PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018

(AUTONOMOUS)

B.E- MECHANICAL ENGINEERING

REGULATIONS – 2015

CURRICULUM

SEMESTER VII

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	ME15701	Mechatronics	3	0	0	3
2	PC	ME15702	Computer Integrated Manufacturing Systems	3	0	0	3
3	PC	ME15703	Automobile Engineering	3	0	0	3
4	HS	BA15151	Professional Ethics and Human Values	3	0	0	3
5	PE	ME1535*	Programme Elective – III	3	0	0	3
6	PE	ME1545*	Programme Elective – IV	3	0	0	3
Practical							
7	PC	ME15704	Mechatronics Laboratory	0	0	2	1
8	PC	ME15705	Computer Aided Manufacturing Laboratory	0	0	2	1
9	EE	ME15706	Project Work (Phase I)	0	0	4	2
			Total	**18**	**0**	**8**	**22**

SEMESTER VIII

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	BA15253	Total Quality Management	3	0	0	3
2	PE	ME1555*	Programme Elective – V	3	0	0	3
3	PE	ME1565*	Programme Elective – VI	3	0	0	3
Practical							
4	EE	ME15801	Project Work (Phase II)	0	0	12	6
			Total	**9**	**0**	**12**	**15**

LIST OF ELECTIVES

PROGRAMME ELECTIVE – III

S.No.	Course Code	Course Title	L	T	P	C
1	ME15351	Maintenance Engineering	3	0	0	3
2	ME15352	Non Destructive Evaluation Techniques	3	0	0	3
3	ME15353	Design of Jigs, Fixtures and Press Tools	3	0	0	3
4	ME15354	Micro Electro Mechanical Systems	3	0	0	3
5	ME15355	Introduction to Aircraft Systems	3	0	0	3

PROGRAMME ELECTIVE – IV

S.No.	Course Code	Course Title	L	T	P	C
1	ME15451	Plant Layout and Material Handling	3	0	0	3
2	ME15452	Productive Management and Re-engineering	3	0	0	3
3	ME15453	Tool Design	3	0	0	3
4	ME15454	Welding Technology	3	0	0	3
5	ME15455	Quality Control and Reliability Engineering	3	0	0	3

PROGRAMME ELECTIVE – V

S.No.	Course Code	Course Title	L	T	P	C
1	ME15551	Computational Fluid Dynamics	3	0	0	3
2	ME15552	Production Planning and Control	3	0	0	3
3	ME15553	Refrigeration and Air Conditioning	3	0	0	3
4	ME15554	Industrial Tribology	3	0	0	3
5	ME15555	Vibration and Noise Control	3	0	0	3

PROGRAMME ELECTIVE – VI

S.No.	Course Code	Course Title	L	T	P	C
1	BA15451	Entrepreneurship Development	3	0	0	3
2	ME15651	Safety in Engineering Industry	3	0	0	3
3	ME15652	Energy Conservation and Management	3	0	0	3
4	ME15653	Industrial Psychology and Work Ethics	3	0	0	3
5	ME15654	Advanced I.C. Engines	3	0	0	3

ME15701 **MECHATRONICS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the structural and functional principles of sensors and transducers used for various physical and nonelectric quantities and how to use them to measure these quantities.
- describe the constructional and functional aspects of mechanical actuators and stepper and servo motors
- get a precise idea about the system structural models and working of controllers
- learn structure and processing of PLC
- gain knowledge about the elements and techniques involved in Mechatronic systems which are very much essential to understand the emerging field of automation.

UNIT I MECHATRONICS, SENSORS AND TRANSDUCERS 9

Introduction to Mechatronics Systems – Measurement Systems – Control Systems. Sensors and Transducers - Performance Terminology – Potentiometer displacement sensor - Inductive displacement sensor - Hall effect sensor- Photoelectric sensor - Eddy current Proximity sensor. Tacho - generator-Strain gauge load cell, Orifice meter, Differential pressure liquid level detector, Resistant temperature detector, Photodiode and Photo transistor light sensors. Selection of Sensors.

UNIT II ACTUATION SYSTEMS 9

Pneumatic and Hydraulic Systems – Rotary Actuators. Mechanical Actuation Systems - Cams- Ratchet and pawl- Belt and Chain Drives. Stepper Motors - switching circuitries for stepper motor – AC & DC Servo motors. Mechanical Switches-Solid State Switches-Diode-SCR-TRIAC.

UNIT III SYSTEM MODELS AND CONTROLLERS 9

Building blocks of Mechanical, Fluid and Thermal Systems, Rotational – Electromechanical Systems- Hydraulic – Mechanical Systems. Continuous and discrete process Controllers – Control Mode – Two – Step mode - Proportional Mode – Derivative Mode – Integral Mode – PID Controllers- Digital Controllers – Velocity Control – Adaptive Control - Architecture of 8085 and 8051.

UNIT IV PROGRAMMING LOGIC CONTROLLERS 9

Programmable Logic Controllers – Basic Structure – Input / Output Processing –Programming – Mnemonics – Internal relays and counters – Shift Registers –Master and Jump Controls – Data Handling – Analogs Input / Output – Selection of a PLC.

UNIT V DESIGN OF MECHATRONICS SYSTEM 9

Stages in designing Mechatronics Systems – Traditional and Mechatronic Design – Possible Design Solutions. Case studies of Mechatronics systems- Pick and place Robot- Wireless surveillance balloon - Engine Management system- Automatic car park barrier.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of the course, students will be able to

- design components and systems to integrate computers, sensors and transducers in mechanical system to meet desired needs.
- have a strong foundation in actuators and fundamental operations of stepper and servo motors in the field of engineering and technology.
- design experiments to evaluate system performance with respect to specifications.
- integrate PLC with Mechanical, Electronic and computer engineering components in the design of mechatronics system.
- develop mechatronics systems for various engineering applications.

TEXT BOOKS

1. Bolton,W, "Mechatronics" , Pearson education, Sixth edition, 2015
2. Smaili.A and Mrad.F, "Mechatronics integrated technologies for intelligent machines", Oxford University Press, 2008.

REFERENCES

1. Rajput. R.K, "A Textbook of Mechatronics", S. Chand & Co, Fourth edition, 2014
2. Michael B. Histand and David G. Alciatore, "Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, Third Edition, 2006.
3. Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, "Mechatronics", Chapman and Hall,1993.
4. Dan Necsulesu, "Mechatronics", Pearson Education Asia, 2002 (Indian Reprint).
5. Devadas Shetty and Richard A.Kolk, "Mechatronics systems design", PWS Publishing company, 2007.

WEB LINKS

1. http://nptel.ac.in/downloads/112103174/
2. https://www.youtube.com/watch?v=qalDDp5V3ek
3. https://www.youtube.com/watch?v=PLYosK87D8E

CO-PO Mapping

COs	Mapping of Course outcomes with Programme outcomes **(1/2/3 indicates strength of correlation)3-Strong, 2-Medium, 1-Weak**													
	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	1	-	-	-	-	-	-	-	-	-	2	2
CO2	2	-	1	-	-	-	-	-	-	-	-	-	2	2
CO3	2	-	1	-	-	-	-	-	-	-	-	-	2	2
CO4	2	-	1	-	-	-	-	-	-	-	-	-	2	2
CO5	2	-	1	-	-	-	-	-	-	-	-	-	2	2

ME15702 COMPUTER INTEGRATED MANUFACTURING SYSTEMS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the integration concept of CAD/CAM, Production planning and control under CIM.
- familiarize the principles of computer aided process planning, Inventory control, MRP and ERP.
- gain knowledge on the design of a manufacturing cell and the elements of cellular manufacturing system.
- learn about the components of Flexible Manufacturing System and AGVs.
- understand the basic concepts of robots, robot anatomy and its industrial applications.

UNIT I INTRODUCTION 10

Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM – Concurrent Engineering-CIM concepts – Computerized elements of CIM system –Types of production – Manufacturing models and Metrics – Mathematical models of Production Performance – Manufacturing Control – Basic Elements of an Automated system – Levels of Automation – Lean production and Just-In-Time Production.

UNIT II PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING 10

Process planning – Computer aided process planning (CAPP) - Logical steps in computer aided process planning- Aggregate Production Planning and the Master Production Schedule - Material Requirement planning - Capacity Planning - Control Systems - Shop Floor Control - Inventory Control - Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP).

UNIT III CELLULAR MANUFACTURING 9

Group Technologies(GT), Part families - Parts Classification and coding - Opitz Part Coding System - Production flow Analysis - Cellular Manufacturing - Composite part concept - Machine cell design and Layout - Quantitative analysis in Cellular Manufacturing - Rank Order Clustering Method - Arranging Machines in a GT cell - Hollier Method – Simple Problems.

UNIT I V FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS) 8

Types of Flexibility - FMS – FMS Components - FMS Application & Benefits - FMS Planning and Control– Quantitative analysis in FMS - Automated Guided Vehicle System (AGVS) – AGVS Application– Vehicle Guidance technology -Vehicle Management & Safety.

UNIT V INDUSTRIAL ROBOTICS 8

Robot Anatomy and Related Attributes - Classification of Robots - Robot Control systems - End Effectors - Sensors in Robotics – Robot Accuracy and Repeatability - Industrial Robot Applications - Robot Part Programming.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of the course, students will be able to

- describe the importance and scope of CIM in fabrication/ manufacturing industries.
- prepare CAPP (Computer Aided Process Planning) for manufacturing processes.
- demonstrate implementation of cellular manufacturing system in industries.
- explain about FMS, AGVs and its applications.
- develop robots and its components for different applications.

TEXT BOOKS

1. Mikell.P.Groover, "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India, 2016.
2. Radhakrishnan P, Subramanyan S. and Raju V., "CAD/CAM/CIM", 2nd Edition, New Age International (P)Ltd, New Delhi, 2008.

REFERENCES

1. Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall India, 2003.
2. Gideon Halevi and Roland Weill, "Principles of Process Planning – A Logical Approach", Londo
3. Rao. P. N Tewari & T.K. Kundra, "Computer Aided Manufacturing", Tata McGraw Hill Publishing Company, 2000.
4. James A. Rehg, "Introduction to Robotics in CIM Systems", Prentice Hall, 5th edition, 2002.
5. Singh. N, "Systems Approach to Computer-Integrated Design and Manufacturing", Wiley India Pvt Ltd., 2011.

WEB LINKS

1. http://www.me.nchu.edu.tw/lab/CIM/www/courses/Computer%20Integrated%20Manufacturing/Chapter2%20-CIM-introduction.pdf.
2. https://www.slideshare.net/suraj_21/computer-integrated-manufacturing.
3. ieeexplore.ieee.org/document/718241.

CO-PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	2	-	-	2	-	-	-	1	1	1	2
CO2	2	-	-	2	-	-	2	-	-	-	1	1	1	2
CO3	2	-	-	2	-	-	2	-	-	-	1	1	1	2
CO4	2	-	-	2	-	-	2	-	-	-	1	1	1	2
CO5	2	-	-	2	-	-	2	-	-	-	1	1	1	2

ME15703 AUTOMOBILE ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the construction and working principles of various parts of an automobile
- have clear understanding of different auxiliary systems.
- gain knowledge about different types of transmission systems
- learn the concepts and working principles of steering, brakes and suspension systems
- acquire knowledge on alternate energy sources in automobiles.

UNIT I VEHICLE STRUCTURE AND ENGINES 10

Types of Automobiles, Vehicle Construction and different layouts, Chassis, Frame and Body, Vehicle Aerodynamics (various resistances and moments involved), IC engines – components - functions and materials, variable valve timing (VVT)

UNIT II ENGINE AUXILIARY SYSTEMS 10

Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and CRDI system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine Emission control by 3- Way catalytic convertor system, Emission norms (Euro and BS).

UNIT III TRANSMISSION SYSTEMS 10

Clutch – Types and Construction, Gear Boxes - Manual and Automatic, Gear Shift Mechanisms – Over Drive, Transfer Box, Fluid flywheel, Torque converter, Propeller shaft, Slip Joints, universal joints, Differential and Rear Axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS 8

Steering Geometry and Types of steering gear box – Power Steering, Types of Front Axle, Types of Suspension systems, pneumatic and hydraulic braking systems, Antilock braking system (ABS), Electronic brake force distribution (EBD) and traction control.

UNIT V ALTERNATIVE ENERGY SOURCES 7

Use of Natural Gas, Liquefied petroleum gas (LPG), Bio-diesel, Bio-ethanol, Gasohol and hydrogen in Automobiles – Engine modification required – performance, Combustion and Emission characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid vehicles, Fuel Cell.

TOTAL PERIODS 45

COURSE OUTCOMES

On successful completion of the course, the student will be able to,

- demonstrate knowledge on vehicle construction and IC Engine components

- describe the principle and working of CRDI, MPFI, electronic fuel injection system, ignition system and 3-way catalytic converter system.
- differentiate between clutch, gear box, rear axle drives, fluid flywheel, and torque converter.
- demonstrate knowledge on parts like the wheels, tyres, steering gear box, suspension system-telescopic, and leaf spring.
- appraise the recent trends in automobile like alternate fuels in automobiles.

TEXT BOOKS

1. Kirpal Singh, "Automobile Engineering", Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 2014.
2. Jain K.K. and Asthana.R.B, "Automobile Engineering" Tata McGraw Hill Publishers, New Delhi, 2014.

REFERENCES

1. Newton, Steeds and Garet, "Motor Vehicles", Butterworth Publishers, 2007.
2. Joseph Heitner, "Automotive Mechanics," Second Edition, East-West Press, 2004.
3. Martin W, Stockel and Martin T Stockle, "Automotive Mechanics Fundamentals," The Good heart –Will Cox Company Inc, USA,2008.
4. Heinz Heisler, "Advanced Engine Technology," SAE International Publications USA, 1998.
5. Ganesan V. "Internal Combustion Engines", Third Edition, Tata McGraw-Hill, 2007.

WEB LINKS

1. nptel.ac.in/syllabus/125106002/
2. bookdha.com/ME6602%20Automobile%20Engineering.html
3. www.uptu.ac.in/academics/automobilesyllabus.pdf.

CO-PO Mapping

COs	Mapping of Course outcomes with Programme outcomes (1/2/3 indicates strength of correlation)3-Strong, 2-Medium, 1-Weak													
	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	2	-	-	-	-	-	-	1	2	2
CO2	2	-	-	-	2	-	-	-	-	-	-	1	2	2
CO3	2	-	-	-	2	-	-	-	-	-	-	1	2	2
CO4	2	-	-	-	2	-	-	-	-	-	-	1	2	2
CO5	2	-	-	-	2	-	-	-	-	-	-	1	2	2

BA15151 PROFESSIONAL ETHICS AND HUMAN VALUES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the basic human values for a professional.
- discuss the significance of ethics in engineering and the theories related to it
- familiarize oneself with the role of engineer as responsible experimenters
- expose the students to their roles and responsibilities in assessing safety and reducing risks
- describe the global issues in ethics and role of engineers as manager and consultants.

UNIT I HUMAN VALUES 10

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time –Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – a Balanced Outlook on Law- the challenger case study.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - the Three Mile Island and Chernobyl case studies Collegiality and loyalty -Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES 8

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers(India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers(IETE), India, etc.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of the course, students will be able to

- describe the basic human values for a professional.
- understand the significance of ethics in engineering and the theories related to it.

- be familiar with the role of engineer as responsible experimenters.
- acquire knowledge about their roles and responsibilities in assessing safety and reducing risks.
- discuss the global issues in ethics and role of engineers as manager and consultants

TEXT BOOKS

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, (2003).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics –Concepts and Cases", Thompson Learning, (2000).

REFERENCES

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, (1999).
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, (2003).
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, (2001).
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective",Biztantra, New Delhi, (2004).
5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003).

WEB LINKS

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org

CO-PO Mapping

COs	Mapping of Course outcomes with Programme outcomes **(1/2/3 indicates strength of correlation)3-Strong, 2-Medium, 1-Weak**													
	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	1	-	-	-	-	-	-	-	-	2	2	2
CO2	2	-	1	-	-	-	-	-	-	-	-	2	2	2
CO3	2	-	1	-	-	-	-	-	-	-	-	2	2	2
CO4	2	-	1	-	-	-	-	-	-	-	-	2	2	2
CO5	2	-	1	-	-	-	-	-	-	-	-	2	2	2

ME15704 **MECHATRONICS LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- acquire practical knowledge on working principles of hydraulic, electro pneumatic kit with Programmable Logic Controller (PLC)
- learn interfacing of servo controller for open and closed loop circuits
- know interfacing of Proportional, Integral and Derivative (PID) controller and stepper motor
- provide practical hands on experience with Assembly Language Programming using 8085 microprocessor

LIST OF EXPERIMENTS

1. Design of basic pneumatic circuits using Electro pneumatic trainer kits.
2. Simulation of Hydraulic and Pneumatic circuits using simulation software
3. Simulation of Electro Pneumatic and electro hydraulic circuits using simulation software
4. Circuits with multiple cylinder sequences in Electro pneumatic using PLC
5. Servo controller interfacing for open loop
6. Servo controller interfacing for closed loop
7. PID controller interfacing
8. Stepper motor interfacing with 8051 Micro controller(i) Full step resolution (ii) Half step resolution
9. Assembly language programming of 8085 – Addition – Subtraction – Multiplication – Division
10. Speed control circuit using basic hydraulic kit

TOTAL PERIODS 30

COURSE OUTCOMES

Upon completion of the course, students will be able to

- simulate Hydraulic, Pneumatic and Electric circuits using software tool
- conduct experiments using servo controller
- apply speed control of stepper motor using PID
- understand and apply the fundamentals of assembly level programming of microprocessors and microcontroller

CO-PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	2	-	-	-	-	-	-	-	-	2	2	2
CO2	3	-	2	-	-	-	-	-	-	-	-	2	2	2
CO3	3	-	2	-	-	-	-	-	-	-	-	2	2	2
CO4	3	-	2	-	-	-	-	-	-	-	-	2	2	2

ME15705 COMPUTER AIDED MANUFACTURING LABORATORY 0 0 2 1

COURSE OBJECTIVES

To enable the students to

- understand the basic concepts of computer numerical control (CNC) machine tool and CNC Programming.
- learn the different types of CNC Machine - Basic working principle, Axis movements, G & M code development programing and test run of programmed part.
- get practical knowledge on different cycles like canned cycle drilling, peck drilling, boring
- demonstrate CL Data and Post process generation using CAM packages

The Lab has Production model CNC lathe and CNC milling machines with CAM simulation Software (Edge CAM)

Exercises

Manual Part Programming

Part Programming - CNC Turning Centre

a. Simple Facing
b. Straight Turning
c. Contouring
d. Facing Cycle
    (i) Box Facing
    (ii) Taper Facing
    (iii) Multiple Facing
e. Turning Cycle
    (i) Box turning
    (ii) Taper turning
    (iii) Multiple turning
f. Pattern Repeating
g. Grooving cycle
h. Thread Cutting.
    (i) External Box threading
    (ii) Multiple Threading cycle
i. End face Peck Drilling Cycle.
j. Boring cycle
k. Parting off

(i) Part Programming - CNC Machining Centre

a. Linear and circular interpolation
b. Contouring
    (i) Cutter diameter compensation
    (ii) subprogram
c. Mirroring
d. Drilling
e. Pocketing
f. Rotation

g. Scaling
h. Canned Cycle - Drilling
i. Canned Cycle -Peck drilling
j. Canned Cycle -Boring
k. Tapping cycle
l. CL Data and Post process generation using CAM packages.

TOTAL PERIODS 30

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- understand and use G and M codes and manual part programming.
- get exposure to modern control systems (Fanuc, Siemens etc).
- know the working principles and application of various CNC machines.
- apply CL Data and Post process generation using CAM packages

CO-PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	2	-	-	-	-	-	-	-	-	2	2	2
CO2	3	-	2	-	-	-	-	-	-	-	-	2	2	2
CO3	3	-	2	-	-	-	-	-	-	-	-	2	2	2
CO4	3	-	2	-	-	-	-	-	-	-	-	2	2	2

ME15706 PROJECT WORK (PHASE I) 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- develop ability to identify problems to solve through project works.
- get exposure to literature review related to project problem and how to find the gap.
- get exposure to required design procedure, experimental setup, analysis package to solve the identified problem.
- Prepare project reports, practice to face viva- voce examination.

GUIDELINES

- The students are expected to get formed into a team of convenient groups of not more than 4 members for a project.
- Every project team shall have a guide who is the member of the faculty of the institution. Identification of student group and their faculty guide need to be completed within the first two Weaks from the day of the
  beginning of 7thsemester.
- The group has to identify and select the problem to be addressed as their project work; work through literature survey and finalize a comprehensive aim and scope of their work.
- 30% of the total work of the project work has to be completed by end of 7th semester.
- A mini project report (of the phase-I) to this effect has to be submitted by each student group.
- Three reviews and end semester review of the progress of the project work have to be conducted by a team of faculty (minimum 3 and a maximum of 5) along with their faculty guide as a member the review team.
- The same team of faculty will evaluate the project phase-I report. This evaluation will form 50% of the internal assessment mark. The remaining 50% of the internal assessment mark will be given at the end of the 8th semester, at the time of completing the full project work.

TOTAL PERIODS 60

COURSE OUTCOME

On Completion of the project work, students will be able to

- identify feasible problems to solve through project works
- Collect literature through research journals and identify the gap in selected area
- Devise the methodology to find solution through gathering complete knowledge on materials/design procedure/analysis and optimisation techniques/ availability of experimental setup/ company permission and other documentation procedures to execute the project
- Prepare project report as per format and confidently face viva voce with proper PPT for presentation

CO-PO Mapping

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COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	2	-	-	-	-	-	3	3	3	2	2	2
CO2	3	-	2	-	-	-	-	-	3	3	3	2	2	2
CO3	3	-	2	-	-	-	-	-	3	3	3	2	2	2
CO4	3	-	2	-	-	-	-	-	3	3	3	2	2	2

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PROGRAMME ELECTIVE – III

ME15351 MAINTENANCE ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn the principles of maintenance and planning activities required for maintenance.
- explore the fundamentals of maintenance policies and classification of maintenance.
- gain knowledge on condition monitoring.
- get in-depth knowledge of repair methods of machine elements and its maintenance.
- gain in-sight into repair methods for material handling equipment.

UNIT I PRINCIPLE AND PRACTICES OF MAINTENANCE PLANNING 10

Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization – Maintenance economics.

UNIT II MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE 9

Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication – TPM.

UNIT III CONDITION MONITORING 9

Condition Monitoring – Cost comparison with and without CM – On-load testing and off-load testing –Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis.

UNIT IV REPAIR METHODS FOR BASIC MACHINE ELEMENTS 9

Repair methods for beds, slideways, spindles, gears, lead screws and bearings – Failure analysis –Failures and their development – Logical fault location methods – Sequential fault location.

UNIT V REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT 8

Repair methods for Material handling equipment - Equipment records – Job order systems - Use of computers in maintenance.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of the course, students will be able to

- have a comprehensive understanding of the basic principles of maintenance, planning principles of maintenance activity, importance of maintenance planning, factors availability of maintenance planning.
- have good grounding on different types of maintenance- comparison of merits of different types of maintenance and also gain knowledge on preventive maintenance, maintenance schedules and repair cycle.

- acquire knowledge on monitoring techniques, cost of condition monitoring, wear debris analysis.
- demonstrate knowledge on material condition and methods used to repair the elements, sequential fault location.
- discuss technically the elements of computer maintenance, job order systems, and methods of material handling equipment.

TEXT BOOKS

1. Srivastava S.K., “Industrial Maintenance Management”, S.Chand and Co., 2002.
2. Bhattacharya S.N., “Installation, Servicing and Maintenance”, S.Chand and Co., 2001.

REFERENCES

1. White E.N., “Maintenance Planning”, I Documentation, Gower Press, 2005.
2. Garg M.R., “Industrial Maintenance”, S. Chand & Co., 2010.
3. Higgins L.R., “Maintenance Engineering Hand book”, McGraw Hill, 5th Edition, 1988
4. Armstrong, “Condition Monitoring”, BSIRSA, 1988
5. Davies, “Handbook of Condition Monitoring”, Chapman &Hall, 1998.

WEB LINKS

1. http://accessengineeringlibrary.com/browse/maintenance-engineering-handbook-seventh-edition
2. https://www.youtube.com/watch?v=f58SW0Hwcf0
3. https://www.accessengineeringlibrary.com/browse/maintenance-engineering-handbook-eighth-edition

CO-PO Mapping

COs	Mapping of Course outcomes with Programme outcomes **(1/2/3 indicates strength of correlation)3-Strong, 2-Medium, 1-Weak**													
	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	2	2	2
CO2	3	-	-	-	-	-	-	-	-	-	-	2	2	2
CO3	3	-	-	-	-	-	-	-	-	-	-	2	2	2
CO4	3	-	-	-	-	-	-	-	-	-	-	2	2	2
CO5	3	-	-	-	-	-	-	-	-	-	-	2	2	2

ME15352 NON DESTRUCTIVE EVALUATION TECHNIQUES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn the basic concepts on non - destructive testing and its limitations**.**
- gain knowledge of NDT methods like liquid penetrant and magnetic particle testing
- know the basic principles of eddy current and thermography testing.
- understand the principles of ultrasonic testing.
- familiarize the concepts involved in radiography techniques.

UNIT I INTRODUCTION TO NON-DESTRUCTIVE TESTING 7

Overview of the Non-Destructive Testing Methods for the detection of manufacturing defects as well as material characterization; Comparison of advantages and limitations of different NDT methods; Visual inspection.

UNIT II SURFACE NDT, LIQUID PENETRANT (PT), MAGNETIC PARTICLE TESTING (MT) 8

PT: Physical Principles – procedure - testing methods - Applications and limitations; MT: Magnetization, principles - methods - Equipment's - evaluation of results.

UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING (ET) 10

Thermography – principles - contact and non-contact methods - Active and Passive Thermography - Application in flaw detection; ET: Principles - permeability and conductivity-Testing for defects- material characterization and Sorting.

UNIT IV ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE) 10

Principle - Transducers - transmission and pulse - echo method - straight beam and angle beam – Instrumentation - data representation - A-scan- B-scan-C-scan; Phased Array Ultrasound-Time of Flight-Diffraction.

UNIT V RADIOGRAPHY (RT) 10

Principle - interaction of X-Ray with matter-imaging - film and film less techniques - Computed Radiography - Computed Tomography.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of the course, students will be able to

- describe knowledge on various NDT techniques to carry out inspections in accordance with the established procedures.
- evaluate concepts involved in the liquid penetrant and magnetic testing methods.
- demonstrate knowledge on thermography and eddy current testing and its behavior.
- employ the functions of transducer and principle of ultrasonic testing at appropriate places.
- illustrate knowledge on radiography techniques and its elements.

TEXT BOOKS

1. Prakash Ravi., “Nondestructive Testing Techniques”, New Age International Publishers. 1st Rev Edition., 2017.
2. Paul E Mix, “Introduction to Non-destructive Testing: a training guide, Wiley”, 2nd edition New Jersey

REFERENCES

1. Baldev Raj., B. Venkataraman., O. J.Varde., Nerulikar., “Practical Magnetic Particle Testing”, Narosa Publishing House.,2007.
2. Charles., J. Hellier., “Handbook of Non-destructive evaluation”, 2nd edition McGraw Hill., New York, 2013.
3. J. Prasad and C. G. K. Nair., “Non-Destructive Test and Evaluation of Materials”, Tata McGraw-Hill Education, 2nd edition 2011.
4. B. Raj., T. Jayakumar and M. Thavasimuthu., “Practical Non-Destructive Testing”, Alpha Science International Limited, 3rd edition, 2002.
5. B.P.C. Rao., “Practical Eddy Current Testing”, Alpha Science International Limited, 2006.

WEB LINKS

1. https://engineering.purdue.edu/AAE/Academics/Courses/Descriptions/AAE552
2. http://www.monash.edu.au/pubs/2014handbooks/units/MEC4801.html
3. http://nptel.ac.in/courses/113106070

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	1	1	1	-	-	-	-	-	-	1	2	2
CO2	2	1	1	3	2	-	-	-	-	-	-	1	2	2
CO3	2	1	1	3	2	-	-	-	-	-	-	1	2	2
CO4	2	1	1	3	1	-	-	-	-	-	-	1	2	2
CO5	2	1	1	3	2	-	-	-	-	-	-	1	2	2

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ME15353 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study the functions of Jigs and Fixtures.
- gain proficiency in design and development of jigs.
- understand the principles, functions and design practices of Fixtures.
- gain the knowledge of press working terminologies and operations.
- become familiar with the design of dies for bending, forming and drawing operations.

(Use of approved design data book is permitted)

UNIT I PURPOSE TYPES AND FUNCTIONS OF JIGS AND FIXTURES 8

Tool design objectives - Production devices - Inspection devices - Materials used in Jigs and Fixtures -Types of jigs - Types of Fixtures - Mechanical actuation - pneumatic and hydraulic actuation - Analysis of clamping force – Tolerance anderror analysis.

UNIT II JIGS 9

Drill bushes - different types of jigs - plate latch, channel, box, post, angle plate, angular post, turnover, Pot jigs - Automatic drill jigs - Rack and pinion operated. Air operated Jigs components. Design and Development of Jigs for given components.

UNIT III FIXTURES 9

General principles of boring, lathe, milling and broaching fixtures - grinding, planning and shaping fixtures, assembly, inspection and welding fixtures - Modular fixtures. Design and development of fixtures for given component**.**

UNIT IV PRESS WORKING TERMINOLOGIES AND ELEMENTS OF DIES AND STRIP LAY OUT 10

Press working terminology - Presses and press accessories - Computation of capacities and tonnage requirements. Elements of progressive combination and compound dies: Die block - die shoe. Bolster Plate - punch plate – punch holder - guide pins and bushes - strippers - knockouts - stops - pilots - Selection of standard die sets strip lay out – strip lay out calculations.

UNIT V DESIGN AND DEVELOPMENT OF DIES 9

Design and development of progressive and compound dies for blanking and piercing operations. Bending dies - Development of bending dies - forming and drawing dies - Development of drawing dies. Design considerations in forging, extrusion, casting and plastic dies.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of the course, students will be able to

- describe the selection of jigs and fixtures and design suitable actuation for fixtures.

- become proficient in different types of jigs for various products.
- implement in practice the principles of design and development of fixtures for different components
- internalize press working terminologies and operations.
- design the dies for bending, forming and drawing operations.

TEXT BOOKS

1. Edward G Hoffman, “Jigs & Fixture Design”, Thomson – Delmar Learning, Singapore 2004.
2. Donaldson. C, “Tool Design”, Tata McGraw-Hill, 2003.

REFERENCES

1. Kempster, “Jigs & Fixtures Design”, The English Language Book Society”, 1978.
2. Joshi, P.H., “Jigs & Fixtures”, Second Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi 2004.
3. Hiram E Grant, “Jigs and Fixture” Tata McGraw-Hill, New Delhi, 2003.
4. “Fundamentals of Tool Design”, CEEE Edition, ASTME, 1983.
5. Design Data Handbook PSG College of Technology, Coimbatore.

WEB LINKS

1. https://smartech.gatech.edu/bitstream/handle/1853/14178/bli.pdf
2. https://www.quora.com/in/What-is-the-difference-between-a-jig-and-a-fixture
3. http://nptel.ac.in/courses/112107144/Metal%20Forming%20&%20Powder%20metallurgy/lecture6/lecture6.htm

CO-PO Mapping

COs	Mapping of Course outcomes with Programme outcomes **(1/2/3 indicates strength of correlation)3-Strong, 2-Medium, 1-Weak**													
	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	2	3	2
CO2	3	2	2	-	-	-	-	-	-	-	-	2	3	2
CO3	3	2	2	-	-	-	-	-	-	-	-	2	3	2
CO4	3	2	2	-	-	-	-	-	-	-	-	2	3	2
CO5	3	2	2	-	-	-	-	-	-	-	-	2	3	2

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ME15354 MICRO ELECTRO MECHANICAL SYSTEMS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- gain knowledge on lithography techniques for Micro/Nano systems.
- understand different sensor packaging technologies.
- study the various types of techniques of mechanical transduction.
- familiarize with pressure sensors techniques and types.
- learn about various electronic devices of MEMS.

UNIT I INTRODUCTION 8

Introduction, Materials-substrates, Additive materials. Introduction to Micro fabrication - Silicon based MEMS processes – Fabrication techniques - Deposition, Lithography etching, Surface micro machining, Thick film screen-Printing and electroplating.

UNIT II MECHANICAL SENSOR PACKAGING 8

Introduction, Standard IC packages - ceramic, plastic and metal packages. Packaging process - Electrical Interconnects, Methods of die attachment, sealing techniques. MEMS mechanical sensor packaging.

UNIT III MECHANICAL TRANSDUCTION TECHNIQUES 9

Piezo resistivity, Piezoresistive sensor materials, Piezoelectricity, Capacitive Techniques, Optical techniques, Resonant techniques. Actuation techniques, Smart Sensors. MEMS Simulation and Design Tools - Behavioral modelling Simulation tools and Finite element simulation tools.

UNIT IV PRESSURE SENSORS 12

Introduction. Techniques for sensing. Physics of pressure sensing-Pressure sensor specifications. Dynamic Pressure sensing. Pressure sensor types. MEMS technology pressure sensors-Micro Machined Silicon diaphragms.

UNIT V FORCE, TORQUE AND INERTIAL SENSORS 8

Introduction - Silicon based devices - Optical devises - capacitive devices-Magnetic devices - Atomic force microscope and scanning probes - micro machined accelerometer - Micro Machined Gyroscope - Future inertial micro machined sensors

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of the course, students will be able to

- describe the fundamental working principles of micro fabrication techniques.
- get strong understanding of mechanical sensor packaging in MEMS.
- apply their knowledge about transduction techniques and MEMS simulation.

- become conversant with the working principles of sensing techniques.
- demonstrate knowledge on various electronic devices involved in MEMS.

TEXT BOOKS

1. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2002
2. Nadim Maluf and Kirt Williams,’ An introduction to Micro electro mechanical System Engineering, Artech House, Inc. Boston 1991

REFERENCES

1. Stephen Beeby, Graham Ensell, Michael Kraft and Neil White,’ MEMS Mechanical sensors’ Artech House, Inc. Boston 2003
2. Julian w. Gardner, Vijay K. Varadan, Osama O. Awadelkarim, "Micro Sensors MEMS and Smart Devices", JohnWiley & Son LTD,2002
3. James J.Allen, "Micro Electro Mechanical System Design", CRC Press Publisher, 2010
4. Thomas M.Adams and Richard A.Layton, “Introduction MEMS, Fabrication and Application,” Springer 2012
5. Chang Liu, "Foundations of MEMS", Pearson Education Inc., 2006

WEB LINKS

1. https://ocw.mit.edu
2. http://nptel.ac.in/courses/117105082/
3. https://lecturenotes.in/subject/134/micro-electro-mechanical-systems-mems

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	2	-	1	-	-	-	-	2	3	2
CO2	3	-	-	-	2	-	1	-	-	-	-	2	3	2
CO3	3	-	-	-	2	-	1	-	-	-	-	2	3	2
CO4	3	-	-	-	2	-	1	-	-	-	-	2	3	2
CO5	3	-	-	-	2	-	1	-	-	-	-	2	3	2

ME15355 INTRODUCTION TO AIRCRAFT SYSTEMS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- learn the basic concepts and principles of hydraulic and pneumatic systems of aircrafts.
- study the control systems of an aircraft.
- acquire knowledge on aircraft engine systems.
- understand the working principles of air-conditioning and pressurizing system of aircrafts.
- familiarize with various instruments used in aircraft.

UNIT I AIRCRAFT SYSTEMS 9

Hydraulic systems - Study of typical workable system - components - Hydraulic system controllers – Modes of operation - Pneumatic systems - Advantages - Working principles - Typical Air pressure system – Brake system - Typical Pneumatic power system - Components, Landing Gear systems - Classification – Shock absorbers - Retractive mechanism

UNIT II AIRPLANE CONTROL SYSTEMS 9

Conventional Systems - Power assisted and fully powered flight controls - Power actuated systems –Engine control systems - Push pull rod system, flexible push full rod system - Components - Modern control systems - Digital fly by wire systems - Auto pilot system active control Technology, Communication and Navigation systems Instrument Landing systems, VOR - CCV case studies.

UNIT III ENGINE SYSTEMS 9

Fuel systems - For Piston and jet engines - Components of multi engines, lubricating systems for piston and Jet Engines - Starting and Ignition systems - Typical examples for piston and Jet engines.

UNIT IV AIR-CONDITIONING AND PRESSURIZING SYSTEM 9

Basic Air cycle systems - Vapour Cycle systems, Boost-Strap air cycle system - Evaporative vapour cycle systems- Evaporative air cycle systems - Oxygen systems - Fire protection systems, Deicing and anti-icing systems

UNIT V AIRCRAFT INSTRUMENTS 9

Flight Instruments and Navigation Instruments - Accelerometers, Air speed Indicators - Mach Meters -Altimeters- Principles and operation - Study of various types of engine instruments - Tachometers – Temperature gauges - Pressure gauges - Operation and Principles

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of the course, students will be able to

- apply principles of hydraulic and pneumatic systems used in aircraft.
- be conversant with the control systems of aircrafts.
- have in-depth knowledge about engines and its components used in aircrafts.

- distinguish between the principle of operation of air-conditioning and pressurizing system used for aircraft systems.
- have greater understanding of different types of aircraft instruments, their operations and control.

TEXT BOOKS

1. Michael J. Kroes, Thomas W. Wild, Aircraft Power plants, Seventh Edition, Tata McGraw Hill education pvt Ltd, New Delhi, 2010
2. "General Hand Books of Airframe and Power Plant Mechanics ", U.S. Dept. of Transportation, Federal Aviation Administration, The English Book Store, New Delhi, 2005.

REFERENCES

1. Mekinley, J.L. and Bent, R.D., “Aircraft Power Plants ", McGraw Hill, 2010.
2. Pallet, E.H.J., “Aircraft Instruments & Principles ", Pitman & Co., 2003.
3. Treager, S., “Aircraft Gas Turbine Engine Technology ", McGraw Hill, 2010.
4. McKinley, J.L., and Bent, R.D., “Aircraft Maintenance & Repair ", McGraw Hill, 2013.
5. Aircraft Maintenance and Repair, Seventh Edition by Michael J Kroes, 2013.

WEB LINKS

1. http://ocw.mit.edu/courses/aeronautics-and-astronautics/16-885j-aircraft-systems-engineering-fall-2004/lecture-notes/
2. http://nptel.ac.in/courses/101108056/module7/lecture13.pdf
3. http://www.srmuniv.ac.in/downloads/Aircraft_ctrl_Systems.pdf

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	1	1	1	2	1	-	-	-	-	1	1	1
CO2	3	3	3	2	2	2	1	-	-	-	-	2	2	2
CO3	3	3	3	2	3	2	1	-	-	-	-	2	2	2
CO4	2	3	2	2	3	2	1	-	-	-	-	2	2	2
CO5	2	1	1	1	2	2	1	-	-	-	-	1	1	1

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PROGRAMME ELECTIVE - IV

ME15451 PLANT LAYOUT AND MATERIAL HANDLING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study the basics of plant layout, physical facilities and the requirements.
- understand and apply the techniques needed to plan, analyze and design new or modify existing production/service facilities.
- familiarize with material handling principles and storage systems.
- gain knowledge on packaging techniques and the significance of packaging and ergonomics.
- learn to analyze the material handling and surveying techniques.

UNIT I INTRODUCTION 9

Plant location - factors to be considered - influence of location on plant layout - selection of plant site. Comparative study of rural and urban sites. Consideration in facilities planning and layout. Equipment required for plant Operation. Capacity, serviceability and flexibility and analysis in selection of equipment space, requirements, man power requirements. Selection site - Case study.

UNIT II PLANT LAYOUT 9

Plant layout - need for layout, types of layout, factors influencing product- process, fixed and combination layout- Comparison of layouts: tools and techniques for developing layout, process chart, flow diagram, string diagram, template and scale models - machine data. Layout planning procedure. Visualization of layout revision and improving existing layout, assembly line balancing-Methods.

UNIT III MATERIAL HANDLING 9

Material handling - Importance and scope. Principles of material handling. Storage system performances. Planning operation and costing principles - types of material handling systems, factors influencing their choice. Design of AGVs.

UNIT IV PACKAGING 9

Industrial buildings and utilities - centralized electrical pneumatic water line systems. Types of building, lighting heating, air-conditioning and ventilation utilities. Planning and maintenance, waste handling statutory requirements. Packing and storage of materials - Importance of packaging layout for packaging - packaging machinery – Ergonomics.

UNIT V ANALYSIS 9

Analysis of material handling - Factors involved, motion analysis, flow analysis, graphic analysis, Network diagram. Number of AGVs determination, safety analysis, equipment cost analysis, analysis of operation material handling surveys.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- demonstrate knowledge on site selection criteria and equipment selection.
- gather thorough knowledge on all the types of plant layout and development.
- describe knowledgeably the principle and operations of material handling systems.
- gain strong grounding on the concepts of packaging.
- analyze the concepts involved in the material handling processes.

TEXT BOOKS

1. K.R Govindan "Plant layout and material handling" Anuradha.2010
2. James, M. Apple., 'Plant Layout and Material Handling', John Wiley & Sons, INC, 3rd Ed., 1977.

REFERENCES

1. James, M. Moore, 'Plant Layout and Design', Macmillan Company, NY, 1963
2. Muther, R., 'Practical Plant Layout', Mc Graw Hill Book Company, NY, 1955
3. Norman Gaither, G. Frazier, "Operations management" Thomson learning 9th edition, 2007
4. Martand Telsang, "Industrial Engineering and Production Management", S. Chand and Company, 2000
5. Kanishka Bedi, "Production and Operations management", Oxford university press, 2nd Edition 2007.

WEB LINKS

1. web.mst.edu/gosavia/EMGT256_13.docx
2. www.uom.ac.mu/faculties/foe/mped/students/notes/lecture7.pdf
3. www.smatzworld.com/PLMHnotes.Pdf.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	2	2	2	-	-	-	-	-	2	2	2
CO2	2	2	2	2	2	-	-	-	-	-	-	2	2	2
CO3	2	2	2	2	2	-	-	-	-	-	-	2	2	2
CO4	2	3	2	3	2	-	-	-	-	-	-	2	2	2
CO5	2	3	2	3	2	-	-	-	-	-	-	2	2	2

ME15452 PRODUCTIVITY MANAGEMENT AND RE-ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the concepts of productivity improvement techniques.
- learn the systems used for productivity measurement and evaluation process.
- know about how the planning and implementation of innovative concepts are carried out.
- familiarize modern practices in Re-engineering process
- acquire ideas of new tools like process improvement models along with BPR and IT

UNIT I INTRODUCTION 3

Basic concept and meaning of Productivity – Significance of Productivity – Factors affecting Productivity - Productivity cycle, Scope of Productivity, Engineering and Management.

UNIT II PRODUCTIVITY MEASUREMENT AND EVALUATION 9

Productivity measurement in International, National and Industrial level – Total Productivity Model –Productivity measurement in Manufacturing and Service sectors – Performance Objective Productivity(PO) model – Need for Productivity Evaluation – Evaluation Methodology.

UNIT III PRODUCTIVITY PLANNING AND IMPLEMENTATION 9

Need for Productivity Planning – Short term and long term productivity planning – Productivity Material improvement approaches, Principles - Productivity Improvement techniques – Technology based, Employee based, Product based techniques – Managerial aspects of Productivity Implementation. Schedule, Productivity audit and control.

UNIT IV RE-ENGINEERING PROCESS 15

Definition, Fundamentals of process reengineering – Principles, Methodology and guidelines for Organization Transformation, DSMCQ and PMP organization Transformation models – Process Improvement Models like PMI, Edosomwan, LMICIP and NPRDC Models.

UNIT V BPR TOOLS AND IMPLEMENTATION 9

Analytical and Process Tools and Techniques - Role of Information and Communication Technology in BPR – Requirements and steps in BPR Implementation – Case studies.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of the course, students will be able to

- internalize concepts of productivity management.
- describe the differences among small, medium and large measurements of productivity and evaluation process.
- aggregate the salient characteristics of productivity measurement models.

- design new concepts on Business Process and Re-engineering.
- develop ability to improve productivity with new tools using latest techniques like IT.

TEXT BOOKS

1. Gopalakrishnan, P. and Banerji, A.K., "Maintenance and Spare Parts, Management", Prentice – Hall of India Pvt. Ltd., 2002.
2. Seiichi Nakajima, "Introduction to TPM", Productivity Press, Chennai, 2004.

REFERENCES

1. Sumanth, D.J."Productivity Engineering and Management", TMH, New Delhi, 2000.
2. Edosomwan, J.A. "Organizational Transformation and Process re- Engineering", British Cataloging in publications, 2006.
3. Premvrat, Sardana, G.D. and Sahay, B.S. "Productivity Management - A systems approach", Narosa Publications, New Delhi, 2002.
4. Prokopenko. J, "Productivity Management, A Practical Handbook", International Labour Organisation, 2000
5. Phusavat. K, Fankham-ai K, Haapasalo. H, & Lin. B, "Productivity Management in an Organization", 2011

WEB LINKS

1. https://onlinecourses.nptel.ac.in/noc18_mg03/preview
2. http://nptel.ac.in/courses/112107143/6
3. www.itil-officialsite.com/home/home.asp

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	2	2	2	-	-	-	-	-	2	2	2
CO2	2	2	2	2	2	-	-	-	-	-	-	2	2	2
CO3	2	2	2	2	2	-	-	-	-	-	-	2	2	2
CO4	2	3	2	3	2	-	-	-	-	-	-	2	2	2
CO5	2	3	2	3	2	-	-	-	-	-	-	2	2	2

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ME15453 TOOL DESIGN 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study various types of cutting tools.
- understand the functions and design principles of cutting tools.
- gain proficiency in the development of die design for different types of dies.
- understand the functions and design principles of Jigs, fixtures.
- gain the knowledge on numerically controlled machine tools.

UNIT I TOOLING MATERIALS 9

Broad Classification of Tools - Cutting tools, Dies, Holding and Measuring tools Introduction – Properties of Materials – Ferrous Tooling Materials – Tool steels – Cast Iron – Mild, or low-carbon Steel – Non-metallic Tooling Materials – Nonferrous Tooling Materials – Metal cutting Tools – Single-point cutting tools – Milling cutters – Drillsand Drilling– Reamer classification – Taps – Tap classification- the selection of carbide cutting tools – Determining the insert thickness for carbide tools.

UNIT II DESIGN OF CUTTING TOOLS 9

Single Point and multi-pint cutting tools. Classification, Nomenclature, geometry, design of single point tools for lathes, shapers, planers etc. Chip breakers and their design. **Tools**: Classification and Specification, nomenclature, Design of drills, milling cutters, broaches, taps etc.

Design of Form Tools: Flat and circular form tools, their design and application.

UNIT III DESIGN OF DIES 9

Classification of dies, Design of Dies for Bulk metal Deformation-Wire Drawing, Extrusion, Forging and Rolling; Design of Dies for Sheet metal: Blanking and Piercing, Bending and Deep-drawing; Design of Dies used for Casting and Molding, microstructure injection molding for MEMs, multi-color injection molding, Powder Metallurgy die design.

UNIT IV DESIGN OF JIGS AND FIXTURES 9

Classification of Jigs and Fixtures, Fundamental Principles of design of Jigs and Fixtures, Location and Clamping in Jigs and fixtures, Simple design for drilling Jigs, Milling fixtures etc. Indexing Jigs and fixtures. Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

UNIT V TOOL DESIGN FOR NUMERICALLY CONTROLLED MACHINE TOOLS 9

Introduction – The need for numerical control – A basic explanation of numeric control – Numerical control systems in use today – Fixture design for numerically controlled machine tools – Cutting tools for numerical control – Tool holding methods for numerical control – Automatic tool changers and tool positioners – Tool pre-setting – Introduction – General explanation of the Brown and sharp machine – tooling for Automatic screw machines.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of the course, students will be able to

- describe knowledge on tools used for different processes, materials used for tool-making and their specific advantages
- gain good grounding on single-point, multi-point cutting tools and design of form-tools along with specifications, nomenclature and designing aspects
- have knowledge for designing of dies for various processes like wire-drawing, forging, rolling, sheet metal, blanking, piercing, casting, moulding and powder metallurgy
- possess knowledge to design Jigs and Fixtures for various processes like drilling, milling and indexing
- demonstrate knowledge for tool design for Numerically controlled machine tools involving tool holding, tool changing and tool setting methods

TEXT BOOKS

1. Cyrll Donaldson, George H.LeCain, V.C. Goold, "Tool Design", Tata McGraw Hill Publishing Company Ltd., 2000.
2. Pollack, H.W. Tool Design, Reston Publishing Company, Inc. 1966

REFERENCES

1. Donaldson. C, "Tool Design", Tata McGraw-Hill, 1986
2. "Fundamentals of Tool Design", CEEE Edition, ASTME, 1983.
3. Kempster, M.H.A. "Principles of Jig and Tool Design", English University Press Ltd
4. Prakash Hiralal Joshi, "Tooling data", Wheeler Publishing, 2000
5. Nicholas Lisitsyn, "Machine Tool Design", 2000

WEB LINKS

1. http://nptel.ac.in/courses/112106137/
2. https://lecturenotes.in/subject/251/metal-cutting-and-tool-design-mctd
3. https://www.docsity.com/en/lecture-notes/engineering/principles-of-machine-tool-design/

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	2	3	2
CO2	3	2	2	-	-	-	-	-	-	-	-	2	3	2
CO3	3	2	2	-	-	-	-	-	-	-	-	2	3	2
CO4	3	2	2	-	-	-	-	-	-	-	-	2	3	2
CO5	3	2	2	-	-	-	-	-	-	-	-	2	3	2

ME15454 WELDING TECHNOLOGY 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand welding techniques and principles of gas and arc welding
- learn the concepts of resistance welding and various resistance welding processes.
- gain knowledge of solid state welding process for engineering applications
- acquire knowledge on special welding processes.
- understand the standards and codes for design and testing of weldments.

UNIT I GAS AND ARC WELDING PROCESSES 9

Fundamental principles – Air Acetylene welding, Oxyacetylene welding, Carbon arc welding, Shielded metal arc welding, Submerged arc welding, TIG & MIG welding, Plasma arc welding and Electro slag welding processes – safety aspects in welding – advantages, limitations and applications.

UNIT II RESISTANCE WELDING PROCESSES 9

Spot welding, Seam welding, Projection welding, Resistance Butt welding, Flash Butt welding, Percussionwelding and High frequency resistance welding processes – advantages, limitations and applications.

UNIT III SOLID STATE WELDING PROCESSES 9

Cold welding, Diffusion bonding, Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and Hot pressure welding processes – advantages, limitations and applications.

UNIT IV OTHER WELDING PROCESSES 9

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

UNIT V DESIGN OF WELD JOINTS, WELDABILITY AND TESTING OF WELDMENTS 9

Various weld joint designs – Weldability of Aluminium, Copper, and Stainless steels. Destructive and non-destructive testing of weldments – brief introduction to welding codes & standards (ASME / ASTM / AWS)

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- gain knowledge on gas and arc welding processes
- describe knowledge on resistance welding processes
- identify solid state welding processes and their correct usage.
- demonstrate sound theoretical knowledge on various welding processes.
- design weldments with proper welding codes and standards

TEXT BOOKS

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

REFERENCES

1. K.S.Yadav. "Advanced Welding Technology", Standard Book Huse Publishers, 2017
2. Martin Thaddeus. "Welding: A Practical guide to joining metal", The Crowood Press Ltd, 2010.
3. AWS- Welding Hand Book. "Welding Process" 8th Edition. Vol- 2.
4. Nadkarni S.V. "Modern Arc Welding Technology", 1st edition, Oxford IBH Publishers, 2005.
5. O.P.Khanna, "Welding Technology", Dhanpat Rai and sons,2008

WEB LINKS

1. http://nptel.ac.in/courses/112107089/
2. https://ocw.mit.edu/courses/materials-science-and-engineering/3-37-welding-and-joining-processes-fall-2002/lecture-notes/

CO-PO Mapping

COs	Mapping of Course outcomes with Programme outcomes **(1/2/3 indicates strength of correlation)3-Strong, 2-Medium, 1-Weak**													
	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	1	-	-	-	-	-	-	-	-	2	2	2
CO2	2	-	1	-	-	-	-	-	-	-	-	2	2	2
CO3	2	-	1	-	-	-	-	-	-	-	-	2	2	2
CO4	2	-	1	-	-	-	-	-	-	-	-	2	2	2
CO5	2	-	1	-	-	-	-	-	-	-	-	2	2	2

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ME15455 QUALITY CONTROL AND RELIABILITY ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- know the concepts of quality assurance, quality control, SQC, six sigma and control charts usage.
- study the basic use of p and np charts, C and U charts in quality control and to analyze and understand process variables.
- learn the process of lot sampling and probability of acceptance techniques and sampling plans with AQL, LTPD, AOQL concepts.
- acquaint with the concepts of life testing and reliability test.
- understand reliability improvements and its techniques and product analysis.

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES 10

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality cost - Variation in process- causes of variation - Theory of control chart - uses of control chart – Control chart for variables – X chart, R chart and S chart - process capability – process capability studies and simple problems. Six sigma concepts.

UNIT II PROCESS CONTROL FOR ATTRIBUTES 8

Control chart for attributes – control chart for non conformings – p chart and np chart – control chart for nonconformities – C and U charts, State of control and process out of control identification in charts.

UNIT III ACCEPTANCE SAMPLING 9

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans.

UNIT IV LIFE TESTING 9

Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate – Weibull model, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Acceptance sampling based on reliability test.

UNIT V QUALITY AND RELIABLITY 9

Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis– Product development - Product life cycles.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- apply the concept of SQC in process control for reliable component production.
- analyze p chart, np chart, and other control chart attributes
- have thorough understanding of standing sampling techniques like AWL, LTPD, AOQL concepts and knowledge to apply them
- get good grounding on reliability, failure rate, hazard rate, maintainability, availability and reliability testing.
- employ optimization in reliability, product design and product life cycle analysis.

TEXT BOOKS

1. Douglas. C. Montgomery, “Introduction to Statistical quality control”, 4th edition, John Wiley 2001.
2. Srinath. L.S., “Reliability Engineering”, Affiliated East west press, 1991.

REFERENCES

1. John.S. Oakland. "Statistical process control”, 5th edition, Elsevier, 2005.
2. Connor, P.D.T.O., “Practical Reliability Engineering”, John Wiley, 1993.
3. Grant, Eugene.L “Statistical Quality Control”, McGraw-Hill, 1996.
4. Monohar Mahajan, “Statistical Quality Control”, Dhanpat Rai & Sons, 2001.
5. Gupta. R.C, “Statistical Quality control”, Khanna Publishers, 1997.

WEB LINKS

1. http://en.wikipedia.org/wiki/Quality_control
2. https://en.wikipedia.org/wiki/Accelerated_life_testing
3. http://www.businessmanagementideas.com/production-2/control-charts-for-variables-and-attributes-quality-control/7044

CO-PO Mapping

COs	Mapping of Course outcomes with Programme outcomes **(1/2/3 indicates strength of correlation)3-Strong, 2-Medium, 1-Weak**													
	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	2	1	-	-	-	-	-	-	2	2	2
CO2	2	2	2	2	2	-	-	-	-	-	-	2	2	2
CO3	2	2	2	2	2	-	-	-	-	-	-	2	2	2
CO4	2	3	2	2	2	-	-	-	-	-	-	2	2	2
CO5	2	2	2	2	2	-	-	-	-	-	-	2	2	2

BA15253 TOTAL QUALITY MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- describe the basic concepts in Quality Management, Customer orientation and retention.
- facilitate the understanding of Quality Management principles and process.
- discuss the techniques in Six Sigma, Bench marking and FMEA.
- understand the basic concepts in Quality Function Development and TPM.
- become familiar with Quality System, Quality Auditing and HR practices.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby -Barriers to TQM -Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

UNIT II TQM PRINCIPLES 9

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Benchmarking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II 9

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) -Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 -ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors. Return on Investment - Personnel management. Recruitment, selection and training - Technology in Agri sectors.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of the course, students will be able to

- discuss the basic concepts in Quality Management, Customer orientation and retention.
- describe the principles and process of Quality Management.
- implement the quality control techniques in Six Sigma, Bench marking and FMEA..

- explain the basic concepts of Quality Function Development and TPM.
- understand the elements in Quality System, Quality Auditing and HR practices.

TEXT BOOKS

1. Dale H. Besterfiled, et at., "Total quality Management", Third Edition, Pearson Education Asia, Indian Reprint, 2006.
2. D.R Kiran, "Total quality Management", Butterworth-Heinemann, 2016.

REFERENCES

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt Ltd., 2006.
3. Janakiraman. B and Gopal.R.K, "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt Ltd., 2006.
4. Dennis Aubuchon, "Understanding the Concept of Quality", Pronoun, 2017.
5. Donna C. S. Summers, "Quality", Pearson, 5th Edition, 2009.

WEB LINKS

1. www.inderscience.com/ijpqm
2. http://nptel.ac.in/courses/110105031/1

CO-PO Mapping

COs	Mapping of Course outcomes with Programme outcomes **(1/2/3 indicates strength of correlation)3-Strong, 2-Medium, 1-Weak**													
	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	2	-	-	2	-	-	-	1	1	1
CO2	2	-	-	-	2	-	-	2	-	-	-	1	1	1
CO3	2	-	-	-	2	-	-	2	-	-	-	1	1	1
CO4	2	-	-	-	2	-	-	2	-	-	-	1	1	1
CO5	2	-	-	-	2	-	-	2	-	-	-	1	1	1

ME15801 PROJECT WORK (PHASE II) 0 0 12 6

COURSE OBJECTIVES

To enable the students to

- get trained in preparing project reports and how to face reviews and viva voce examinations.
- develop ability to identify problems to solve through project works.
- acquire knowledge on literature review related to project problem and how to find the gap.
- gain exposure to required design procedure, experimental setup, analysis package to solve the identified problem.

GUIDELINES

1. The students are expected to get formed into a team of convenient groups of not more than 4 members on a project.
2. Two mid semester review and another end semester review for the progress of the project work have to be conducted by a team of faculty along with their faculty guide as a member the review team.
3. Progress of project work has to be monitored by the project guide and committee periodically.
4. Attendance for review is mandatory. If a student fails to attend review for some valid reasons, one more chance may be given.
5. The project report should be submitted by the students around the first Weak of April.

TOTAL PERIODS 180

COURSE OUTCOMES

On Completion of the project work, the students will be able to

- to take up any challenging practical problems and find solution by formulating proper
- collect literature through research journals and identify the gap in selected area
- devise the methodology to find solution through gathering complete knowledge on materials/design procedure/analysis and optimisation techniques/ availability of experimental setup/ company permission and other documentation procedures to execute the project.
- prepare project report as per format and confidently face viva voce with proper PPT for presentation

CO-PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	2	-	-	-	-	-	3	3	3	2	2	2
CO2	3	-	2	-	-	-	-	-	3	3	3	2	2	2
CO3	3	-	2	-	-	-	-	-	3	3	3	2	2	2
CO4	3	-	2	-	-	-	-	-	3	3	3	2	2	2

PROGRAMME ELECTIVE - V

ME15551 COMPUTATIONAL FLUID DYNAMICS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study the concept of finite difference method
- gain knowledge on conduction and convection heat transfer problems
- understand the incompressible fluid flow.
- understand the convective heat transfer
- integrate the concepts of different types of turbulence models

UNIT I GOVERNING DIFFERENTIAL EQUATION AND FINITE DIFFERENCE METHOD 10

Classification, Initial and Boundary conditions – Governing equations of fluid dynamics -Initial and Boundary Value problems – Finite difference method, Central, Forward, Backward difference, Uniform and non-uniform Grids Numerical Errors, Grid Independence Test.

UNIT II CONDUCTION HEAT TRANSFER 10

Steady one-dimensional conduction, Two and three-dimensional steady state problems, Transient One-Dimensional problem, Two-dimensional Transient Problems.

UNIT III INCOMPRESSIBLE FLUID FLOW 10

Governing Equations, Stream Function – Vorticity method, Determination of pressure for viscous flow, SIMPLE Procedure of Patankar and Spalding, Computation of Boundary layer flow, finite difference approach.

UNIT IV CONVECTION HEAT TRANSFER AND FEM 10

Steady One - Dimensional and Two-Dimensional Convection – diffusion, unsteady one – dimensional convection – diffusion, unsteady two- dimensional convection – Diffusion – Introduction to finite element method – solution of steady heat conduction by FEM – Incompressible flow – simulation by FEM.

UNIT V TURBULENCE MODELS 5

Algebraic Models – One equation model, K – ϵ Models, Standard and High and Low Reynolds number Models, Prediction of fluid flow and heat transfer using standard codes.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of this course, students will be able to

- become conversant with the governing equations used in computational fluid mechanics.
- solve heat transfer problems
- demonstrate knowledge on incompressible fluid flow concepts
- solve problems of convection heat transfer using finite element methods.
- develop different types of turbulence models

TEXT BOOKS

1. Versteeg, H.K., and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The finite Volume Method", Pearson Education Ltd. Second Edition, 2007.
2. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill Publishing Company Ltd., 2012.

REFERENCES

1. Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 2003.
2. Taylor, C and Hughes, J.B. "Finite Element Programming of the Navier-Stokes Equation", Pineridge Press Limited, U.K., 2001.
3. Anderson, D.A., Tannehill, J.I., and Pletcher, R.H., "Computational fluid Mechanics and Heat Transfer", Hemisphere Publishing Corporation, New York, USA, 2001.
4. Patankar, S.V. "Numerical Heat Transfer and Fluid Flow", Hemisphere Publishing Corporation, 2004.
5. Ghoshdasdidar, P.S, "Computer Simulation of flow and heat transfer" Tata McGraw-Hill Publishing Company Ltd., 1998.

WEB LINKS

1. http://ocw.mit.edu/courses/mechanical-engineering/2-29-numerical-fluid-mechanics-fall 2011/lecture-notes/
2. www.engr.uky.edu/~acfd/me691-lctr-nts.pdf
3. www.nptel.ac.in/courses/112107080/

2. https://en.wikipedia.org/wiki/Gear#Manufacture

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CO-PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	-	2	-	-	-	-	-	-	2	3	3
CO2	3	3	3	-	2	-	-	-	-	-	-	2	3	3
CO3	3	3	3	-	2	-	-	-	-	-	-	2	3	3
CO4	3	3	3	-	2	-	-	-	-	-	-	2	3	3
CO5	3	3	3	-	2	-	-	-	-	-	-	2	3	3

ME15552 PRODUCTION PLANNING AND CONTROL 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the concepts of production planning, product development and design and break-even analysis
- become familiar with basic procedure, selection, work measurement involved in work study
- gain knowledge on value analysis, product planning, routing, batch production and balancing analysis of process capabilities of product planning and process planning.
- Learn methods of scheduling, material requirement planning, kanban, dispatching process and techniques for aligning completion time of Production scheduling
- study concepts like inventory control, bin system, ABC analysis, Just in Time system and other recent trends in production planning and control

UNIT I INTRODUCTION 9

Objectives and benefits of planning and control - Functions of production control - steps in production planning and control - Types of production – job - batch and continuous - Product development and design - Marketing aspect - Functional aspect -Operational aspect - Durability and dependability aspect aesthetic aspect. Profit consideration - Standardization, Simplification &Specialization - Break even analysis - Economics of a new design.

UNIT II WORK STUDY 9

Method study - basic procedure – Selection - Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Steps - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

UNIT III PRODUCT PLANNING AND PROCESS PLANNING 9

Product planning - Extending the original product information-Value analysis - Problems in lack of product Planning- Process planning and routing – Pre-requisite information needed for process planning-Steps in process planning- Quantity determination in batch production-Machine capacity, balancing-Analysis of process capabilities in a multi-product system.

UNIT IV PRODUCTION SCHEDULING 9

Production Control Systems - Loading and scheduling - Master Scheduling-Scheduling rules - Gantt charts-Perpetual loading - Basic scheduling problems - Line of balance – Flow production scheduling-Batch production scheduling - Product sequencing – Production Control systems - Periodic batch control - Material requirement planning kanban – Dispatching - Progress reporting and expediting - Manufacturing lead time - Techniques for aligning completion times and due dates.

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PRODUCTION PLANNING AND CONTROL 9

Inventory control - Purpose of holding stock - Effect of demand on inventories - Ordering procedures. Two bin System - Ordering cycle system - Determination of Economic order quantity and economic lot size - ABC analysis- Recorder procedure - Introduction to computer integrated production planning systems - elements of JUST IN TIME SYSTEMS - Fundamentals of MRP II and ERP.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of this course, students will be able to

- internalize the concepts of production control, product development, break even analysis and economics of new design.
- thoroughly understand production components like selection, recording procedure, work measurement, time study and predetermined motion time standards.
- demonstrate knowledge on product planning, value analysis, planning and routing, batch production and balancing, analysis of multi product system
- be conversant with production control, scheduling, product sequencing, material requirement planning, kanban, dispatching and manufacturing lead time and techniques of scheduling
- implement techniques of inventory control, ordering procedure, two bin system, ABC analysis and elements of Just in Time systems.

TEXT BOOKS

1. Martand Telsang, “Industrial Engineering and Production Management”, S. Chand and Company, First edition, 2000.
2. James.B.Dilworth, ”Operations management – Design, Planning and Control for manufacturing and services” Mcgraw Hill International edition 2005

REFERENCES

1. Samson Eilon, “Elements of production planning and control”, Universal Book Corpn.2001.
2. Elwood S.Buffa, and Rakesh K. Sarin, “Modern Production / Operations Management”, 8th Ed. John Wiley and Sons, 2000.
3. Kanishka Bedi, “Production and Operations management”, Oxford university press, 2nd Edition 2007.
4. Norman Gaither, G. Frazier, “operations management” Thomson learning 9th edition, 2007.
5. Jain. K.C & L.N. Aggarwal, “Production Planning Control and Industrial Management”, Khanna Publishers, 2002.

WEB LINKS

1. http://mech.at.ua/PPC-NOTES.pdf
2. http://nptel.ac.in/courses/112107143/1
3. https://www.youtube.com/watch?v=yYIVumq6sVM

CO-PO Mapping

COs	Mapping of Course outcomes with Programme outcomes **(1/2/3 indicates strength of correlation)3-Strong, 2-Medium, 1-Weak**													
	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	2	-	-	2	-	-	-	1	1	1
CO2	2	-	-	-	2	-	-	2	-	-	-	1	1	1
CO3	2	-	-	-	2	-	-	2	-	-	-	1	1	1
CO4	2	-	-	-	2	-	-	2	-	-	-	1	1	1
CO5	2	-	-	-	2	-	-	2	-	-	-	1	1	1

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ME15553 REFRIGERATION AND AIR CONDITIONING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- get familiar with the basic principles and concepts of refrigeration applied in the engineering practice.
- understand the fundamentals of refrigeration system components, properties of refrigerants and applications of refrigeration systems.
- learn about Psychrometric processes and its properties.
- gain knowledge on different air conditioning systems.
- study the cooling load calculations in various systems.

UNIT I REFRIGERATION CYCLE 9

Review of thermodynamic principles of refrigeration. Air cycle refrigeration system. Vapour compression refrigeration cycle - use of P-H charts - multistage and multiple evaporator systems - cascade system - COP comparison. Vapor absorption refrigeration system. Ammonia water and Lithium - Bromide water systems. Steam jet refrigeration system.

UNIT II REFRIGERATION SYSTEM COMPONENTS AND REFRIGERANTS 9

Compressors: Types – based on operation and based on arrangement. Condensers: Types-air cooled, water cooled and evaporative condensers. Evaporators: Flooded and dry expansion types. Expansion devices: Capillary tube, Automatic expansion valve, Thermostatic expansion valve. Refrigerants: Properties and Selection. Eco friendly refrigerants: Ozone Depletion Potential (ODP) and Global Warming Potential (GWP).

UNIT III PSYCHROMETRIC PROCESSES 9

Review of fundamental properties of psychrometry, Psychrometric chart, Psychrometry properties calculation, Psychrometric processes, Bypass factor, Apparatus Dew Point (ADP) temperature, numerical problems.

UNIT IV AIR CONDITIONING SYSTEMS 9

Air conditioning – definition, standards of temperature, humidity and air motion, components of air conditioning system. Summer, winter and year-round air conditioners, Window, Split air conditioners, Central air conditioner systems. Air distribution system. Thermal insulation of air conditioning systems- applications

UNIT V COOLING LOAD CALCULATIONS 9

Types of load - design of space cooling load - heat transmission through building. Solar radiation -infiltration - internal heat sources (sensible and latent) - outside air and fresh air load - estimation of total load - Domestic, commercial and industrial systems - central air conditioning systems.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of the course, the students will be able to

- use with understanding the basic concepts and terms involved in refrigeration and Air-Conditioning systems like refrigerants, refrigeration cycle, compressor, COP etc.
- describe knowledge on different types of compressors and different types of refrigerants
- demonstrate thorough understanding of Psychrometric chart and its usage
- be conversant with Air-conditioning systems for car, stores and public buildings
- learn Cooling load calculations for different types of Air-Conditioning requirements like domestic, commercial and industrial systems

TEXT BOOKS

1. R.K.Rajput, “Refrigeration and Air-Conditioning” , S.K. Kataria & Sons, 3rd Edition:2015
2. R.S. Khurmi ,“Refrigeration and Air-conditioning” S.Chand, Dec 2006

REFERENCES

1. Manohar Prasad, "Refrigeration and Air Conditioning", Wiley Eastern Ltd., 2010.
2. Domkundwar, Arrora and Domkundwar, "Refrigeration and Air Conditioning", Dhanpat Rai and co,2009
3. Ramesh Arora,” Refrigeration and Air-conditioning”, Prentice Hall of India, 2010.
4. Arora. C.P., "Refrigeration and Air Conditioning", Tata McGraw-Hill New Delhi, 2008.
5. W.F.Stocker and J.W.Jones, “Refrigeration and Air Conditioning", McGraw-Hill, 2009.

WEB LINKS

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2. nptel.ac.in/courses/112105129/35
3. nptel.ac.in/courses/112105129/pdf/R&AC%20Lecture%2027.pdf

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CO-PO Mapping

COs	Mapping of Course outcomes with Programme outcomes **(1/2/3 indicates strength of correlation)3-Strong, 2-Medium, 1-Weak**													
	Programme Outcomes(POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	2	-	-	3	-	-	-	-	2	3	2
CO2	3	2	2	2	2	-	3	-	-	-	-	2	3	3
CO3	3	3	3	2	2	-	3	-	-	-	-	2	3	2
CO4	3	3	3	2	2	-	3	-	-	-	-	2	3	3
CO5	3	3	3	2	2	-	3	-	-	-	-	2	3	3

ME15554 **INDUSTRIAL TRIBOLOGY** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- acquire knowledge on various terminology involved in Tribology
- become familiar with the basic principles of Wear Mechanism
- learn about various properties and types of lubricants
- study the fundamental concepts of film lubrication theory
- familiarize with the concept of surface engineering and bearing materials

UNIT I SURFACES AND FRICTION 9

Topography of Engineering surfaces- Contact between surfaces - Sources of sliding Friction – Adhesion – Ploughing - Energy dissipation mechanisms Friction Characteristics of metals - Friction of non-metals. Friction of lamellar solids - friction of Ceramic materials and polymers - Rolling Friction - Source of Rolling Friction – Stick slip motion - Measurement of Friction.

UNIT II WEAR 9

Types of wear - Simple theory of Sliding Wear Mechanism of sliding wear of metals – Abrasive wear – Materials for Adhesive and Abrasive wear situations - Corrosive wear - Surface Fatigue wear situations - Brittle Fracture - wear - Wear of Ceramics and Polymers - Wear Measurements.

UNIT III LUBRICANTS AND LUBRICATION TYPES 9

Types and properties of Lubricants - Testing methods – Concepts of Hydrodynamic, Hydrostatic, Elasto - hydrodynamic, and Boundary Lubrication. Thin film and thick film lubrication – Methods of lubrication – Semi solid and Solid Lubrication.

UNIT IV FILM LUBRICATION THEORY 9

Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation Reynolds Equation for film Lubrication - High speed unloaded journal bearings – Loaded journal bearings – Reaction torque on the bearings - Virtual Co-efficient of friction – The Sommerfeld diagram.

UNIT V SURFACE ENGINEERING AND MATERIALS FOR BEARINGS 9

Surface modifications - Transformation Hardening, surface fusion - Thermo chemical processes – Surface coatings - Plating and anodizing - Fusion Processes - Vapour Phase processes - Materials for rolling Element bearings - Materials for fluid film bearings - Materials for marginally lubricated and dry bearings.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of the course, the students will be able to

- understand the significance of tribology and how it affects the life of machine components

- identify different types of wear, wear behavior of different types of materials and perform wear measurements
- select suitable lubricants, know their properties and different methods of lubrication.
- describe technically film lubrication theory, bearings and the governing equations of lubrication
- use modification techniques to resist wear and design components with good tribological properties.

TEXT BOOKS

1. Basu S.K. et. Al., “Fundamentals of Tribology” PHI Learning Private Limited, 2009.
2. Sushil Kumar Srivatsava, “Tribology in Industry”, S. Chand &Co,2010

REFERENCES

1. M.M. Khonsari & E.R.Booser, “ Applied Tribology”, John Willey & Sons, New York,2001
2. E.P. Bowden and Tabor D., " Friction and Lubrication ", Heinemann Educational Books Ltd., 1974.
3. A. Cameron, “Basic Lubrication theory ", Longman, U.K.., 1981.
4. M.J.Neale (Editor), “Tribology Handbook ", Newnes. Butter worth, Heinemann, U.K., 1995.
5. Applied Tribology: Bearing Design and Lubrication (Tribology in Practice Series)” by Michael M Khonsari and E Richard Booser

WEB LINKS

1. nptel.ac.in/courses/112102015/
2. www.stle.org.
3. https://ocw.mit.edu/courses/mechanical-engineering/2-800-tribology-fall-2004/lecture-notes/

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	3	-	-	-	-	1	-	-	-	2	2	3
CO2	1	2	3	-	-	-	-	1	-	-	-	2	2	3
CO3	1	2	3	-	-	-	-	1	-	-	-	2	2	3
CO4	1	2	3	-	-	-	-	1	-	-	-	2	2	3
CO5	1	2	3	-	-	-	-	1	-	-	-	2	2	3

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ME15555 VIBRATION AND NOISE CONTROL 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- become conversant with the fundamentals of vibration.
- develop analytical competency in solving vibration problems.
- understand the various techniques of measurement and control of vibration
- get familiar with the concepts of basic noise terms.
- acquire good grounding on industrial acoustics and control measures of noise

UNIT I BASICS OF VIBRATION 9

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non-linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.

UNIT II VIBRATION OF CONTINUOUS SYSTEMS 9

Vibration of continuous systems: exact methods, boundary value problem, eigen value problem, axial vibration of rods, transverse vibration of beams, response of system by modal analysis, general elastic waves, approximate methods to analyse system, different methods like Rayleigh's energy method, Rayleigh-Ritz method, Dunkerleys method.

UNIT III VIBRATION MEASUREMENT AND CONTROL 9

Measurement of vibration, FFT analyzer-Methods of vibration control-Vibration absorbers-tuned absorbers,tuned and damped absorber (qualitative treatment only), untuned viscous dampers, Vibration isolation, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNIT IV BASICS OF NOISE 9

Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment and equipment, frequency analysis, tracking analysis, sound quality analysis.

UNIT V INDUSTRIAL NOISE AND CONTROL 9

Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise. Methods for control of engine noise, combustion noise, predictive analysis, palliative treatments and enclosures, automotive noisecontrol principles, sound in enclosures, sound energy absorption, sound transmission through barriers.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of the course, the students will be able to

- gain knowledge on basics of vibration, damped and un damped systems and analysis of frequencies.
- solve problems using various methods involved in the analysis of different vibration systems.
- employ various control techniques to arrest vibrations like crank shaft damping and shock absorbers
- use appropriately the basic terms of noise like amplitude, wave length, frequency, decibel levels and their analysis.
- apply the industrial noise control principles to control different types of noises like engine noise, combustion noise, mechanical noise and use sound absorbing materials appropriately.

TEXT BOOKS

1. Ambekar A.G. "Mechanical Vibrations and Noise Engineering" Prentice Hall of India Pvt. Ltd, 2006.
2. Singiresu S. Rao - "Mechanical Vibrations", 6th Edition, Pearson Education, 2016.

REFERENCES

1. Rao V. Dukkipati & Srinivas J. "Mechanical Vibrations" - Prentice Hall of India Pvt. Ltd, 2008.
2. Kewal Pujara "Vibrations and Noise for Engineers", Dhanpat Rai & Co (p) Ltd, 2013.
3. Theory of Vibrations with applications – W. T. Thomson, CBS Publishers & Distributors 2002.
4. Benson H Tongue. "Principles of Vibrations", 2nd Edition. Oxford University Press, NY, 2002.
5. Meirovich.L, "Elements of Vibration analysis", 2nd Ed. Tata Mc-Grawhill, 2007.

WEB LINKS

1. http://www.aticourses.com/sampler/Vibration%20&%20Noise%20Control.pdf
2. https://www.kth.se/en/studies/master/engineering-mechanics/sound-and-vibration-track·
3. http://nptel.ac.in/courses/112103111/

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	3	-	-	-	-	1	-	-	-	2	2	3
CO2	1	2	3	-	-	-	-	1	-	-	-	2	2	3
CO3	1	2	3	-	-	-	-	1	-	-	-	2	2	3
CO4	1	2	3	-	-	-	-	1	-	-	-	2	2	3
CO5	1	2	3	-	-	-	-	1	-	-	-	2	2	3

BA15451 ENTREPRENEURSHIP DEVELOPMENT 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- acquire the knowledge about competencies required for an entrepreneur.
- impart knowledge in motivation techniques in entrepreneurship
- discuss the various factors that has to be considered while preparing a business plan.
- understand the various sources of finance and accounting for business
- describe the role of government and other agencies in promoting entrepreneurship.

UNIT I ENTREPRENEURSHIP 9

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur, Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION 9

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, - Self Rating, Business Game, Thematic Appreciation Test – Stress Management, Entrepreneurship - Development Programs – Need, Objectives.

UNIT III BUSINESS 9

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation - Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING 9

Need– Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Network Analysis – Taxation – Income Tax, Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS 9

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures – Business Incubators - Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of the course, the students will be able to

- acquire skills necessary to become an entrepreneur
- exhibit the skills required to manage small business
- analyze and develop a business plan.
- identify the various factors to be considered for launching a small business.
- comprehend the support rendered by government and other agencies in entrepreneurship development

TEXT BOOKS

1. S.S. Khanka “Entrepreneurial Development” S. Chand & Co. Ltd. Ram Nagar New Delhi.2013
2. Donald F Kuratko, “Entrepreneurship – Theory, Process and Practice”, 9th Edition, Cengage Learning, 2014.

REFERENCES

1. Hisrich R D and Peters M P, “Entrepreneurship” 8th Edition Tata McGraw-Hill, 2013.
2. Mathew J Manimala,” Entrepreneurship theory at cross roads: paradigms and praxis” 2nd edition Dream tech, 2005.
3. Rajeev Roy, "Entrepreneurship" 2nd Edition, Oxford University Press, 2011.
4. EDII “Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: “Entrepreneurship Development” Institute of India, Ahmadabad, 2006.
5. S. Anil Kumar, “Entrepreneurship Development”, New Age international, 2008.

WEB LINKS

1. http://www.preservearticles.com/201101223640/objectives-of-entrepreneurial-developmentprogramme.html
2. http://nptel.ac.in/courses/122106032/Pdf/7_3.pdf
3. http://freevideolectures.com/Course/2689/Management-Science

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	-	-	-	-	2	-	1	-	-	2	2	2	3
CO2	1	-	-	-	-	2	-	1	-	-	2	2	2	3
CO3	1	-	-	-	-	2	-	1	-	-	2	2	2	3
CO4	1	-	-	-	-	2	-	1	-	-	2	2	2	3
CO5	1	-	-	-	-	2	-	1	-	-	2	2	2	3

ME15651 SAFETY IN ENGINEERING INDUSTRY 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- gain basic knowledge of modern safety concepts.
- understand the principles of industrial toxicology and their hazards.
- acquire knowledge on environmental hazards and control.
- familiarize the concept of system safety analysis techniques.
- get exposure to various types of safety regulation and case studies.

UNIT I INTRODUCTION 9

Evolution of modern safety concepts – Fire prevention – Mechanical hazards – Boilers, pressure vessels, Electrical Exposure.

UNIT II CHEMICAL HAZARDS 9

Chemical exposure – Toxic materials – Radiation Ionizing and Non-ionizing Radiation -Industrial Hygiene - Industrial Toxicology.

UNIT III ENVIRONMENTAL CONTROL 9

Industrial Health Hazards – Environmental Control – Industrial Noise - Noise measuring Instruments, Control of Noise, Vibration - Personal Protection.

UNIT IV HAZARD ANALYSIS 9

System Safety Analysis –Techniques – Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), HAZOP analysis and Risk Assessment.

UNIT V SAFETY REGULATIONS 9

Explosions – Disaster management – catastrophe control, hazard control, Factories Act, Safety regulations; Product safety – case studies.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of the course, the students will be able to

- describe the modern safety concepts and mechanical hazards.
- discuss about the chemical exposure and industrial toxicology.
- explain the safety precaution required for environmental control.
- demonstrate knowledge of system safety analysis techniques.
- become well versed with disaster management, control measures and safety regulations.

TEXT BOOKS

1. John V. Grimaldi, “Safety Management”, AITB S Publishers, 2003.
2. M. Deshmukh, “Industrial Safety management”, Tata McGraw-Hill. 5th Edition, 2009.

REFERENCES

1. Raju.K.S.N, “Chemical process industry safety ”, Tata McGraw-Hill,2014.
2. “Accident Prevention Manual” – NSC, Chicago, 2009.
3. “Occupational safety Manual” BHEL, Trichy, 2015.
4. David L. Goetsch, “Occupational Safety and Health for Technologists”, Engineers and Managers, Pearson Education Ltd. 5th Edition, 2005.
5. Indian Boiler acts and Regulations, Government of India, 2015.

WEB LINKS

1. https://www.abdn.ac.uk/study/.../safety-and-reliability-engineering-for-oil-and-gas
2. https://www.araiindia.com
3. www.hse.gov.uk/engineering

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	2	3	3	1	-	-	-	2	2	2
CO2	2	-	-	-	2	3	3	1	-	-	-	2	2	2
CO3	2	-	-	-	2	3	3	1	-	-	-	2	2	2
CO4	2	-	-	-	2	3	3	1	-	-	-	2	2	2
CO5	2	-	-	-	2	3	3	1	-	-	-	2	2	2

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ME15652 ENERGY CONSERVATION AND MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the basic principles of energy consumption and know how energy auditing is applied in engineering practice.
- gain knowledge on the analysis of various power generation systems involved in electrical systems.
- know the fundamentals of boilers and the factors to improve their efficiency.
- acquire knowledge for conserving energy from pumps, fans, blowers, refrigeration and air conditioning systems.
- learn the concepts of Energy resource management and utilize the available resources in optimal ways.

UNIT I IMPORTANCE OF ENERGY CONSERVATION AND MANAGEMENT 8

World, national Energy consumption – environmental aspects – Energy prices, policies – Energy auditing: methodology, analysis, energy accounting – Measurements – Thermal and Electrical.

UNIT II ELECTRICAL SYSTEMS 12

AC / DC current systems, Demand control, power factor correction, load management, Motor drives: motorefficiency testing, energy efficient motors, motor speed control – Lighting: lighting levels, efficient options,daylighting, timers, Energy efficient windows – electrical distribution systems – Transformers – Power quality – harmonic distortion

UNIT III THERMAL SYSTEMS 10

Boiler – efficiency testing, excess air control, Steam distribution & use – steam traps, condensate recovery, flash steam utilization, Thermal Insulation. Heat exchanger networking – concept of pinch, Target settling, problem table approach.

UNIT IV ENERGY CONSERVATION 8

Energy conservation in Pumps, Fans (flow control) and blowers, Compressed Air Systems, Refrigeration and air conditioning systems – Waste heat recovery recuperators, heat sheets, heat pipes heat pumps.

UNIT V ENERGY MANAGEMENT, ECONOMICS 7

Energy resource management – Energy Management information systems – Computerized energy management – Energy economics – discount rate, payback period, internal rate of Return, life cycle costing – Financing energy conservation Project.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- carry out energy accounting and balancing.
- demonstrate knowledge on various motor drives and transformers.

- get strong grounding on basics of boilers and identify the various concepts/components/processes involved in thermal systems
- implement practices like cogeneration in industry and waste heat recovery techniques for energy conservation.
- apply the concepts of energy management and energy economics for energy savings in practical life.

TEXT BOOKS

1. L.C. Witte, P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation" Hemisphere Publications, Washington, 2002.
2. Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford, 2005.

REFERENCES

1. Albert Thumann, Handbook of Energy Audits, 6th Edition, The Fairmont Press,2007
2. W.C. turner, "Energy Management Hand book" Wiley, New York,2009
3. W.R. Murphy and G. Mc KAY "Energy Management" Butterworths, London,2007
4. Dale R Patrick, Stephen W Fardo, "Energy Conservation Guidebook" 2nd Edition, CRC Press,2005
5. I.G.C. Dryden, "The Efficient Use of Energy" Butterworths, London, 2003.

WEB LINKS

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2. www.gtuinfo.in/.../Syllabus/.../Energy+Conservation+And+Management.
3. http://www.valluriorg.com/blog/energy/energy-conservation-and-management

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**													
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CO1	2	-	-	-	2	3	3	1	-	-	-	2	2	2
CO2	2	-	-	-	2	3	3	1	-	-	-	2	2	2
CO3	2	-	-	-	2	3	3	1	-	-	-	2	2	2
CO4	2	-	-	-	2	3	3	1	-	-	-	2	2	2
CO5	2	-	-	-	2	3	3	1	-	-	-	2	2	2

ME15653 INDUSTRIAL PSYCHOLOGY AND WORK ETHICS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the industry needs, scope and major influences from psychological point of view
- familiarize the factors like cultures, values, cross-cultural issues that shape the structure of an organization.
- learn the significance of inter-personal relationship and managing emotions among industry personnel.
- Know about the modern concept of Corporate Social Responsibility.
- get clear understanding of work ethics, moral and ethical values, leadership styles and other ethics related concepts.

UNIT I INDUSTRIAL PSYCHOLOGY 9

Introduction to Industrial Psychology – Definitions & Scope Major influences on industrial Psychology - Scientific management and human relations schools Hawthorne Experiments. Individual behavior – Group behavior – Group Dynamics – Leadership Styles – Industrial Fatigue.

UNIT II ORGANIZATIONAL STRUCTURE 9

Key organizational design process, Structural differentiations, Forces reshaping organizations. Functions of organizational culture, Organizational Socialization, Assessing Cultural Values and Fit, Cross Cultural issues. Lewin's Change Model.

UNIT III INTERPERSONAL RELATIONSHIP 9

Managing emotions – Emotional Intelligence – Building Better interpersonal Relations – Managing the Boss – Dealing with Subordinates – Case Study. Basic Theories of Motivation – Importance of Perception – Need for Shaping Perception.

UNIT IV SOCIAL RESPONSIBILITY AND ETHICS 9

Concept of Social Responsibility – Importance of Social Responsibility – Business Ethics. Decision making process, individual influences, group decision process.

UNIT V WORK ETHICS 9

Professional Values & Ethics – Need – Issues – Challenges – Ethical Leadership, Leadership Vs Management, Leadership Theories, Emerging issues in Leadership. Value crisis in Contemporary Indian Society – Aesthetic Values, Moral and Ethical Values – Values in the Work place.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- discuss the importance of psychological problems and issues involved in running an industry.

- demonstrate knowledge on how organizational structure is shaped by issues like cultures, values and emotions involving different sections of people.
- apply knowledge gained on interpersonal relations to run a business smoothly.
- understand the social responsibility of a business concern and follow ethical ways to run a business.
- consciously follow work ethics, moral and ethical values, appropriate leadership style in running a business.

TEXT BOOKS

1. Vikram Bisen & Priya, "Industrial Psychology", New Age International (P) Ltd., Publishers, 2010.
2. Murthy C.S.V., "Business Ethics", Himalaya Publishing House, 2007.

REFERENCES

1. Luthans, Fred, "Organizational Behavior", McGraw Hill 2008
2. Tripathi. A. N., "Human Values", New Age International Pvt. Ltd., New Delhi, 2002.
3. Maynard, H., "Industrial Engineering Hand Book", McGraw Hill Book Co., New York, l999
4. Ronald E. Riggio, "Introduction to Industrial and Organizational Psychology", Pearson Education, Inc. New York, 2008
5. Joel Lefkowitz, "Ethics and Values in Industrial-Organizational Psychology", Taylor and Francis, e-library, 2009.

WEB LINKS

1. http://www.ergonomics.org.uk/learning/what-ergonomics/
2. http:// www.iea.cc/whats/
3. https://books.google.co.in/books?isbn=1111839972

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	2	1	2	-	-	-	2	2	2
CO2	2	-	-	-	-	2	2	2	-	-	-	2	2	2
CO3	2	-	-	-	-	2	2	2	-	-	-	2	2	2
CO4	2	-	-	-	-	2	2	3	-	-	-	2	2	2
CO5	2	-	-	-	-	2	1	3	-	-	-	2	2	2

ME15654 ADVANCED I.C. ENGINES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the underlying principles of operation of Spark Ignition Engines and its components.
- get educated about the principles and operation of Compression Ignition Engines and its components.
- gain knowledge on pollutant formation and control methods.
- acquire knowledge on various alternate fuels available to replace non-renewable energy.
- update knowledge on recent trends and developments in IC engines.

UNIT I SPARK IGNITION ENGINES 9

Mixture requirements – Fuel injection systems – Mono point, Multipoint & Direct injection - Stages of combustion – Normal and Abnormal combustion – Knock - Factors affecting knock – Combustion chambers.

UNIT II COMPRESSION IGNITION ENGINES 9

Diesel Fuel Injection Systems - Stages of combustion – Knocking – Factors affecting knock – Direct and Indirect injection systems – Combustion chambers – Fuel Spray behaviour – Spray structure and spray penetration– Air motion.

UNIT III POLLUTANT FORMATION AND CONTROL 9

Pollutant – Sources – Formation of Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters, Selective Catalytic Reduction and Particulate Traps – Methods of measurement – Emission norms and Driving cycles.

UNIT IV ALTERNATIVE FUELS 9

Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits - Engine Modifications.

UNIT V RECENT TRENDS 9

Air assisted Combustion, Homogeneous charge compression ignition engines – Variable Geometry turbochargers – Common Rail Direct Injection Systems - Hybrid Electric Vehicles – NOx Adsorbers - Onboard Diagnostics.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- describe knowledge on the operations of Spark Ignition Engine and its components.
- discuss in detail the operations of Compression Ignition Engine and its components.
- understand about pollutants developed from various fuel sources and apply controlling techniques.
- demonstrate knowledge on alternate fuels and engine design modifications required to use them
- keep trend with the latest developments in I.C engines like rail direct injection systems, On-board diagnostics and hybrid vehicles.

TEXT BOOKS

1. Ganesan.V, "Internal Combustion Engines", II Edition, TMH, 2002.
2. Ramalingam. K.K., "Internal Combustion Engine Fundamentals", Scitech Publications, 2002.

REFERENCES

1. Mathur. R.B. and R.P. Sharma, "Internal Combustion Engines"., Dhanpat Rai & Sons 2007.
2. Duffy Smith, "Auto Fuel Systems", The Good Heart Willcox Company, Inc., 1987.
3. Eric Chowenitz, "Automobile Electronics", SAE Publications, 1995.
4. Ed May, “Automotive Mechanics”, Tata McGraw-Hill,2003
5. Kirpal Singh “Automobile Engineering”, Standard Publishers, New Delhi, 2009.

WEB LINKS

1. http://nptel.ac.in/courses/112101004/
2. https://easyengineering.net/me6016-advanced-i-c-engines/
3. http://thebooksout.com/downloads/ic-engine-notes-for-gate.pdf

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	-	-	-	2	2	-	-	-	-	2	2	2
CO2	2	2	-	-	-	2	2	-	-	-	-	2	2	2
CO3	2	2	-	-	-	2	2	-	-	-	-	2	2	2
CO4	2	3	-	-	-	2	3	-	-	-	-	2	2	2
CO5	2	3	-	-	-	2	3	-	-	-	-	2	2	2

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