measuring instruments. .

3. Risering and Gating: Requirement of a riser, general considerations of risering, riser shapes, riser size, and location, riser design, insulating and exothermic materials used for risers, internal chills, external chills, padding for directional solidification, open type and blind risers.

Gating system – components of gating system, types of gates, laws of fluid flow, turbulence in gating system, slag trap systems, need for tapered sprue, gating system design, gating ratio.

SECTION-B

4. Special Casting Methods: Hot chamber die casting, cold chamber die casting, pressure die casting, Investment casting, centrifugal casting, permanent mould casting, vacuum moulding, shell moulding.

5. Non-ferrous Casting: Melting procedure, problems during melting, pouring and solidification, problem of hydrogen and oxygen, dross, casting of aluminum and copper based alloys.

6. Inspection and testing of casting: Cleaning of casting, Casting defects, causes and remedies, Non destructive testing (NDT) of casting (i.e. visual, mechanical, ultrasonic, dye penetration, magnetic particle and X-ray testing).

7. Modernization and Mechanization of Foundry: Need for modernization, and mechanization, moulding and core making, melting, pouring, shake out equipment and fettling, dust and fume control, material handling equipments for sand moulds and cores, molten metal and castings, Pollution control in foundries, energy saving in foundries.

REFERENCES:

1. Principal of Metal Casting by Richard W. Heine , Carl R Hoper, Philip C. Rosenthal, Tata McGraw Hill.
2. Principal of Foundry Technology by P. L. Jain , Tata McGraw Hill
3. Casting Technology and Cast Alloys by A. K. Chakraborti, , Prentice hall India.
4. Castings, John Campbell, , Elsevier
5. Foundry practice by W.H. Salmon, Issac Pitman.
6. Foundry Technology, P. N. Rao, Tata Mc Graw Hill
7. Text Book of Foundry Technology by O. P. Khanna and M. Lal , Dhanpat Rai and Sons.
8. Fundamentals of Metals Casting by R.A. Flinn, Addison Wesley.
9. ASME, Metals Handbook- Metal Casting.

MME 216 MANAGEMENT OF PRODUCTION SYSTEMS

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. **INTRODUCTION**: Objectives of Production, Concept of Production system, relationship of production and production manager to other areas of firm, Organization of Production system, Span-of-control concept, centralization versus decentralization, horizontal versus vertical integration, production organization & information system.

2. **SYSTEMS APPROACH**: Principles of Management, Feedback loops, flow networks in organization, concept of PAC, Decision making and management process, approaches to decision making, break even analysis

3. **PLANT DESIGN & FACILITIES**: Plant Location decision, importance in production system design, choice of site, plant location trends, basic types of plant layouts, objectives of plant layouts, factors affecting layout, principles of material handling, factors affecting materials handling decision, risk of inefficient material handling, Human factors in job.

4. **PRODUCTION SYSTEMS AT PLANT & OPERATION LEVEL**: Manufacturing support systems, Communication oriented production information and control system (COPICS); material requirements planning; capacity planning; shop floor control and operation scheduling.

SECTION-B

5. **PRODUCT DEVELOPMENT & AUTOMATION**: Product development, the developmental procedure, use of PERT in product development, cost control in R&D, Product design, project milestone schedules, introduction to automation & use of computers, advantages & disadvantages of automation.

6. **PPC & PROCUREMENT**: Functions of PPC, types of production control, PPC in different systems, relation of production planning to other areas of the firm, objectives of procurement department, relationship of procurement to other areas of the firm, make, buy or lease decisions, value analysis, legal & ethical aspects of procurement.

7. **QUALITY MANAGEMENT**: Purpose of inspection and quality, concept of quality, feedback and inspection process, variables and attributes in inspection process, sources of quality problems, statistical terms for quality, quality control charts, introduction to motion-study and time-study.

8. **VALUE ENGINEERING**: Value, Nature and measurement of value, Maximum value, Normal degree of value, Importance of value, The value Analysis Job Plan, Value Engg., Concurrent Engineering, Reverse Engineering, QFD (House of Quality).

REFERENCES:

1. Eilon, “Elements of production planning and control”, Macmillan.
2. Donald Bowerson and David Closs, “Logistical Management”, Mc-Graw Hill.
3. James Dilworth, “Production and Operations Management”, Mc-Graw Hill.
4. M. Therese Flaherty, “Global Operations Management”, Mc-Graw Hill.
5. Nauhria, R.N. & Parkash Rajnish, “Management of Systems”, Wheeler Publishing, New Delhi
6. Elwood S Buffa, “Modern Production Management”, Wiley Eastern, New Delhi

MME 217 OPERATIONS RESEARCH

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. Introduction: Nature and developments of operations research, characteristics of operations research, necessity of operations research in industry, scope of OR in management, objectives of OR, role of computers in OR, limitations of OR.
2. Definition of models: Classification of models, construction of models, approximations in OR models.

3.Linear Programming: Requirements of linear programming problems, formulation of linear programming problem, graphical solution, simplex algorithm, computational procedure in simplex, duality and its concept, application of L.P. model to product mix, limitations of linear programming, Sensitivity analysis in linear programming.

4.Transportation model: Definition of transportation model, methods of finding starting solution, Vogel's approximation method to find feasible solution in transportation models, methods for finding optimal solution, degeneracy in transportation problems, maximization in transportation problem, Sensitivity analysis in transportation problems..

SECTION-B

5. Queuing Models: Characteristics of Queuing Models, waiting time and idle time costs, transient and steady states of the system. Single channel queuing theory, Model I [(M/M/I): FCFS/α/α)]. Applications of Queuing Models.

6. Integer Programming: Cutting plane algorithm – Branch and bound technique, cut algorithm method for solving integer programming problems.

7. Dynamic Programming: Introduction to deterministic and probabilistic dynamic programming, characteristics of dynamic programming problem, deterministic programming models for solution of investment problem, allocation problem.

8. PERT & CPM: Network situations where PERT & CPM can be applied, planning, scheduling & control, work breakdown structure, Similarity and differences of CPM and PERT, use of crashing.

REFERENCES:

1. P.K.Gupta and D.S.Hira, Operations Research, S. Chand and Company, New Delhi
2. H.A. Taha, Operation Research -An Introduction, Macmillan Publishing Co., New Delhi
3. Paneerselvam, Operations Research, Prentice Hall of India, New Delhi
4. Natrajan, Balasubramani, Operations Research, Pearson Education Asia, New Delhi
5. HM Wagner, Principles of Operations Research, Prentice Hall, New York.

MME 218 ADVANCED ENGINEERING MATHEMATICS

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. TENSOR ANALYSIS : Introduction, curvilinear coordinates, summation convention, Transformation of coordinates, Contravariant and co-variant vectors, Tensors of order Zero, Tensor of Higher orders. Symmetric and skew -Symmetric, Tensors, Algebra of Tensors, Conjugate Tensors, Associated Tensor, Physical component, Christoffel's Symbols, Covariant differentiation of covariant and Contra variant Tensors.

2. INTEGRAL TRANSFORMS : Fourier Sine and Cosine Integral, Complex forms of Fourier Integral, Finite Fourier sine and cosine Transforms, Properties, Convolution Theorem, Farseval's Identity for Fourier transforms, Relations between Fourier and Laplace - Transforms. Fourier transforms of the derivatives of a Functions, Inverse Transforms by the method of Residues, Applications to boundary value problems.

3. Z-TRANSFORMS : Some Standard Z -Transforms Linear property, Damping rule, some Standard Results, shifting rules, Initial and final value theorems, Convolution theorem, Evaluation of inverse transformation's. Applications to finite difference equations.

SECTION-B

4. CONFORMAL MAPPING : Geometrical representation of complex function, Standard Transformations W=Z+C, CZ, 1/Z, Z^n , Log Z, exp(Z), sin Z, Bilinear Transformation, Schwarz Christoffel's transformation, Complex : integration, Chauchy's Theorem, Series of complex Terms, Residues and Residues theorem, Evaluation of real definite integrals. Application to Mechanical Engineering problem.

5. CALCULUS OF VARIATIONS : Euler's and Langrange's Equation, Isoperimetric problems, Several dependent variables, higher order derivatives, boundary value problems, Rayleigh -Ritz Method, Galerkin's Method, Hamilton's Principle. Applications to Mechanical Engineering Problems.

REFERENCES:

1. Churchill, Fourier Series and boundary value problems, Tata Mc-Graw Hill.
2. Churchill, Complex Variables and applications, Tata Mc-Graw Hill.
3. Golfand and Pomin, Calculus of variations, Prentice Hall.
4. Spiegel, Vector analysis and introduction to tensor analysis, Schaum's out lines Mc-Graw Hill.
5. C-Ray,Wylie and Louis, Advanced engineering Mathematics Barret Mc-Graw Hill
6. B.S. Grewal, Higher engineering Mathematic, Khanna Publishers, Delhi

MME 219 GEAR DESIGN

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. FUNDAMENTALS OF TOOTHED GEARING: Applications of different types of gears, Conjugate action. Construction of conjugate profile. Basic Tooth Profiles, Cycloidal gears. Involute gears. Basic terminology and formulae. Involutometry – formula for tooth thickness. Introduction to Gear Arrangements : Simple, reverted & Epicyclic gear trains

2. KINEMATICS OF CYLINDRICAL GEARS: Nature of tooth engagement in spur gear drive, Sliding velocity and efficiency.. Path and arc of contact. Contact ratio. Helical gears. Interference in involute gears. Profile correction & Peaking. Characteristics of corrected gears, Types of corrected gearing, Distribution of correction factors. Internal spur gears, Root fillet radii of curvature.

3. DESIGN OF CYLINDRICAL GEARS : Design criteria for gear dimensions. Force analysis of spur and helical gears. Dynamic loads on gear teeth. Contact stress and surface durability. Strength calculation and power rating.

4. METROLOGY AND INSPECTION OF CYLINDRICAL GEARS : System of Standards, Quality grades. Types of errors in gears. Measurement by gear tooth calipers. Base tangent measurement. Backlash, Allowances & Tolerances of gears. Measurement over pins. Composite error test.

SECTION-B

5. BEVEL GEARS: Theory of bevel gears. Bevel gear basic rack and modules. Terminology and relations. Force analysis of bevel gears. Blanks and mountings for bevel gears. Spiral bevel gears. Zerol bevel gears. Hypoid gears.

6. WORM AND WORM WHEEL: Introduction. Types of worms. Basic parameters. Worm drive with concave-convex profile. Force analysis of worm drive. Efficiency of worm drive.

7. GEAR MATERIALS, CUTTING, PROCESSING AND LUBRICATION: Materials for gears. Methods for manufacturing gears. Form and generative tooth cutting. Milling cutters. Gear shaping. Gear hobbing. Heat treatment of gears. Gear finishing processes. Gear lubricants and their characteristics.

8. TYPES AND CAUSES OF GEAR FAILURES: Possible causes of gear failures. Incompatibility in gear systems. Nomenclature of gear failures. Tooth breakage. Pitting of gear teeth. Scoring failures. Wear failures. Overload failures. Gear casing problems. Lubrication failures. Thermal problems in fast running gears.

REFERENCES:

1. Darle W. Dudley, Handbook of Practical Gear Design, CRC Press.
2. Gitin M. Maitra, Handbook of Gear Design Tata McGraw Hill.
3. Faydor L. Litvin and Alfonso Fuentes, Gear Geometry and Applied Theory, Cambridge Press.
4. Faydor L. Litvin and W.-J. Tsung, New Generation Methods for Spur, Helical and Spiral-Bevel Gears, NASA Technical Memorandum 88862. USAAVSCOM Technical Report 86-C-27.
5. Earle Buckingham & Eliot K. Buckingham, Manual on Gear Design – Section 1,2 and 3, Industrial Press.
6. Joseph E. Shigley, Mechanical Engineering Design, McGraw Hill.
7. R.L.C. Juvinall, Fundamentals of Machine Component Design, John Wiley.
8. H.E. Merritt, Gear Engineering, Wheeler Publishing.

WEB REFRENCES:

http://www.agma.org/
http://www.qtcgears.com/Q410/Q420Cat.html

APPLICABLE STANDARDS:

DIN: 3960, 3961, 3962 (Part I & II), 3963, 3967, 867, 3990
IS: 2535, 4460, 7443, 5037, 7403, 2048, 2293

MME 220 FACILITIES PLANNING & DESIGN

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.
Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. Introduction: Importance of plant layout in plant design, its relationship with plant layout, types of layout, classifications of production process structures, Principles of plant layout design, Importance of facilities planning

2. Plant layout Factors: Factors affecting design of plant layout: viz: man, materials, machinery, waiting, movement, building, change.

3. Plant location: Plant location factors, selection of plant site, quantitative analysis of plant location.

4. Design of Process and Product layout: Quantitative techniques for plant layout decisions, Muther's Grid, Process Layout evaluation, load distance analysis. Evaluation of product type of layout, heuristics for line balancing.

SECTION-B

5. Systematic Layout Planning: Introduction to Systematic Layout Planning, phases involved in SPIF.

6. Computerization Layout Planning: Need for computerized layout planning, classification of computerized layout planning algorithms, description of various algorithms for layout planning, namely CRAFT, ALDEP & CORELAP.

7. Material Handling: Significance of material handling, integrating plant layout and material handling systems, principles of material handling, systems approach to material handling, classification & selection of MH equipment.

8. Material Handling Systems: Characteristic features of various MH systems, automated guided vehicle systems and automated storage & retrieval systems.

REFERENCES:

1. Richard Muther, Practical Plant Layout, McGraw Hill Book Company, New York.
2. Vijay Sheth, Facilities Planning and Materials Handling, Marcel Decker, New York
3. Tompkins, White, Facilities planning, John Wiley & Sons, New York.
4. G.K. Aggarwal, Plant layout & Material Handling, Jain Publishers, New Delhi
5. S.C. Sharma, Plant Layout & Material Handling, Khanna Publishers, New Delhi
6. Krajewski, Operations Management, Pearson Education, New Delhi.
7. Martinich, Opeations Management, John Wiley & Sons, New York.
8. Francis White, Facility Location & Layout, PHI, New Delhi

MME 221 TOTAL QUALITY MANAGEMENT

L-T-P
3- 1- 0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.

Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. QUALITY MANAGEMENT: Evolution of Philosophy of Quality, Quality Gurus-Crosby, Deming and Juran, Attributes of Quality, Quality Characteristics-Quality of Design, Quality of Performance and Quality of Conformance, Organization For Quality, Total Quality Management (TQM), TQM Models, 4 – C'S of TQM; Barriers to Implement TQM.

2. ORGANISING FOR QUALITY: Developing an Organization Al Structure for Quality. Quality Management System. Role of top Management, Quality Council, Quality Policies, Quality Improvement Teams, Role of Middle and Lower Management, Quality Circles, Organization Structure for Quality Circles. Problem Solving Techniques. Zero Defects.

3. QUALITY MEASUREMENT; TOOL AND TECHNIQUES: Seven Basic (B7) Tools – Scatter diagram, Cause & effect diagram, Pareto chart, Check sheet, Histogram, Control chart, flow chart. New Seven (S7)Tools – affinity diagram, relations diagram, tree diagram, matrix diagram, matrix data analysis, arrow diagram, Process Decision Program Chart (PDPC).

SECTION-B

4. QUALITY ASSURANCE & CONTROL: Causes of Quality Failure, Quality Assurance-Need and Various Elements In Quality Assurance Programme. Quality Control- On Line and Off Line, Statistical Concepts in Quality, Chance and Assignable causes. Types of control charts. Control chart for variables (X and R charts). Interpreting patterns of variations on X and R charts. Control chart for attributes: Attribute chart for defectives, P- chart, NP- chart. Attribute chart for number of defects per unit, C-Chart and U-Chart.

5. INNOVATIVE TECHNIQUES IN QM: Quality Function Deployment (QFD)-Definition and Phases in QFD, Taguchi Approach to quality-system design, parameter design and Tolerance design, Six- Sigma - Definition & Implementation Steps, ISO-9000 and 14000, Role of Total Productive Management (TPM), Benchmarking in quality management.

REFERENCES:

1. Amrik Sohal, TQM Text with Cases
2. B. G. Pale, Managing Quality
3. John S. Oaklend, TQM Text with Cases
4. Arora, TQM and ISO –14000
5. Besterfield, TQM

MME 222 BUSINESS INTELLIGENCE

L	T	P
3	1	0

Maximum Marks: 50 **Maximum Time: 3 Hrs.**
Minimum Pass Marks: 40% **Lectures to be delivered: 45-55**

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.

Instructions for candidates: Candidates are required to attempt three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

1. Introduction to Business Intelligence

2. Introduction to digital data and its types – structured, semi-structured and unstructured, Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP), BI Definitions & Concepts, BI Framework, Data Warehousing concepts and its role in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, Business Applications of BI, BI best practices.

3. Basics of Data Integration (**E**xtraction **T**ransformation **L**oading)

4. Concepts of data integration, needs and advantages of using data integration, introduction to common data integration approaches, Meta data - types and sources, Introduction to data quality, data profiling concepts and applications, introduction to ETL using Kettle.

SECTION-B

5. Introduction to Multi-Dimensional Data Modeling

6. Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, introduction to business metrics and KPIs, creating cubes using Microsoft Excel.

7. Basics of Enterprise Reporting

8. A typical enterprise, Malcolm Baldrige - quality performance framework, balanced scorecard, enterprise dashboard, balanced scorecard vs. enterprise dashboard, enterprise reporting using MS Access / MS Excel, best practices in the design of enterprise dashboards.

REFERENCES:

1 R.N. Prasad and Seema Acharya, Fundamentals of Business Analytics, Wiley India Ltd.
2 Mike Biere, Business Intelligence for the Enterprise, Prentice Hall Professional.
3 Teo Lachev, Applied Microsoft Analysis Services 2005: And Microsoft Business Intelligence Platform, Prologika Press.
4 David Taniar, Progressive methods in data warehousing and business intelligence: concepts and competitive analytics, Idea Group Inc (IGI).
5 Data warehousing: the ultimate guide to building corporate business intelligence, Birkhäuser.
6 Mark Humphries, Michael W. Hawkins, Michelle C. Dy, Data warehousing: architecture and implementation, Prentice Hall Professional.

MME 251 MECHANICAL ENGINEERING LAB

L-T-P
0- 0- 4

Each student will be required to complete a course on Lab Work comprising of advanced practicals related to Mechanical Engineering. The experiments in the Lab Work will be decided by the concerned teacher/section-in charge. The student will be required to complete the prescribed Lab Course and other requirements related to evaluations of the Practical Course. The evaluation will be done jointly by the committee of examiners constituted by Head of Department.

MME 252 SELF STUDY & SEMINAR

L-T-P
0-0- 6

Each student will be required to prepare a Seminar Report and present a Seminar on a topic in any of the areas of modern technology related to Mechanical Engineering including interdisciplinary fields. The topic/title will be chosen by the student in consultation with the Faculty Advisor allocated to each student. The student will be required to submit the Seminar Report and present a talk to an audience of Faculty/Students in open defense in front of the Seminar Evaluation Committee having Faculty Advisor as one of its members. The Seminar Evaluation Committee will be constituted by Head of Department.

MME 253 PROJECT

L-T-P
0- 0- 6

Each student will be required to complete a Project and submit a Project Report on a topic on any of the areas of modern technology related to Mechanical Engineering including interdisciplinary fields. The title and objectives of the Project will be chosen by the student in consultation with the Project Guide allocated to each student. The student will be required to present a talk to an audience of Faculty/Students in open defense in front of the **Project Evaluation Committee** having Project Guide as one of its members. The Project Evaluation Committee will be constituted by Head of Department for the purpose of evaluation for internal assessment.

MME 254 DISSERTATION

Each student will be required to complete a Dissertation and submit a written Report on the topic on any of the areas of modern technology related to Mechanical Engineering including interdisciplinary fields in the Final semester of M.Tech. course. The title and objectives of the Dissertation will be chosen by the student in consultation with the Supervisor (s) and the same will be required to be defended by the student in open defense in front of the **Dissertation Monitoring Committee** approved by the Head of Department. The title and objectives will be approved by the Dissertation Monitoring Committee having main Supervisor as one of its members. The progress will also be monitored at weekly coordination meetings with the Supervisor (s). The student will be required to present a talk to the gathering in open defense in front of the Dissertation Monitoring Committee having main Supervisor as one of its members. The Dissertation Monitoring Committee will be constituted by Head of Department for the purpose examining the suitability of the work carried out by the student in the Dissertation for its evaluation by the external examiner. The Dissertation will be sent to the External Examiner for its evaluation only after its due approval by the Dissertation Monitoring Committee. The external evaluation will be done jointly by the main Supervisor and external examiner appointed by the Head of Department. The dissertation (non-credit course) will be either approved or rejected. The external examiner will evaluate the dissertation and the viva-voce will be fixed by the Head of Department. After Viva-voce, the examiners (internal and external) will approve/reject the dissertation. In case, the dissertation is rejected, the candidate will rework and resubmit the dissertation. The dissertation will be again be evaluated jointly by the same external examiner and the Main Supervisor.