GURU KASHI UNIVERSITY

Master of Technology in Mechanical Engineering

Session: 2023-24

Department of Mechanical Engineering

GRADUATE OUTCOME OF THE PROGRAMME

After completing this program, a student will be able to develop an ability to apply appropriate knowledge in Mechanical Engineering to identify, formulate, analyze, and solve complex engineering problems in order to develop sustainable computing solutions in broader economic, societal and environmental contexts.

PROGRAMME LEARNING OUTCOMES

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and a mechanical engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex mechanical engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex mechanical engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex mechanical engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the mechanical engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Structure

Semester: 1st						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
MME101	Advance Manufacturing Processes	Core Course	4	0	0	4
MME102	Advanced Heat and Mass Transfer	Core Course	3	1	0	4
MME103	Optimization Techniques	Core Course	3	1	0	4
MME104	Metallurgy & Materials Testing Lab	Laboratory Course	0	0	2	1
MME105	Seminar	Skill Based	0	0	2	1
Discipline Elective-I(Any one of the following)						
MME106	Industrial Tribology	Discipline Elective	3	0	0	3
MME107	Quality Assurance & Reliability Engineering					
MME108	Computer Integrated Manufacturing					
Discipline Elective-II (Any one of the following)						
MME109	Computer Aided Design	Discipline Elective	3	0	0	3
MME110	Instrumentation and Control Engineering					
MME111	Advanced Internal Combustion Engine					
Total			**16**	**2**	**4**	**20**

Semester: 2nd						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
MME201	Materials Technology	Core Course	4	0	0	4
MME202	Welding Technology	Core Course	4	0	0	4
MME203	Mechatronics	Core Course	4	0	0	4
MME204	Mini Project	Project	0	0	2	1
Discipline Elective-III (Any one of the following)						
MME205	Advance Casting Processes	Discipline Elective	3	0	0	3
MME206	Composite Material					
MME207	Modelling & Simulation of Mechanical Systems					
Discipline Elective-IV(Any one of the following)						
MME208	Additive Manufacturing	Discipline Elective	3	0	0	3
MME209	Theory of Cutting & Machine Tool Design					
MME210	Industrial Automation & Robotics					
Value Added Course (Any one of the following)						
MME211	English for Research Paper Writing	VAC	1	0	0	1
MME212	Value Education					
MME213	Pedagogy Studies					
Total			**19**	**0**	**2**	**20**

Semester: 3rd						
Course Code	**Course Title**	**Type**	**L**	**T**	**P**	**Credits**
MME301	Research Methodology	Research Based	4	0	0	4
MME302	Dissertation Phase-I	Research Based	-	-	-	6
MME399	XXX	MOOC	-	-	-	4
Discipline Elective-V(Any one of the following)						
MME303	Rapid Prototyping	Discipline Elective	3	0	0	3
MME304	Machine Tool Design					
MME305	Metal Forming					
Open Elective Course						
XXX	XXX	OEC	3	0	0	3
Total			**10**	**0**	**0**	**20**
Open Elective Courses (For other Departments)						
MME306	Industrial Safety and Environment	OEC	2	0	0	2
MME307	Total Quality Management					

Semester: 4th						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
MME401	Dissertation	Research Based	-	-	-	20
Total						20
			45	**2**	**6**	**80**

Evaluation Criteria for Theory Courses

A. Continuous Assessment: [30 Marks]

CA-I Surprise Test (Two best out of three) - (10 Marks)
CA-II Assignment(s) (10 Marks)
CA-III Term paper/Quiz/Presentation (5 Marks)

B. Attendance (5 marks)

C. Mid Semester Test: [30 Marks]

D. End Semester Exams: [40 Marks]

Evaluation Criteria for Practical Courses

Performance of each practical-(10 Marks)
Report- (5 Marks)
Practical Viva – **(**5 Marks)
Total - (20 Marks) (Each Practical)

SEMESTER: I

Course Title: ADVANCE MANUFACTURING PROCESS
Course Code: MME101

L	T	P	Credits
4	0	0	4

Total Hours-60

Learning Outcomes: After successful completion of this course, the students will be able to

1. Explain the evolution, classification and need of non-traditional machining technology in modern manufacturing
2. Compare and demonstrate the process principle and physical description; understand the parametric effect on process performance; solve problems related to process modelling, selection and material removal mechanics of mechanical energy based proc.
3. Predict and demonstrate the process principle and physical description; understand the parametric effect on process performance; solve problems related to process modeling, selection and material removal mechanics of thermal and electro-thermal energy based processes
4. Apply the latest developments in the applications of nontraditional hybrid machining processes
5. Understand the different types of advanced machining processes

Course Content

Unit I **15 hours**

Introduction:
Overview of general trends in Manufacturing, concept and significance of important properties related to manufacturing processes, limitations of conventional manufacturing processes need and evolution of advanced manufacturing, selection and economics of manufacturing processes.

Unit II **15 hours**

Advanced Machining Processes:
Classification, Review of conventional machining processes, Principles, process parameters, capabilities and mechanism of material removal of AJM, WJM, AWJM, USM

Electro Chemical Type Advanced Machining Processes:
ECM-Process principle, mechanism of material removal; Kinematics and dynamics of ECM; Tooling design; Choice and analysis of process parameters; Surface finish and accuracy.

Unit III **15 hours**

Thermal Type Advanced Machining Processes:
EDM, LBM and EBM processes: Working principle; Power circuits; Mechanism of material removal; Process parameters and characteristics; Surface finish and accuracy: Shape and materials applications, limitations.

Unit I V **15 hours**

Derived and Hybrid Advanced Machining Processes:

Introduction of processes like rotary ultra-sonic machining, electro stream drilling, shaped tube electro machining, wire electro discharge machining, electro chemical grinding, electro chemical honing, electro chemical deburring and electrochemical spark machining.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Shan, H. S & Pandey, P.C. (1993). Modern Machining Processes, Tata Mc Hill N. Delhi*
- *Kalpakjian, S and Steven, R. S (2001).Manufacturing Processes for Engg. Materials,. Pearson Education*
- *G.F Benedict. (1987). Non Traditional manufacturing. Marcel Dekker New York,*
- *Mishra, P.K. (1997). Non Conventional Machining. Narosa Publishing House N. Delhi*

SEMESTER: I

Course Title: ADVANCED HEAT AND MASS TRANSFER
Course Code: MME102

L	T	P	Credits
3	1	0	4

Total Hours-60

Learning Outcomes: After successful completion of this course, the students will be able to

1. Understand both the physics and the mathematical treatment of the advanced topics pertaining to the modes of heat transfer.
2. Understand physical and mathematical aspects of mass transfer.
3. Predict the concepts of radiation heat transfer for enclosure analysis
4. Analyze free and forced convection problems involving complex geometries with proper boundary conditions
5. Apply principles of heat transfer to develop mathematical models for uniform and non-uniform fins.

Course Content

Unit-I

Conduction **15 hours**

General heat conduction equation in rectangular, polar and spherical co-ordinates, one dimensional heat conduction, variable thermal conductivity, composite walls, elementary cases of two dimensional heat conduction, critical insulation thickness, unsteady heat conduction, heat transfer from extended surfaces, numerical methods.

Unit-II

Radiation **15 hours**

Introduction, properties and definitions, review of radiation principles (Planck's law, Kirchoff's law, Stefan Boltzman law, Lambert's cosine law).Radiation through non-absorbing media; Hottel's method of successive reflections; Radiation through absorbing media; logarithmic decrement of radiation; apparent abosrptivity of simple shaped gas bodies; net heat exchange between surfaces separated by absorbing medium; radiation of luminous gas flames.

Unit-III

Convection **15 hours**

Heat transfer in laminar flow; free convection between parallel plates; forced internal flow through circular tubes; fully developed flow; velocity and thermal entry lengths; solutions with constant wall temperature and with constant heat flux; forced external flow over a flat plate; the two dimensional velocity and temperature boundary layer equations; Karman Pohlhousen approximate integral method. Heat transfer in turbulent flow; eddy heat diffusivity;

Unit-IV

Mass Transfer **15 hours**

Introduction, concentration, velocities and fluxes, Fick's law of diffusion, steady state diffusion in common geometries, equimolal counter-diffusion in gases, steady state

diffusion in liquids, transient mass diffusion in common geometries, mass transfer coefficient, convective mass transfer

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Eckert, E. R. G., & Drake Jr, R. M. (1987). Analysis of heat and mass transfer.*
- *Grober, Erk and Grigul (1989). Fundamentals of Heat Transfer. McGraw Hill*
- *Holman, J. P. (2008). Heat Transfer (Si Units) Sie. Tata McGraw-Hill Education.*
- *Schneider, P. J. (1955). Conduction heat transfer. Addison-Wesley Publishing Company.*
- *Howell, J. R., Siegel, R., & Mengüç, M. P. (1969). Thermal radiation heat transfer. Boca Raton, FL, USA: National Aeronautics and Space Administration.6. Rohsenhow and Choi Heat, Mass and Momentum Prentice Hall*

SEMESTER: I

Course Title: OPTIMIZATION TECHNIQUES
Course Code: MME103

L	T	P	Credits
3	1	0	4

Total Hours-60

Learning Outcomes: On the successful completion of this course, the students will able to

1 Understand the fundamental knowledge of Linear Programming and Dynamic Programming problems.

2 Apply the classical optimization techniques and numerical methods of optimization.

3 Comprehend the basics of different evolutionary algorithms.

4 Enumerate fundamentals of Integer programming technique and apply different techniques to solve various optimization problems arising from engineering areas.

5 Optimize the industrial process management.

Course Content

Unit-I **15 hours**

Definition of Optimization:
Meaning of Operations Research, Modeling in operation research, principles of modeling, Introduction to linear and non-linear programming problems and formulation of problems.

Linear Programming:
Modeling of linear programming problem – a few examples; Solution of linear programming problem – simplex method, two-phase method, M-method; Sensitivity analysis – graphical approach

Unit –II **15 hours**

Transportation Model:
Transportation problem, Vogel's approximation method for finding feasible solution in transportation, methods for finding optimal solution, degeneracy in transportation problems, maximization in transportation problems.

Assignment Model:
Definition of assignment model, comparison with transportation problems, Hungarian method to find optimal solution, travelling salesman problems, branch and bound method.

Unit –III **15 hours**

Queuing Theory:
Types of queuing situation: Queuing models with Poisson's input and exponential service, their application to simple situations.

Dynamic Programming:
Deterministic and Probabilistic Dynamic programming

Unit-IV **15 hours**

CPM & PERT:
Network situations where PERT & CPM can be applied, planning, scheduling & control, work breakdown structure, Similarity and differences of CPM and PERT
Game theory: Two-person, Zero-sum games, Games with mixed strategies, Graphical solution, Solution by linear programming.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Rao, S.S. (1944). Engineering Optimization Theory and Practice. New Age International*
- *Kalyanmoy, D. (2014). Optimization for Engineering Design, PHI*
- *Arora, J.S. (1979). Optimization Techniques. John Wiley*

SEMESTER: I

Course Title: METALLURGY & MATERIALS TESTING LAB
Course Code: MME104

L	T	P	Credits
0	0	2	1

Total Hours-15

Course Content

List of Experiments

1. Study of metallurgical microscope and sample preparation
2. Microscopic examination of plain carbon steels, stainless steels and tool steels
3. Microscopic examination of cast irons
4. Microscopic examination of
    - Magnesium alloys
    - Aluminium alloys
    - Titanium alloys
    - Copper alloys
    - Super alloys
5. Tensile Testing
6. Hardness Measurements
7. Impact Testing All above tests will include ferrous and nonferrous alloys.
8. Determination of crystal structure parameters from XRD data

SEMESTER-I

Course Title: Seminar
Course Code: MME105

L	T	P	Credits
0	0	2	1

Total hours: 15

Learning Outcomes: On successful completion of this course, the students will be able to:

1. Locate different sources of information.
2. Filter and select relevant information.
3. Prepare the power point presentation of the specific topic.
4. Deliver the seminar on a specific topic.

Course Content

Develop effective communication skills necessary for delivering seminars and technical presentations. Enhance public speaking abilities and confidence in presenting complex technical concepts. Understand the principles of effective visual aids and utilize appropriate tools for creating impactful presentations. Learn techniques for structuring and organizing seminar content to engage and inform the audience. Gain proficiency in handling question and answer sessions and addressing audience feedback. Understand the importance of effective time management during presentations. Develop critical thinking skills to evaluate and analyze seminar topics and research findings. Foster teamwork and collaboration skills through group presentations and peer feedback.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

SEMESTER: I

Course Title: INDUSTRIAL TRIBOLOGY
Course Code: MME106

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: On the successful completion of this course, the students will able to

1 Examine the causes of wears and friction in different contact surfaces.

2 Perform design calculations of hydrostatic and hydrodynamic lubrication for basic problems.

3 Describe the design of bearing and analyze the performance of bearings.

4 Analyze the tribological systems in IC engine

Course Content

Unit -I **11 hours**

Introduction:
Friction, wear and lubrication, Types of Engg. Contacts: conforming and non-conforming. Types of Motion, rubbing, sliding, oscillating, Rolling and surface of interactions, elastic and plastic deformations, properties of materials, surface energy and flash temp theory.

Friction:
Law of sliding friction, concept of adhesion, Taylor's model of friction, Measurement of friction.

Unit –II **10 hours**

Wear:
Laws of wear, types of wear such as adhesive, declamation, abrasive, fatigue, corrosive, fretting erosive, electrical and oxidative. Measurement of wear in dry atmosphere and different environments preventive, control of wear, wear of cutting tool and dies, study of abrasion in grinding, lapping and honing

Unit -III **12 hours**

Lubricants:
Mechanisms of lubricants, boundary, squeeze film hydrodynamic and elasto hydrodynamic and hydrostatic lubricants plasto hydrodynamic lubricants, solution of Reynolds equation in two and three-dimensional flow. Pressure distribution load carrying capacity friction forces in oil film and coefficient of friction in journal bearing. Solid lubricants types and applications

Bearing Design:
Design of bearing, Clearance in journal bearing, minimum film thickness, sommar-field number, oil grooves and flow of oil in axial and circumferential grooves cavitations and turbulence in oil bearings, Heat generation and cooling or bearing hydrostatic and dynamic and their applications in machine tools, Design of air bearing ad other gas bearing

Unit IV **12 hours**

Rolling Friction:
Reynolds's slip, concept, selection of roller bearings and their methods of lubrication design aspects and modes of bearing failures and also hydrodynamic lubrication

Solid Lubricants: Solid lubricants and its applications in metal forming processes

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Sharma, P.C. & Aggarwal, D.K. (2013). A text book Machine Design. Kataria.*

- *Powell, A. (2010). Machine Design Handbook. McGraw Hill*
- *Shigley, Mischke & Brown. (2004). Standard handbook of machine design. McGraw Hill*
- *Prabhu, B.S. (1993). Industrial Tribology, McGraw Hill*

SEMESTER: I

Course Title: QUALITY ASSURANCE & RELIABILITY ENGINEERING

Course Code: MME107

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: On successful completion of this course, the students will able to

1. Understand the basic techniques of quality improvement, fundamental knowledge of statistics and probability
2. Analysis use control charts to analyze for improving the process quality
3. Examine the defective item analysis (type of defect, frequency, number of defects), the student manager will be able to draw and justify the pareto chart to prioritize the defects
4. Comprehend the enlist and justify the four levels of benchmarking and/ or enlist and brief seven step benchmarking model
5. Analysis the concepts of reliability and maintainability

Course Content

Unit-I **11 hours**

Quality and Total Quality Management, Excellence im manufacturing/service, factors of excellence, relevance of TQM. benefits of TQM.
Concept and definition of quality, total quality control (TQC) and Total Quality Management (TQM), salient features of TQC and TQM. Total Quality Management Models,
Just-in-time (JIT): Definition: Elements, benefits, equipment layout for JIT system, Kanban system MRP (Material Requirement planning) vs JIT system, Waste elimination, workers involvement through JIT: JIT cause and effect chain, JIT implementation, Role of JIT in lean manufacturing.

Unit-II **11 hours**

Customer Satisfaction: data collection and complaint, redressal mechanism.
Planning Process: Policy development and implementation, plan formulation and implementation.
Process Management: Factors affecting process management, Quality function development (QFD), and quality assurance system.
Total Employees Involvement (TEI): Empowering employees: team building, quality circles, reward and Recognition, education and training, Suggestion schemes.

Unit-III **12 hours**

Problems solving Defining problem, Problem identification and solving process, QC tools.
Benchmarking definition, concept, process and types of benchmarking.

Unit-IV **11 hours**

Quality Systems: Concept of quality system standards: relevance and origin of ISO 9000, Benefits, Elements of ISO 9001, ISO 9002, ISO 9003.
Advanced techniques of TQM: Design of experiments: failure mode effect analysis: Taguchi methods

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Satpathy, D., & Chandra, K. (2003). Total Quality Management (TQM) in the Era of Globalization. In 21st Annual Convention and Conference Society for Information Science .*
- *Zairi, M. (2013). The TQM legacy–Gurus' contributions and theoretical impact. The TQM Journal.*
- *YEAR, B. T. S. University College of Engineering.*
- *Rezic, S., Visekruna, V., & Majstorovic, V. (2007). Planning and quality management framework at University of Mostar. Annals of DAAAM & Proceedings.*

SEMESTER: I

Course Title: COMPUTER INTEGRATED MANUFACTURING
Course Code: MME108

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: On completion of this course, the successful students should be able to

1. Understand the concepts and underlying theory of modeling and the usage of models in different engineering applications
2. Analyses Create accurate & precise geometry of complex engineering systems and use the geometric models in different engineering applications
3. Predict the different types of modeling techniques and explain the central role solid models play in the successful completion of
4. Comprehend coMMErcial CAD/CAM tools efficiently, effectively and intelligently in advanced engineering applications
5. Examine current state-of-the-art CAD/CAM technology in research

Course Content

Unit-I **10 hours**

The meaning and origin of CIM- the changing manufacturing and management scene - External communication - islands of automation and software-dedicated and open systems-manufacturing automation protocol - product related activities of a company-marketing engineering - production planning - plant operations - physical distribution- business and financial management.

Unit-II **10 hours**

Building blocks of flexible manufacturing system; Manufacturing Machines and their Design Consideration e.g. CNC Turn, CNC Mill etc., Pallet, CMM, Measuring Probes, Robots, Job Loading & Unloading Arm, Work Transfer stations, Assembly Stations, Automated Storage Retrieved System (ASRS), Material Handling Systems: Automated Guided Vehicles (AGV), Conveyers, Computer Control System. Mechatronics: Sensors, Actuators, Convertors, Modular Automation.

Unit-III **12 hours**

Shop Floor Control & Integration of Components Shop floor control-phases -factory data collection system -automatic identification methods- Bar code & RFID technology-automated data collection system, Integration of manufacturing & business functions.

Unit-IV **13 hours**

Integrated Manufacturing System: Introduction to Flexible Manufacturing Systems(FMS), different types of flexibilities in FMS, type of FMS, machining system of 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.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Groover, Mikell P. (1996). Automation, Production System and CIMS. Prentice Hall of India, New Delhi.*
- *Zeid, I. (1991). CAD/CAM theory and practice. McGraw-Hill Higher Education.*
- *Koren, Y. (1983). Computer control of manufacturing systems (pp. 134-141). New York: McGraw-Hill.*
- *Smith, G.T. (1998). CNC-Machining Techniques-Vol. 1, 2 & 3. Verlag.*
- *Ranky, P. G. (1986). Computer integrated manufacturing. Prentice-Hall Inc.*
- *Chang, Y. W., Zhu, K., Wu, G. M., Wong, D. F., & Wong, C. K. (1985). An Introduction to Automated. In Process Planning, Prentice-Hall International Series in Industrial and Systems Engineering.*

SEMESTER: I

Course Title: COMPUTER AIDED DESIGN
Course Code: MME109

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: On the successful completion of this course, the students will able to

1 Describe the different wireframe primitives using parametric representations.
2 Illustrate surface primitives using parametric modeling.
3 Create the different solid primitives using the different representation schemes.
4 Apply geometric transformations on the created wireframe, surface and solid models
5 Examine fundamental and advanced features of CNC machines

Course Content

Unit-I **10 hours**

Introduction:
Design process in general and using computers, hardware and software in CAD applications, Overview of Conventional Design, Computer's role in Design

Two and Three Dimensional Object representations:
Parametric representation of synthetic curves, spline representations, cubic spline interpolation methods, Bezier curves and surfaces, B spline curves and surfaces, conversion between spline representations

Unit –II **11 hours**

Representation of Solids:
Half spaces, boundary representation (B-rep), sweep representation, constructive solid geometry (CGS),solid manipulations.

Transformations:
Translation, Rotation, Scaling SyMMEtry and Reflection, Homogeneous Transformations.
Orthographic Projections, Axonometric Projections, Oblique Projections, Perspective Transformation.

Unit –III **12 hours**

Visual Realisation:
Basic concepts of visual realization,hiddenline removal,hidden surface removal,shading surface sand solids visibility techniques, sorting coherence, hidden line removal for curved surface.
CAD Standards:
CAD and CAM integration:

Introduction, Part production cycle, manufacturing system, process, integration requirements, process planning, tool path generation and verification, Design and Engg. applications.

Unit IV **12 hours**

Introduction to Reverse Engineering and Rapid Prototyping:
Practice on available CAD packages, computer programming for geometric modelling of curves, surfaces &solids, projects involving assemble and kinematics analysis of mechanisms, surface modelling in any available CAD package.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Groover and ZiMMEr. (1984). CAD/CAM. Prentice Hall.*
- *Zeid, Ibrahim. (1991). CAD/CAM theory and practice. New York: McGraw-Hill.*
- *Mortenson, M. E. (1985). Geometric modeling. New York: Wiley.*

SEMESTER: I

Course Title: INSTRUMENTATION & CONTROL ENGINEERING

Course Code: MME110

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: On the successful completion of this course, the students will able to

1 Understand the methods of measurement and selection of measuring instruments, standards of measurement.
2 Identify and apply various measuring instruments
3 Develop an ability of problem solving and decision making by identifying and analyzing the cause for variation and recoMMEnd suitable corrective actions for quality improvement
4 Recommend the Quality Control Techniques and Statistical Tools appropriately
5 Explain tolerance, limits of size, fits, geometric and position tolerances and gauge design

Course Content

Unit-I **11 hours**

Introduction to instrumentation and control engineering:

Classification of measuring instruments, generalized measurement system, types of inputs: Desired, interfering and modifying inputs. Static characteristics: Static calibration, Linearity, Static Sensitivity, Accuracy, Static error, Precision, Reproducibility, Threshold, Resolution, Hysteresis, Drift, Span & Range etc. Error in measurement: Types of errors, Effect of component errors on combination and distribution of combination errors on components, Probable errors.

Unit-II **10 hours**

Metrology:

Definition and concept of metrology, Standardization and standardizations, International system of units measurement, Line standard including linear standard meter, End standard, wavelength standard, Classification of standards of traceability. Interchangeability: Meaning of interchangeability, types of interchangeability, and advantages of interchangeability., Methods of measurements, standards of measurements: Standards, standards of linear

Unit-III **12 hours**

Surface Measurements:

Definition, terminology, methods of measuring surface finish, Analysis of surface traces, assessment of surface roughness as per Indian standards,

Unit-IV **12 Hours**

Mechanical Measurements:

Mechanical tachometers, vibration reed tachometer and stroboscope, proving ring, hydraulic and pneumatic load cells, torque on rotating shafts, Absorption, transmission and driving dynamo meters. Definition, terminology, methods of measuring surface finish, Analysis of surface traces, assessment of surface roughness as per Indian standards,

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Sawhney, A K. (2004). Mechanical Measurements and Instruments. Dhanpat Rai & Sons.*
- *Rangan, C. S. & Sharma G. R. (1983). Instrumentation Devices and Systems. Tata McGraw Hill.*
- *Kumar, D S. (1979). Mechanical Measurements and Control. Metropolitan publication.*

SEMESTER: I

Course Title: ADVANCE INTERNAL COMBUSTION ENGINE
Course Code: MME111

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After successful completion of this course, the students will be able to

1. Predict the operations of different IC engine and components and can evaluate the pollutant formation, control and alternate fuel.
2. Analyze the combustion process of common fuels and their basic working cycles with exhaust emission and methods to reduce them.
3. Predict the environmental, social, and technological issues related to the future widespread use of internal combustion engines.
4. Understand the design parameters like fuel-air mixtures and cycle analysis.
5. Comprehend the flow in carburetor, Intake manifolds and modern concepts like lean burn, HCCI and GDI

Course Content

Unit-I **10 hours**

Introduction

Basic characteristics of engines: Compression ratio – energy supply to an engine – power developed by engine – specific weight and specific volume – cylinder pressures – IMEP determination – torque characteristics – cylinder arrangement and their relative merits. Engine cooling systems: types of cooling – cooling of critical engine components – recooling the coolant – comparison of air cooled and liquid cooled engines.

Unit-II **11hours**

Fuel & Injection Systems

Fuel delivery in SI engines: Classification of fuel delivery systems – fuel transfer pumps – fixed jet carburetor – computer controlled carburetor – gasoline injection systems. Ignition systems in SI engines: Battery ignition system – requirements for satisfactory operation of the ignition system – ignition timing and advancing mechanisms – magneto ignition system – electronic ignition system.

Unit-III **12 hours**

Combustions in I.C. Engines

Combustion and combustion systems in CI engines: Air motion in CI engines – delay period in CI engines – types of diesel combustion systems. Scavenging and super charging in CI engines: types of scavenging systems in two stroke SI engines – improved and modified scavenging systems – super charging and engine performance – methods of super charging.

Unit-IV **12 hours**

Emissions in I.C. Engines

Engine emissions, control systems and engine developments: SI engine pollutants – exhaust gas analyzer – SI engine emission control systems – particulate emissions – diesel pollution control methods – low heat rejection engines.

Fuels for I.C. Engines

Conventional and alternate fuels for IC engines: desirable characteristics of gasoline – desirable characteristics of diesel fuel – alternative fuels for SI engines and CI engines.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Heywood John, B (1988). Internal combustion engines fundamentals. McGraw – Hill international editions.*
- *Ganesan, V (1995). Internal combustion engines. Tata McGraw Hill book cop.*
- *Obert, Edward F. (1973). Internal combustion engines and air pollutions, Intext education publishers.*
- *Stone, Richard (2004) Introduction to internal combustion engines 3rd edition. Society of automotive engineers.*

SEMESTER: II

Course Title: MATERIAL TECHNOLOGY
Course Code: MME201

L	T	P	Credits
4	0	0	4

Total Hours-60

Learning Outcomes: On the successful completion of this course, the students will able to

1 Understand the different structural materials for various engineering applications based on their properties for best performance under the specified conditions.
2 Specify property degradation and different modes of failure of materials during their application in different working environments and can suggest suitable surface modification techniques.
3 Examine nondestructive testing techniques for flaw detection in materials
4 Apply new knowledge as needed, using appropriate learning strategies
5 Develop and conduct appropriate experimentation, analyze and interpret data.

Course Content

Unit-I **15 hours**

Introduction:
Introduction to material science & engineering, Classification of engineering materials, Properties of materials, Crystal geometry and structure determination.
Mechanical Properties & Testing of Materials:
Fundamental mechanical properties, creep, fatigue and fracture processes, Factors effecting mechanical properties, destructive and non-destructive testing of materials.

Unit –II **15 hours**

Metals and Alloys:
Ferrous and non-ferrous metals, alloy system, solid solutions, Phase diagram, phase transformation, iron-carbon system, isothermal transformation – TTT diagram, Heat treatment of plain carbons steels, low alloy steels stainless steel, aluminum alloys, copper alloys and.
Ceramic Materials:
Introduction, Simple ceramic crystal structure, silicate structure, mechanical properties of ceramics.

Unit –III **15 hours**

Polymer Materials:
Polymer, broad classification, basic concept of polymer science, mechanical properties of polymers, reinforced polymers, manufacturing processes of polymer.
Nano Structural Materials:

Production methods for Carbon Nano Tubes (CNT), Properties of CNT, Advantages of Nano-materials.

Unit IV **15 hours**

Composite Materials:

Introduction, Characteristics of particles, reinforced and fibre reinforced composites.

Deterioration of Materials:

Oxidation and Corrosion, Corrosion control and corrosion resistance of alloys Wear and Erosion, effect of porosity and hardness on degradation of materials.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Sidney, H. A. (1964). Introduction to Physical Metallurgy, Mc-GrawHill, N. York.*
- *Donald, R. A & Pradeep, P. P. (2002). The science and Engineering of Materials, Thomson.*
- *Raghavan,V. (2008). Material Science & Engineering. Prentice-Hall of India (P), N. Delhi*
- *William F. Smith. (1996). Principles of Materials Science and Engineering, Mc-Graw Hill.*
- *Shirvastav, D.P.K (1995). Non-Destructive Testing Techniques. Mc-Graw Hill.*
- *Jena, A.K. & Chaturvedi, M.C. (1992). Phase Transformations in Materials. Prentice Hall.*

SEMESTER: II

COURSE TITLE: WELDING TECHNOLOGY
COURSE CODE: MME202

L	T	P	Credits
4	0	0	4

Total Hours-60

Learning Outcomes: After successful completion of this course, the students will be able to

1. Analyses metallurgical changes exist in weld metal and its effect on properties
2. Comprehend the purpose and classification of coating of the electrodes
3. Understand the various types of modes of metal transfer exist in welding processes.
4. Examine the difference between various welding processes and its industrial utilization.
5. Predict theory and mechanism of solid state welding

Course Content

Unit-I **15 Hours**

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.

Unit-II **15 Hours**

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. 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.

Unit-III

15 Hours

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. Electrode coatings, classification of coatings of electrodes for SMAW, SAW fluxes, role of flux in gradients and shielding gases, classification of solid and flux code wires.

Unit-IV **15 Hours**

Theory and mechanism of solid state welding. Techniques and scope of friction welding, diffusion welding, cold pressure welding and ultrasonic welding. High energy rate welding. Analysis of the Process. Technique, scope and application of the electron beam and laser welding processes. Under water welding - process & problem.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Parmar, R.S. (1996). Welding processes & Technology. Khanna Publishers.*
- *Nandkarni, S.V. (1998). Modern Arc Welding Technology. Oxford & IDH publishing Co.*
- *Gourd, L.M. (1980). Principles of Welding Technology, ELBS/ Edward Arnold.*
- *Richard, L. Little. (1973). Welding & Welding Technology. Mc-Graw Hill.*
- *Rossi, B.E. (1954). Welding Technology. Mc-Graw Hill.*

SEMESTER: II

COURSE TITLE: MECHATRONICS
COURSE CODE: MME203

L	T	P	Credits
4	0	0	4

Total Hours-60

Learning Outcomes: On the successful completion of this course, the students will able to

1 Construct the block diagram of any physical mechatronics device used in day-to-day life.

2 Calculate the output to input relation of any physical model in the form of a transfer function.

3 Evaluate the performance of any physical system in terms of its performance parameters.

4 Develop the mathematical model of any physical model from any engineering domain.

5 Interface the sensors and actuators of a mechatronic device to the computer/laptop.

Course Content

Unit-I **15 hours**

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

Sensors Strain Gauge, Potentiometer, Optical Encoders:
Incremental and absolute encoders, Linear variable differential transformer (LVDT), Piezoelectric, Proximity sensor, Resistance Temperature Detector, (RTD), Thermistors, Thermocouple, Hall Effect sensor,

Unit-II **15 hours**

Electronic Fundamentals:
Signal Conditioning Process, Operational Amplifier, Digital Logic, Logic Gates, Boolean Algebra, Sequential Logic, Data Acquisition Systems, Measurement Systems, Testing and Calibration.

Precision Mechanical Actuation:
Pneumatic actuation systems, electro-pneumatic actuation systems, hydraulic actuation systems, electro-hydraulic actuation systems, mechanical systems, types of motion, kinematics, inverse kinematics, timing belts, ball screw and nut, linear motion guides, linear bearings, harmonic transmission, bearings, motor/drive selection.

Unit-III **15 hours**

Electromechanical Drives:
Relays and solenoids, stepper motors, DC brushed and brushless motors, DC servo motors, AC / DC motors for non-servo motion drives, braking methods, pulse width modulated, Bipolar driver, Mosfet drives, SCR drives, variable frequency drives.

Microprocessor and Computers:

Introduction to 8085 , Architecture, programming, I/O, Computer interfacing, Function of PLC, Architecture, Components of PLC, selection of PLC, Ladder Logic diagram, Logic functions: latching, sequencing, counters, shift registers, jumpers, manipulation of data, arithmetic operations

Unit IV **15 hours**

Input/Output Systems:

Interfacing, input / output ports, interface requirements, peripheral interface adapters, serial communication interface, direct memory access.

Control System:

System transfer function, Laplace transformation and its applications, continuous and discrete processes, proportional control, integral control, differential control, PID control, digital controllers, control system performance, controller tuning, adaptive control, frequency response, PLC, PMC, introduction to fuzzy logic and neural networks.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Kamm, L.J. (1996). Understanding of Electro-Mechanical Engineering-An Introduction to Mechatronics. Prentice-HallofIndia.*
- *Koren, Y. (1983). Computer Control of Manufacturing system. McGraw Hill.*
- *Groover, M.P. (2001). Production Systems and CIM,PHI.*
- *Maleki, R.A. (1991).Flexible Manufacturing systems. Prentice Hall.*
- *Kuo, B. C. (2003). Feedback Control Systems. PHI.*

SEMESTER-II

Course Title: Mini Project
Course Code: MME204

L	T	P	Credits
0	0	2	1

Total hours: 15

Learning Outcomes: On successful completion of this course, students will be able to:

1. Engage in independent study to research literature in the identified domain
2. Consolidate the literature search to identify and formulate the engineering problem
3. Identify the community that shall benefit through the solution to the identified engineering problem and also demonstrate concern for environment
4. Demonstrate compliance to the press Cribbed standards/ safety norms through implementation of the identified engineering problem

Course Content

To achieve a desired outcome at a specific end date employing a specific amount of resources.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

SEMESTER: II

Course Title: ADVANCE CASTING PROCESSES
Course Code: MME205

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes:

On successful completion of this course, the students will be able to:

1. Understand the principles of metal casting processes and develop analytical relation between input and output process parameters.
2. Understand the concept of cooling rate of materials in metal casting.
3. Apply theoretical and experimental techniques for measurement of important outcomes of casting processes like hardness, dimensional accuracy etc.
4. Comprehend the model of casting economics and optimization and its measurement.
5. Apply the fundamentals of physics to develop theoretical relations for different types of casting processes

Course Content

UNIT I **10 Hours**

Casting Processes: Classification, characteristics of sand casting processes, metal mould casting processes and casting processes using other mould/core Materials, Pattern materials, types of patterns, Mould and core making materials and their characteristics

UNIT II **10 Hours**

Technology of Selected Casting Processes, clay bonded, oil bonded, synthetic resin bonded, and inorganic material bonded mould and core making processes. Sand additives and mould coatings. Metal mould casting processes, centrifugal and continuous casting processes.

UNIT III **12 Hours**

Nucleation and grain growth, Solidification of pure metals, short and long freezing range alloys. Rate of solidification, macrostructure and microstructure. Solidification Contraction; Fluidity and its measurement. Mould-metal interface reactions.

UNIT IV **13 Hours**

Melting and quality control of various steels and non-ferrous alloys casting defects - fettling, inspection and testing of castings. 6 Design for cast ability-process friendly design, cast ability analysis and collaborative engineering.

Casting for heterogeneous materials: FRP, quick casting, full mould casting Evaporative pattern casting

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Flinn, R.A.(1963). Fundamentals of Metals Casting. Addison Wesley.*
- *Heine, R.W.(1967). Principles of Metal Casting. Tata McGraw Hill.*
- *Niebel, B.W.& Draper, A.B.(1974). Product Design & Process Engineering. Tata McGraw Hill.*
- *ASME (1988). Metals Handbook- Metal Casting. ASM International.*

SEMESTER: II

Course Title: COMPOSITE MATERIAL
Course Code: MME206

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: On the successful completion of this course, the students will able to

1 Identify the properties of fiber and matrix materials used in coMMErcial composites, as well as some common manufacturing techniques.
2 Predict the elastic properties of both long and short fiber composites based on the constituent properties.
3 Relate stress, strain and stiffness tensors using ideas from matrix algebra.
4 Analyze a laminated plate in bending, including finding laminate properties from lamina properties.
5 Predict the failure strength of a laminated composite plate.

Course Content

Unit-I **10 hours**

Introduction:

Definitions, Composites, Reinforcements and matrices, Types of reinforcements, Types of matrices, Types of composites, Carbon Fibre composites, Properties of composites in comparison with standard materials, Applications of metal, ceramic and polymer matrix composites.

Unit-II **11 hours**

Manufacturing methods:

Hand and spray lay - up, injection molding, resin injection, filament winding, pultrusion, centrifugal casting and prepregs. Fibre/Matrix Interface, mechanical. Measurement of interface strength. Characterization of systems; carbon fibre/epoxy, glass fibre/polyester, etc.

requirements planning, capacity planning, shop floor control and operation scheduling.

Unit-III **12hours**

Mechanical Properties -Stiffness and Strength:

Geometrical aspects – volume and weight fraction. Unidirectional continuous fibre, discontinuous fibers, Short fiber systems, woven reinforcements –Mechanical Testing: Determination of stiffness and strengths of unidirectional composites; tension, compression, flexure and shear

Unit-IV **12 hours**

Laminates:

Plate Stiffness and Compliance, Assumptions, Strains, Stress Resultants, Plate Stiffness and Compliance, Computation of Stresses, Types of Laminates -, SyMMEtric Laminates, AntisyMMEtric Laminate, Balanced Laminate, Quasi-isotropic Laminates, Cross-ply Laminate, Angleply Laminate. Orthotropic Laminate, Laminate Moduli, Hygro thermal Stresses.

Joining Methods and Failure Theories:

Joining –Advantages and disadvantages of adhesive and mechanically fastened joints. Typical bond strengths and test procedures.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *ASM hand book. (2019). Materials characterization. Vol. 10. ASM International*
- *Dieter, G.(2017). Mechanical Metallurgy (3rd Edition). Tata McGraw Hill.*
- *Speyer, R.F.(1994). Thermal Analysis of Materials. Marcel Decker.*
- *Bhargava, A.K.(2012). Engineering Materials: Polymers, Ceramics and Composites(2nd Edition). Prentice Hall India.*

SEMESTER: II

Course Title: MODELLING & SIMULATION of MECHANICAL SYSTEMS
Course Code: MME207

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: On the successful completion of this course, the students will able to

1. model of rigid bodies, structural systems, hydraulic systems, thermal systems, electronic and mechatronic systems.
2. understand and model mechanisms, manipulators, vehicles etc.
3. analyze and model of different control strategies in physical domain.
4. model welding dynamics and plant water dynamics.
5. realize thermal modelling of twin tube shock absorber and car cabin exposed to sunlight.

Course Content

Unit-I **10 hours**

Introduction: Introduction to bond graphs, Power variables of bond graphs and models of simple circuits, Reference power directions, Bond graph elements and their constitutive relations, Causality, Generation of system equations from bond graph models. The Idea of activation.

Unit-II **11 hours**

System Modelling: Modelling of a system of rigid bodies, structural systems, Hydraulic systems, Thermal systems, electronic and mechatronic systems.

Unit-III **12 hours**

Modelling of multi body systems: mechanisms, parallel and hybrid manipulators and vehicles

Advanced topics in bond graph modelling of physical systems: Elements of multi-bond graphs, Thermo-mechanical bond graphs and continuous systems, bond graph for welding dynamics and plant water dynamics, thermal modelling of twin tube shock absorber and car cabin exposed to sunlight

Unit-IV **12 hours**

Control System: Modelling systems for control strategies and design of control strategies in physical domain. Numerical prototyping as modelling for design and synthesis using computational tools like SYMBOLS, MATLAB etc.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Mukherjee, R. Karmakar, A.K. Samantaray, Bond Graph in Modeling, Simulation and fault Identification, CRC Press, FL (2006).*
- *D.C. Karnopp, D.L. Margolis, R.C. Rosenberg, System Dynamics, Modeling and Simulation of Mechatronic Systems, John Wiley & Sons, N, (2000).*

- *B Ould Bouamama , J Thoma , Jean U Thom, Modelling and Simulation in Thermal and Chemical Engineering: A Bond Graph Approach, Springer, New York (2000).*

SEMESTER: II

Course Title: ADDITIVE MANUFACTURING PROCESSES
Course Code: MME208

L	T	P	Credits
3	0	0	3

Total Hours- 45

Learning Outcomes:

On successful completion of this course, the students will be able to:

1. Understand the working principle and process parameters of AM processes
2. Explore the applications of AM processes in various fields
3. Select the suitable material and process for fabricating a given product
4. Apply the knowledge in Material science in Additive Manufacturing Components.

Course Content

UNIT I **10 Hours**

Introduction to Additive Manufacturing: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Steps in AM, Classification of AM processes, Advantages of AM and Types of materials for AM. Vat Photo polymerization AM Processes: Stereo lithography (SL), Materials, Process Modelling, SL resin curing process, SL scan patterns, Micro-stereo lithography, Mask Projection Processes, Two-Photon vat photo polymerization, Process Benefits and Drawbacks, Applications of Vat Photo polymerization, Material Jetting and Binder Jetting AM Processes.

UNIT II **10 Hours**

Extrusion - Based AM Processes: Fused Deposition Modelling (FDM), Principles, Materials, Process Modelling, Plotting and path control, Bio Extrusion, Contour Crafting, Process Benefits and Drawbacks, Applications of Extrusion-Based Processes. Sheet Lamination AM Processes: Bonding Mechanisms, Materials, Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Gluing, Thermal bonding, LOM and UC applications

UNIT III **12 Hours**

Powder Bed Fusion AM Processes: Selective laser Sintering (SLS), Materials, Powder fusion mechanism and powder handling, Process 11 Modelling, SLS Metal and ceramic part creation, Electron Beam melting (EBM), Process Benefits and Drawbacks, Applications of Powder Bed Fusion Processes.

UNIT IV **13 Hours**

Directed Energy Deposition AM Processes: Process Description, Material Delivery, Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Electron Beam Based Metal Deposition, Processing-structure properties, relationships, Benefits and drawbacks, Applications of Directed Energy Deposition Processes. Materials science for AM - Multifunctional and graded materials in AM, Role of solidification rate, Evolution of non equilibrium structure, microstructural studies, Structure property relationship.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing", 2nd Edition, Springer, 2015.*
- *Patri K. Venuvinod and Weiyin Ma, "Rapid Prototyping: Laser-based and Other Technologies", Springer, 2004.*
- *Chua Chee Kai, Leong Kah Fai, "3D Printing and Additive Manufacturing: Principles & Applications", 4th Edition, World Scientific, 2015.*

- *D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer 2001.*

SEMESTER: II

Course Title: THEORY OF CUTTING & MACHINE DESIGN
Course Code: MME209

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After successful completion of this course, the students will be able to

1. Understand Cutting forces, Chip formation, merchant's circle diagram and calculation.
2. Analyses metal Cutting machine Tools, Kinematics of machine tools and basic Principles of machine Tool Design.
3. Comprehend design considerations of electrical, mechanical and hydraulic drives in machine
4. Understand anti friction bearings and sliding bearings..
5. Predict automation, testing and Standardization for machine tools

Course Content

Unit-I **10 Hours**

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.
Introduction To Machine Tool Design: Introduction to Metal Cutting Machine Tools, Kinematics of machine tools, Basic Principles of machine Tool Design.

Unit-II **11 Hours**

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.
Design of Machine Tool Structures: Principles, materials, static & dynamic stiffness, Shapes of Machine tool Structures. Design of beds, columns, housings, tables, ram etc.

Unit-III **12 Hours**

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.
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.

Unit-IV **12 Hours**

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.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Juneja, B.L. & Sekhon, G.S, (1980). Fundamentals of metal cutting and machine tools. New Age International (P) Ltd., N. Delhi*
- *Shaw, M.C. (2000). Metal Cutting Principles. Oxford Clarendon Press.*
- *Bhattacharya, A.S. (2002). Metal Cutting Theory and Practice. New Central Book Agency(P) Ltd, Calcutta.*
- *Arshinov & Alel rev. (2004). Metal Cutting Theory and Cutting Tool Design. MIR Publishers, Moscow.*
- *Mehta, N.K. (1995). Machine Tool Design. Tata Mc-Graw Hill, N. Delhi*

SEMESTER: II

Course Title: INDUSTRIAL AUTOMATION & ROBOTICS
Course Code: MME210

L	T	P	Credits
3	0	0	3

Total Hours-28

Learning Outcomes: After successful completion of this course, the students will be able to

1. Analyses design and implement automated systems using pneumatics
2. Understand hydraulic solutions for designing automated systems.
3. Comprehend devise assembly automated systems using feeders, orienters and escapement devices.
4. Predict design and implement electro-pneumatic/hydraulic solutions for automated systems.
5. Examine skills in performing spatial transformations associated with rigid body motions.

Course Content

Unit-I

10 Hours

Concept of automation in industry, mechanization and automation, classification of automation systems. Difference between hard automation and robotic automation.
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.

Unit-II

10 Hours

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

Unit-III

8 Hours

Introduction to robot technology- robot physical configuration and basic robot motions
Types of manipulators- constructional features, servo and non servo manipulators.

Unit-IV

10 Hours

Feedback systems and sensors- encoders and other feed back systems, vision, ranging systems, tactile sensors
Concept of spatial desecrations and transformations, manipulator kinematics, Inverse manipulator, Kinematics Jacobians, Velocity and static forces, manipulator dynamics

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Craig, Johon. (1998). introduction to Robotics. Pearson Education.*
- *Niku, Saeed. B. (2000). Introduction to Robotics. Pearson Education Asia.*
- *Parr, Andrew. (1999) Hydraulics and Pnematics. Jaico Publishing House,*
- *Dudleyt, A. Pease and John J. Pippenger, " Basic Fluid Power ", Prentice Hall,*
- *Anthony, Esposite. (1980). Fluid Power with Applications. Prentice Hall.*

SEMESTER: II

Course Title: ENGLISH for RESEARCH PAPER WRITING
Course Code: MME211

L	T	P	Credits
2	0	0	2

Total Hours-30

Learning Outcomes: After successful completion of this course, the students will be able to

1. Understand professional writing by studying management communication contexts and genres, researching contemporary business topics, analyzing quantifiable.
2. Examine the formal elements of specific genres of organizational communication: white papers, recoMMEndation and analytical reports, proposals, memorandums, web pages, wikis, blogs, business letters, and promotional documents.
3. Understand how to critically analyze data from research; incorporate it into assigned writing clearly, concisely, and logically; and attribute the source with proper citation.
4. Comprehend the ethical, international, social, and professional constraints of audience, style, and content for writing situations

Course Content

Unit-I **8 Hours**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit-II **6 Hours**

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

Unit-III **8 Hours**

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, and skills are needed when writing the Conclusions

Unit-IV **8 Hours**

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Goldbort, R. (2008). Writing for science. Yale university press.*
- *Day, R. (2013). Bringing extensive reading into the classroom-Into the Classroom. Oxford University Press*
- *3Highman, N. (1998). Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.*

SEMESTER: II

Course Title: VALUE EDUCATION
Course Code: MME212

L	T	P	Credits
2	0	0	2

Total Hours-30

Learning Outcomes: After successful completion of this course, the students will be able to

1. Understand value of education and self- development
2. Predict the good values in students
3. Examine about the importance of character
4. Comprehend the essential steps to become good leaders

Course Content

Unit-I **8 Hours**

Values and self-development
Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements

Unit-II **6 Hours**
Importance of cultivation of values.
Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism, Love for nature, Discipline

Unit-III **8 Hours**
Personality and Behavior Development
Soul and Scientific attitude. Doing best for saving nature Association and Cooperation. Aware of self-destructive habits. Happiness Vs suffering, love for truth. True friendship. Universal brotherhood and religious tolerance. Free from anger, Dignity of labour. Avoid fault Thinking. Punctuality, Love and Kindness. Positive Thinking. Integrity and discipline.

Unit-IV **8 Hours**
Character and Competence
Holy books vs. Blind faith. Honesty, studying effectively. Mind your Mind, Self-control. All religions and same message. Equality, Nonviolence, Humility, Role of Women. Science of reincarnation. Self-management and Good health.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Chatterjee, S. R. (1997). Values and Ethics for Organizations: Theory and Practice. The Asia Pacific Journal of Economics & Business.*

SEMESTER: II

Course Title: PEDAGOGY STUDIES
Course Code: MME213

L	T	P	Credits
2	0	0	2

Total Hours-30

Learning Outcomes: After successful completion of this course, the students will be able to

1. Understand nature of education and pedagogic processes through enriched experiences.
2. Comprehend content analysis in subject areas and use it for facilitating learning in the classroom.
3. Examine various educational issues in the context of diverse socio cultural & Multilingual Indian Society
4. Predict the difference between theory and practice by dovetailing both appropriately.
5. Identify critical evidence gaps to guide the development.

Course Content

Unit-I **8 Hours**

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and0 terminology Theories of learning, Curriculum, Teacher education. Overview of methodology and Searching Conceptual framework, Research questions.

Unit-II **6 Hours**

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

Unit-III **8 Hours** Evidence on the effectiveness of pedagogical practices. How can teacher education (curriculum and practicum) and the school curriculum. Methodology for the in depth stage: quality assessment of included studies. Teachers' attitudes and beliefs and Pedagogic strategies. Pedagogic theory and pedagogical approaches. Strength and nature of the body of evidence for effective pedagogical practices. Theory of change and guidance materials best support effective pedagogy.

Unit-IV **8 Hours**

Professional development: alignment with classroom practices and follow- up. Peer support. Support from the head teacher and the community. Barriers to learning: limited resources and large class sizes. Curriculum and assessment.

Research gaps and future directions Research design, Contexts, Pedagogy, Teacher education, Dissemination and research impact. Curriculum and assessment.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested reading

- *Ackers, J., & Hardman, F. (2001). Classroom interaction in Kenyan primary schools. Compare: a journal of comparative and international education, 31(2), 245-261.*
- *2.Agrawal, M. (2004). Curricular reform in schools: the importance of evaluation. Journal of curriculum studies, 36(3), 361-379.*
- *Akyeampong, K. (2003). Teacher Training in Ghana-Does it Count? Multi-Site Teacher Education Research Project (MUSTER), Country Report One (No. 666-2016-45498).*

SEMESTER: III

COURSE TITLE: RESEARCH METHODOLOGY
COURSE CODE: MME301

L	T	P	Credits
4	0	0	4

Total Hours-60

Learning Outcomes: On the successful completion of this course, the students will able to

1 Examine various kinds of research, objectives of doing research, research process, research designs and sampling.
2 Predict basic knowledge on qualitative research techniques
3 Examine the scaling techniques as well as the quantitative data analysis
4 Predict data analysis-and hypothesis testing procedures
5 Organize and conduct research (advanced project) in a more appropriate manner

Course Content

UNIT-I **12 Hours**

Research: its concept, nature, scope, need and Objectives of Research, Research types, Research methodology, Research process – Flow chart, description of various steps, Selection of research problem.

UNIT-II **15 Hours**

Research Design: Meaning, Objectives and Strategies of research, different research designs, important experimental designs,Types of data collection and classification, Observation method, Interview Method, Collection of data through Questionnaires, Schedules, data analysis and interpretation, editing, coding, content analysis and tabulation

UNIT-III **17 Hours**

Sampling Methods:
Different methods of Sampling: Probability Sampling methods, Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling and Multistage Sampling. Non probability Sampling methods, Sample size.

UNIT-IV **15 Hours**

Introduction to Intellectual Property Rights: Concept & theories, Kinds of intellectual Property Rights, Advantages & Disadvantages of IPR, Development of IPR in India, Role & Liabilities of IPRs in India.

Report writing and Presentation: Types of reports, Report Format – Cover page, Introductory page, Text, Bibliography, Appendices, Typing instructions, Oral Presentation

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Panneerselvam, R , 'Research Methodology', PHI, New Delhi.*
- *Cooper, D.R.,Schindler,P.S., 'Business Research Methods,' Tata McGraw Hill*
- *Gupta S P,' Statistical Methods', Sultan Chand & Sons, Delhi*
- *Ronald E Walpole, 'Probability and Statistics for Engineers and Scientists' (International Edition) , Pearson Education.*
- *Geode, Millian J. & Paul K. Hatl, "Methods in Research", McGraw Hills, New Delhi*
- *Kothari C.R., "Research Methodology", New Age Publisher*
- *Nargundkar R, Marketing Research, Tata McGraw Hill, New Delhi, 2002.*
- *Sekran, Uma, "Business Research Method", Miley Education, Singapore*
- *Law Relating to Intellectual Property Rights" by V K Ahuja*
- *Intellectual Property Rights" by Neeraj Pandey and Khushdeep Dharni*

Website/Links/Online Portal/ICT

- *https://www.academia.edu/*
- *https://www.studeersnel.nl*
- *https://www.scribd.com*

SEMESTR-III

Course Title: Dissertation Phase-I
Course Code: MME302

L	T	P	Credits
0	0	0	10

Total hours: 30

Learning Outcomes: On successful completion of this course, students will be able to:

1. To apply knowledge of recent technologies, skills and current tools of mechanical engineering.
2. To design and conduct experiments, as well as to analyze data.
3. To understand the contemporary research issues in the different areas of mechanical engineering.
4. To explore research gaps, analyze and carry out research in the specialized/emerging areas.

Course Content

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations with implementation tools with suitable platform.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

SEMESTR-III

Course Title: RAPID PROTOTYPING
Course Code: MME303

L	T	P	Credits
3	0	0	3

Total Hours -45

Learning Outcomes: On completion of this course, the successful students should be able to:

1. Analyses types of prototype, need for the compression in product development
2. Understand principle, process parameter, process details, data preparation, data files and machine details, application.
3. Predict thermal jet printer, sander's model market, 3-D printer, Genisys Xs printer HP system
4. Comprehend indirect rapid tooling -Silicon rubber tooling.
5. Examine Principle of operation, machine details, applications, laminated object manufacturing.

Course Contents

UNIT I **10 Hours**

Introduction: Definition of Prototype, Types of prototype, Need for the compression in product development, History of RP systems, Survey of applications, Growth of RP industry, classification of RP systems. Stereo lithography Systems: Principle, Process parameter, process details, Data preparation, data files and machine details, Application.

UNIT II **12 Hours**

Selective Laser Sintering: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications, FUSION DEPOSITION MODELLING: Principle, Process parameter, Path generation, Applications.

UNIT III **12 Hours**

Solid Ground Curing: Principle of operation, Machine details, Applications, Laminated Object Manufacturing: Principle, of operation, LOM materials, process details, application. Concepts Modelers: Principle, Thermal jet printer, Sander's model market, 3-D printer, Genisys Xs printer HP system 5, object Quadra systems, Laser Engineering Net Shaping (LENS)

UNIT VI **11 Hours**

Rapid Tooling : Indirect Rapid tooling -Silicon rubber tooling —Aluminum filled epoxy tooling Spray metal tooling ,Cast kirksite, 3D keltool etc. Direct Rapid Tooling — Direct, AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, Pro Metal ,Sand casting tooling ,Laminate tooling soft Tooling vs. hard tooling.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Paul F. Jacobs & Stereo lithography (1996). RP & M Technologies. SME NY,*
- *Flham D.T & Dinjoy S.S. (2001). Rapid Manufacturing. Verlog London.*
- *Terry Wohler. (2000). Wohler's Report. Wohler's Association.*

SEMESTR-III

Course Title: MACHINE TOOL DESIGN
Course Code: MME304

L	T	P	Credits
3	0	0	3

Total Hours -45

Learning Outcomes: On completion of this course, the successful students should be able to:

1. Understand cutting tool geometry, mechanism of chip formation and mechanism of orthogonal cutting.
2. Analyze conventional design, computer's role in design.
3. Comprehend design locating and clamping device to produce a component.
4. Examine a machining oper4atiopn and corresponding machine tool for specific application in real time.
5. Understand the computer controlled manufacturing.

Course Contents

UNIT I **10 Hours**

Introduction To Machine Tool Design: Introduction to Metal Cutting Machine Tools, Kinematics of machine tools, Basic Principles of machine Tool Design.

UNIT II **10 Hours**

Design of Machine Tool Structures: Principles, materials, static & dynamic stiffness, Shapes of Machine tool Structures. Design of beds, columns, housings, tables, ram etc.

UNIT III **12 Hours**

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.

UNIT VI **13 Hours**

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.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Juneja, B.L. & Sekhon, G.S, (1980). Fundamentals of metal cutting and machine tools. New Age International (P) Ltd., N. Delhi*
- *Shaw, M.C. (2000). Metal Cutting Principles. Oxford Clarendon Press.*
- *Arshinov & Alelrev. (2004). Metal Cutting Theory and Cutting Tool Design. MIR Publishers, Moscow.*
- *Mehta, N.K. (1995). Machine Tool Design. Tata Mc-Graw Hill, N. Delhi*

SEMESTR-III

Course Title: METAL FORMING
Course Code: MME305

L	T	P	Credits
3	0	0	3

Total Hours -45

Learning Outcomes: On completion of this course, the successful students should be able to:

1. Understand elementary theory of plasticity, stress / strain / strain-rate characteristics of materials
2. Analyze rolling, process parameters, pressure distribution and roll separating force.
3. Comprehend forces in strip forging and disc forging, defects in forged components.
4. Examine deep drawing force analysis, defects in drawn components.
5. Predict extrusion Process, parameters, determination of work load from stress analysis

Course Contents

UNIT I **10 Hours**

Classification of Metal Forming Processes: Elementary theory of plasticity, stress / strain / strain-rate characteristics of materials, yield criteria of metals, formability.
Mechanics of Forming Process: Rolling, process parameters, pressure distribution and roll separating force, rolling pressure, driving torque and power requirements.

UNIT II **13 Hours**

Forging: Determination of forces in strip forging and disc forging, defects in forged components.
Drawing**:** Drawing stresses, limiting draw ratio, factors affecting drawability determination of force and power in wire drawing, determination of maximum allowable reduction, deep drawing force analysis. Defects in drawn components.

UNIT III **11 Hours**

Bending: Bendability, determination of work load and spring back.
Extrusion: Process, parameters, determination of work load from stress analysis and energy considerations, power loss, hydrostatic extrusion, pressure required to extrude, variables affecting the process.

UNIT VI **11 Hours**

Punching & Blanking: Two-dimensional deformation model and fracture analysis, determination of working force.
High Energy Rate Forming: Classification, comparison of conventional and high speed forming, Introduction to High Energy Rate Forming Processes (HERF).

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Rowe J. W. (2005). An Introduction to the Principles of Industrial Metal Working. Edward Arnold, London.*
- *Juneja, B. L. (2007). Fundamentals of Metal Forming Processes, New Age International Publishers, N. Delhi.*
- *Avitzur,(1998). Metal Forming Analysis. McGraw Hill, New York*
- *Johnson & Millore. (2002). Plasticity for Mechanical Engineers. Van Nostrand, London*
- *Ghosh & Malik. (2000). Manufacturing Science Affiliated East-West Press, New Delhi.*

SEMESTER-IV

Course Title: Dissertation Phase-II
Course Code: MME401

L	T	P	Credits
0	0	0	20

Learning Outcomes: On successful completion of this course, the students will able to:

Total hours: 300

1. Create, analyze and critically evaluate different technical solutions.
2. Analyze the consciousness critically of the ethical aspects of research and development work.
3. Create analyze and evaluate different technical.
4. Explain the capability of critically and systematically integrate knowledge.

Course Content

The dissertation will normally contain:

1. A clear indication, at appropriate stages, of original and critically elements. The level of originality expected is likely to include the application of existing techniques to new environments, the use of original materials, the re-working of existing materials, and the Use of comparative approaches to the provision of information technology;

2. A discussion of its scope and aims, and its theoretical and professional significance, including discussion of the context in which the problem is seen as important;

3. An analysis of the topic within a critically review of the relevant literature;

4. An evaluation of methods used in the dissertation, their reliability, validity, and a comparison with alternative methods;

5. An account of the process of obtaining the data required for the dissertation and the results obtained;

6. An analysis of the results of the dissertation to include a discussion of their significance, their relationship to other research, and any methodological or theoretical implications;

7. The relationship of the findings to existing professional understanding and, where Appropriate, potential implementation difficulties. It is not intended to restrict students to a precisely defined format for the dissertation but it should follow the

standard practices of dissertation writing. Although a written report will normally be expected, it should be accompanied by soft copy on CD.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning