

ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS

B.E. MECHANICAL ENGINEERING
II TO VIII SEMESTERS CURRICULUM AND SYLLABI

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SEMESTERS VI

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
MG 2351	<u>Principles of Management</u>	3	0	0	3
ME 2351	<u>Gas Dynamics and Jet Propulsion</u>	3	1	0	4
ME 2352	<u>Design of Transmission Systems</u>	3	1	0	4
ME 2354	<u>Automobile Engineering</u>	3	0	0	3
ME 2353	<u>Finite Element Analysis</u>	3	1	0	4
	Elective – I	3	0	0	3
PRACTICALS					
ME 2355	<u>Thermal Engineering Lab – II</u>	0	0	3	2
ME 2356	<u>Design & Fabrication Project</u>	0	0	4	2
GE 2321	<u>Communication Skills Lab</u>	0	0	4	2
	TOTAL	18	3	11	27

Elective I

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
MG 2021	<u>Marketing Management</u>	3	0	0	3
ME 2021	<u>Quality Control & Reliability Engineering</u>	3	0	0	3
ME 2022	<u>Refrigeration & Air conditioning</u>	3	0	0	3
ME 2023	<u>Renewable Sources of Energy</u>	3	0	0	3
ME 2024	<u>Industrial Tribology</u>	3	0	0	3
ME 2025	<u>Vibration & Noise Control</u>	3	0	0	3
ME 2026	<u>Unconventional Machining Processes</u>	3	0	0	3

MG2351

**PRINCIPLES OF MANAGEMENT
(COMMON TO ALL BRANCHES)**

**L T P C
3 0 0 3**

UNIT I OVERVIEW OF MANAGEMENT 9

Organization – Management – Role of managers – Evolution of Management thought – Organization and the environmental factors – Managing globally – Strategies for International Business.

UNIT II PLANNING 9

Nature and Purpose planning – Planning process – Types of plans – Objectives – Managing by objective (MBO) Strategies – Types of strategies – Policies – Decision Making – Types of decision – Decision Making Process - Rational Decision Making Process – Decision Making under different conditions.

UNIT III ORGANISING 9

Nature and purpose of organizing – Organization structure – Formal and informal groups / organization – Line and Staff authority – Departmentation – Span of Control – Centralization and Decentralization – Delegation of authority – Staffing – Selection and Recruitment – Orientation Career Development – Career stages – Training – Performance Appraisal.

UNIT IV DIRECTING 9

Creativity and Innovation – Motivation and Satisfaction – Motivation Theories Leadership – Leadership theories – Communication – Hurdles to effective communication – Organization Culture – Elements and types of culture – Managing cultural diversity

UNIT V CONTROLLING 9

Process of controlling – Types of control – Budgetary and non-budgetary control techniques – Managing Productivity – Cost Control – Purchase Control – Maintenance Control – Quality Control – Planning operations.

TEXT BOOKS: TOTAL: 45 PERIODS

1. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition.
2. Charles W.L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.

REFERENCES:

1. Hellriegel, Slocum & Jackson, 'Management – A Competency Based Approach', Thomson South Western, 10th edition, 2007.
2. Harold Koontz, Heinz Weihrich and mark V Cannice, 'Management – A global & Entrepreneurial Perspective', Tata Mcgraw Hill, 12th edition, 2007.
3. Andrew J. Dubrin, 'Essentials of Management', Thomson Southwestern, 7th edition, 2007.

ME2351

GAS DYNAMICS AND JET PROPULSION

**L T P C
3 1 0 4**

AIM:

To impart knowledge to the students on compressible flow through ducts, jet propulsion and space propulsion.

OBJECTIVE:

- To understand the basic difference between incompressible and compressible flow.
- To understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and Rocket Propulsion.

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS 6

Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers – Use of Gas tables.

UNIT II FLOW THROUGH DUCTS 9

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties – Use of tables and charts – Generalised gas dynamics.

UNIT III NORMAL AND OBLIQUE SHOCKS 10

Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Use of table and charts – Applications.

UNIT IV JET PROPULSION 10

Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operation principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

UNIT V SPACE PROPULSION 10

Types of rocket engines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion – Performance study – Staging – Terminal and characteristic velocity – Applications – space flights.

TUTORIALS: 15, TOTAL: 60 PERIODS

TEXT BOOKS:

1. Anderson, J.D., Modern Compressible flow, McGraw Hill, 3rd Edition, 2003.
2. H. Cohen, G.E.C. Rogers and Saravanamutto, Gas Turbine Theory, Longman Group Ltd., 1980.
3. S.M. Yahya, fundamentals of Compressible Flow, New Age International (P) Limited, New Delhi, 1996.

REFERENCES:

1. P. Hill and C. Peterson, Mechanics and Thermodynamics of Propulsion, Addison – Wesley Publishing company, 1992.
2. N.J. Zucrow, Aircraft and Missile Propulsion, vol.1 & II, John Wiley, 1975.
3. N.J. Zucrow, Principles of Jet Propulsion and Gas Turbines, John Wiley, New York, 1970.
4. G.P. Sutton, Rocket Propulsion Elements, John wiley, 1986, New York.
5. A.H. Shapiro, Dynamics and Thermodynamics of Compressible fluid Flow, , John wiley, 1953, New York.
6. V. Ganesan, Gas Turbines, Tata McGraw Hill Publishing Co., New Delhi, 1999.
7. PR.S.L. Somasundaram, Gas Dynamics and Jet Propulsions, New Age International Publishers, 1996.
8. V. Babu, Fundamentals of Gas Dynamics, ANE Books India, 2008.

OBJECTIVE:

- To gain knowledge on the principles and procedure for the design of power Transmission components. To understand the standard procedure available for Design of Transmission sip terms To learn to use standard data and catalogues

UNIT I DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS 12

Selection of V belts and pulleys – selection of Flat belts and pulleys - Wire ropes and pulleys – Selection of Transmission chains and Sprockets. Design of pulleys and sprockets.

UNIT II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 12

Gear Terminology-Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects - Fatigue strength - Factor of safety - Gear materials – Module and

Face width-power rating calculations based on strength and wear considerations - Parallel axis Helical Gears – Pressure angle in the normal and transverse plane-Equivalent number of teeth-forces and stresses. Estimating the size of the helical gears.

UNIT III BEVEL, WORM AND CROSS HELICAL GEARS 12

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears.

Worm Gear: Merits and demerits- terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair.

Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

UNIT IV DESIGN OF GEAR BOXES 12

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box -Constant mesh gear box. – Design of multi speed gear box.

UNIT V DESIGN OF CAM CLUTCHES AND BRAKES 12

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses.

Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches-internal and external shoe brakes.

TUTORIALS: 15, TOTAL: 60 PERIODS

NOTE: (Usage of P.S.G Design Data Book is permitted in the University examination)

TEXT BOOKS:

1. Shigley J.E and Mischke C. R., "Mechanical Engineering Design", Sixth Edition, Tata McGraw-Hill , 2003.
2. Sundararamamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.

REFERENCES:

1. Maitra G.M., Prasad L.V., "Hand book of Mechanical Design", II Edition, Tata McGraw-Hill, 1985.
2. Bhandari, V.B., "Design of Machine Elements", Tata McGraw-Hill Publishing Company Ltd., 1994.
3. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000,
4. Hamrock B.J., Jacobson B., Schmid S.R., "Fundamentals of Machine Elements", McGraw-Hill Book Co., 1999.
5. Ugural A,C, "Mechanical Design, An Integrated Approach", McGraw-Hill , 2003.

STANDARDS:

1. IS 4460 : Parts 1 to 3 : 1995, Gears – Spur and Helical Gears – Calculation of Load Capacity.
2. IS 7443 : 2002, Methods of Load Rating of Worm Gears
3. IS 15151: 2002, Belt Drives – Pulleys and V-Ribbed belts for Industrial applications – PH, PJ, PK, PI and PM Profiles : Dimensions
4. IS 2122 : Part 1: 1973, Code of practice for selection, storage, installation and maintenance of belting for power transmission : Part 1 Flat Belt Drives.
5. IS 2122: Part 2: 1991, Code of practice for selection, storage, installation and maintenance of belting for power transmission : Part 2 V-Belt Drives.

OBJECTIVE:

- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system

UNIT I VEHICLE STRUCTURE AND ENGINES**9**

Types of automobiles , vehicle construction and different layouts ,chassis, frame and body, resistances to vehicle motion and need for a gearbox, components of engine-their forms ,functions and materials

UNIT II ENGINE AUXILIARY SYSTEMS**9**

Electronically controlled gasoline injection system for SI engines., Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system ,Turbo chargers, Engine emission control by three way catalytic converter system .

UNIT III TRANSMISSION SYSTEMS**9**

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**9**

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 and Traction Control

UNIT V ALTERNATIVE ENERGY SOURCES**9**

Use of Natural Gas, Liquefied Petroleum Gas. Bio-diesel, Bio-ethanol , Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance ,Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell

Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Kirpal Singh, “ Automobile Engineering Vol 1 & 2 “, Standard Publishers, Seventh Edition ,1997, New Delhi
2. Jain,K.K.,and Asthana .R.B, “Automobile Engineering” Tata McGraw Hill Publishers, New Delhi, 2002

REFERENCES:

1. Newton ,Steeds and Garet,” Motor Vehicles “, Butterworth Publishers,1989
2. Joseph Heitner, “Automotive Mechanics,” , Second Edition ,East-West Press ,1999

3. Martin W. Stockel and Martin T Stockle , “ Automotive Mechanics Fundamentals,” The Goodheart –Will Cox Company Inc, USA ,1978
4. Heinz Heisler , ‘Advanced Engine Technology,” SAE International Publications USA,1998
5. Ganesan V..” Internal Combustion Engines” , Third Edition, Tata Mcgraw-Hill ,2007

ME2353

FINITE ELEMENT ANALYSIS

L T P C
3 1 0 4

INTRODUCTION (Not for examination) **5**

Solution to engineering problems – mathematical modeling – discrete and continuum modeling – need for numerical methods of solution – relevance and scope of finite element methods – engineering applications of FEA

UNIT I FINITE ELEMENT FORMULATION OF BOUNDARY VALUE PROBLEMS **5+3**

Weighted residual methods –general weighted residual statement – weak formulation of the weighted residual statement –comparisons – piecewise continuous trial functions-example of a bar finite element –functional and differential forms – principle of stationary total potential – Rayleigh Ritz method – piecewise continuous trial functions – finite element method – application to bar element

UNIT II ONE DIMENSIONAL FINITE ELEMENT ANALYSIS **8+4**

General form of total potential for 1-D applications – generic form of finite element equations – linear bar element – quadratic element –nodal approximation – development of shape functions – element matrices and vectors – example problems – extension to plane truss– development of element equations – assembly – element connectivity – global equations – solution methods –beam element – nodal approximation – shape functions – element matrices and vectors – assembly – solution – example problems

UNIT III TWO DIMENSIONAL FINITE ELEMENT ANALYSIS **10+4**

Introduction – approximation of geometry and field variable – 3 noded triangular elements – four noded rectangular elements – higher order elements – generalized coordinates approach to nodal approximations – difficulties – natural coordinates and coordinate transformations – triangular and quadrilateral elements – iso-parametric elements – structural mechanics applications in 2-dimensions – elasticity equations – stress strain relations – plane problems of elasticity – element equations – assembly – need for quadrature formulæ – transformations to natural coordinates – Gaussian quadrature – example problems in plane stress, plane strain and axisymmetric applications

UNIT IV DYNAMIC ANALYSIS USING FINITE ELEMENT METHOD **8+4**

Introduction – vibrational problems – equations of motion based on weak form – longitudinal vibration of bars – transverse vibration of beams – consistent mass matrices – element equations –solution of eigenvalue problems – vector iteration methods – normal modes – transient vibrations – modeling of damping – mode superposition technique – direct integration methods

UNIT V APPLICATIONS IN HEAT TRANSFER & FLUID MECHANICS 6+3

One dimensional heat transfer element – application to one-dimensional heat transfer problems- scalar variable problems in 2-Dimensions – Applications to heat transfer in 2-Dimension – Application to problems in fluid mechanics in 2-D

L=42, T=18, TOTAL: 60 PERIODS

TEXT BOOK:

1. P.Seshu, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd. New Delhi, 2007. ISBN-978-203-2315-5

REFERENCE BOOKS:

1. J.N.Reddy, "An Introduction to the Finite Element Method", McGraw-Hill International Editions(Engineering Mechanics Series), 1993. ISBN-0-07-051355-4
2. Chandrupatla & Belagundu, "Introduction to Finite Elements in Engineering", 3rd Edition, Prentice-Hall of India, Eastern Economy Editions. ISBN-978-81-203-2106-9
3. David V.Hutton,"Fundamentals of Finite Element Analysis", Tata McGraw-Hill Edition 2005. ISBN-0-07-239536-2
4. Cook,Robert.D., Plesha,Michael.E & Witt,Robert.J. "Concepts and Applications of Finite Element Analysis",Wiley Student Edition, 2004. ISBN-10 81-265-1336-5

Note: L- no. of lectures/week, T- no. of tutorials per week

ME2355	THERMAL ENGINEERING LAB - II	L T P C
		0 0 3 2
	LIST OF EXPERIMENTS	
HEAT TRANSFER		30
Thermal conductivity measurement by guarded plate method		
Thermal conductivity of pipe insulation using lagged pipe apparatus		
Natural convection heat transfer from a vertical cylinder		
Forced convection inside tube		
Heat transfer from pin-fin (natural & forced convection modes)		
Determination of Stefan-Boltzmann constant		
Determination of emissivity of a grey surface		
Effectiveness of Parallel/counter flow heat exchanger		
REFRIGERATION AND AIR CONDITIONING		15
Determination of COP of a refrigeration system		
Experiments on air-conditioning system		
Performance test on single/two stage reciprocating air compressor.		

TOTAL: 45 PERIODS

LIST OF EQUIPMENT
(for a batch of 30 students)

- | | |
|---|---------|
| 1. Guarded plate apparatus | – 1 No. |
| 2. Lagged pipe apparatus | – 1 No. |
| 3. Natural convection-vertical cylinder apparatus | – 1 No. |
| 4. Forced convection inside tube apparatus | – 1 No. |
| 5. Pin-fin apparatus | – 1 No. |
| 6. Stefan-Boltzmann apparatus | – 1 No. |
| 7. Emissivity measurement apparatus | – 1 No. |
| 8. Parallel/counter flow heat exchanger apparatus | – 1 No. |
| 9. Single/two stage reciprocating air compressor. | – 1 No. |
| 10. Refrigeration test rig | – 1 No. |
| 11. Air-conditioning test rig | – 1 No. |

ME2356

DESIGN AND FABRICATION PROJECT
(COMMON TO MECHANICAL AND PRODUCTION)

L T P C
0 0 4 2

The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.

The students in convenient groups of not more than 4 members have to take one small item for design and fabrication. Every project work shall have a guide who is the member of the faculty of the institution and if possible with an industry guide also.

The item chosen may be small machine elements (Example-screw jack, coupling, machine vice, cam and follower, governor etc), attachment to machine tools, tooling (jigs, fixtures etc), small gear box, automotive appliances, agricultural implements, simple heat exchangers, small pumps, hydraulic /pneumatic devices etc.

The students are required to design and fabricate the chosen item in the college and demonstrate its working apart from submitting the project report. The report should contain assembly drawing, parts drawings, process charts relating to fabrication.

TOTAL: 60 PERIODS

GE2321

COMMUNICATION SKILLS LABORATORY

L T P C
0 0 4 2

Globalisation has brought in numerous opportunities for the teeming millions, with more focus on the students' overall capability apart from academic competence. Many students, particularly those from non-English medium schools, find that they are not preferred due to their inadequacy of communication skills and soft skills, despite possessing sound knowledge in their subject area along with technical capability. Keeping in view their pre-employment needs and career requirements, this course on Communication Skills Laboratory will prepare students to adapt themselves with ease to the industry environment, thus rendering them as prospective assets to industries. The course will equip the students with the necessary communication skills that would go a long way in helping them in their profession.

OBJECTIVES:

- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

I. PC based session	(Weightage 40%)	24 periods
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A. ENGLISH LANGUAGE LAB

(18 Periods)

1. LISTENING COMPREHENSION:

(6)

Listening and typing – Listening and sequencing of sentences – Filling in the blanks - Listening and answering questions.

2. READING COMPREHENSION:

(6)

Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.

3. SPEAKING:

(6)

Phonetics: Intonation – Ear training - Correct Pronunciation – Sound recognition exercises – Common Errors in English.

Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation)

B. DISCUSSION OF AUDIO-VISUAL MATERIALS

(6 PERIODS)

(Samples are available to learn and practice)

1. RESUME / REPORT PREPARATION / LETTER WRITING

(1)

Structuring the resume / report - Letter writing / Email Communication - Samples.

2. PRESENTATION SKILLS:

(1)

Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples

3. SOFT SKILLS:

(2)

Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise - Video Samples

4. GROUP DISCUSSION:

(1)

Why is GD part of selection process ? - Structure of GD – Moderator – led and other GDs - Strategies in GD – Team work - Body Language - Mock GD -Video samples

5. INTERVIEW SKILLS:

(1)

Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews- Video samples.

II. Practice Session**(Weightage – 60%)****24 periods**

1. **Resume / Report Preparation / Letter writing:** Students prepare their own resume and report. **(2)**
2. **Presentation Skills:** Students make presentations on given topics. **(8)**
3. **Group Discussion:** Students participate in group discussions. **(6)**
4. **Interview Skills:** Students participate in Mock Interviews **(8)**

TEXT BOOKS

1. Anderson, P.V, **Technical Communication**, Thomson Wadsworth, Sixth Edition, New Delhi, 2007.
2. Prakash, P, **Verbal and Non-Verbal Reasoning**, Macmillan India Ltd., Second Edition, New Delhi, 2004.

REFERENCES

1. John Seely, **The Oxford Guide to Writing and Speaking**, Oxford University Press, New Delhi, 2004.
2. Evans, D, **Decisionmaker**, Cambridge University Press, 1997.
3. Thorpe, E, and Thorpe, S, **Objective English**, Pearson Education, Second Edition, New Delhi, 2007.
4. Turton, N.D and Heaton, J.B, **Dictionary of Common Errors**, Addison Wesley Longman Ltd., Indian reprint 1998.

LAB REQUIREMENT

1. Teacher console and systems for students.
2. English Language Lab Software
3. Career Lab Software

Requirement for a batch of 60 students

Sl.No.	Description of Equipment	Quantity required
1.	Server	1 No.
	○ PIV system	
	○ 1 GB RAM / 40 GB HDD	
	○ OS: Win 2000 server	
	○ Audio card with headphones (with mike)	
○ JRE 1.3		
2.	Client Systems	60 No.
	○ PIII or above	
	○ 256 or 512 MB RAM / 40 GB HDD	
	○ OS: Win 2000	

	<ul style="list-style-type: none"> ○ Audio card with headphones (with mike) ○ JRE 1.3 	
3.	Handicam Video Camera (with video lights and mic input)	1 No.
4.	Television - 29"	1 No.
5.	Collar mike	1 No.
6.	Cordless mikes	1 No.
7.	Audio Mixer	1 No.
8.	DVD Recorder / Player	1 No.
9.	LCD Projector with MP3 /CD /DVD provision for audio / video facility - Desirable	1 No.

MG2021

MARKETING MANAGEMENT

**L T P C
3 0 0 3**

OBJECTIVES:

- To understand the various processes involved in Marketing and its Philosophy.
- To learn the Psychology of consumers.
- To formulate strategies for advertising, pricing and selling

UNIT I MARKETING PROCESS 9
Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION 9
Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic -Psycho graphic and geographic segmentation, process, patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9
Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9
Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9
Characteristics, impact, goals, types, and sales promotions- point of purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Govindarajan. M, "Marketing management – concepts, cases, challenges and trends", Prentice hall of India, second edition 2007.
2. Philip Kotler, Koshy Jha "Marketing Management", Pearson Education , Indian adapted edition. 2007

REFERENCES:

1. Ramasamy and Nama kumari, "Marketing Environment: Planning, implementation and control the Indian context", 1990.
2. Czinkota & Kotabe, "Marketing management", Thomson learning, Indian edition 2007
3. Adrain palmer, " Introduction to marketing theory and practice", Oxford university press IE 2004.
4. Donald S. Tull and Hawkins, "Marketing Research", Prentice Hall of India-1997.
5. Philip Kotler and Gary Armstrong "Principles of Marketing" Prentice Hall of India, 2000.
6. Steven J. Skinner, "Marketing", All India Publishers and Distributes Ltd. 1998.
7. Graeme Drummond and John Ensor, Introduction to marketing concepts, Elsevier, Indian Reprint, 200

ME2021 QUALITY CONTROL AND RELIABILITY ENGINEERING L T P C
(Common to Mechanical, Automobile and Production) **3 0 0 3**

OBJECTIVES:

- To introduce the concept of SQC
- To understand process control and acceptance sampling procedure and their application.
- To learn the concept of reliability.

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 σ 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, pattern study.

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 - RELIABILITY 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 – O.C Curves.

UNIT V QUALITY AND RELIABILITY 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: 45 PERIODS

Note: Use of approved statistical table permitted in the examination.

TEXT BOOKS:

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

REFERENCES:

1. John.S. Oakland. "Statistical process control", Elsevier, 5th edition, 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. R.C.Gupta, "Statistical Quality control", Khanna Publishers, 1997.
6. Besterfield D.H., "Quality Control", Prentice Hall, 1993.
7. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publishers, 1998.
8. Danny Samson, "Manufacturing & Operations Strategy", Prentice Hall, 1991

**ME2022 REFRIGERATION AND AIR CONDITIONING L T P C
3 0 0 3**

AIM:

To reach the underlying principles of operation in different Refrigeration & Air conditioning systems and components.

OBJECTIVES:

- To provide knowledge on various refrigeration cycles, system components and refrigerants. To provide knowledge on design aspects of Refrigeration & Air conditioning Systems.

UNIT I REFRIGERATION CYCLE 7

Review of thermodynamic principles of refrigeration. Carnot refrigeration cycle – Vapour compression refrigeration cycle – use of P.H. charts – multistage and multiple evaporator systems – cascade system – COP comparison. Air Refrigeration cycles.

UNIT II REFRIGERANTS AND SYSTEM COMPONENTS 10
Compressors – reciprocating and rotary (elementary treatment), Types of condensers, evaporators, cooling towers – Functional aspects. Refrigerants – properties – selection of refrigerants, Alternate Refrigerants, Cycling controls.

UNIT III PSYCHROMETRY 10
Psychrometric processes use of psychrometric charts – Grand and Room Sensible Heat Factors – bypass factor – air washers, requirements of comfort air conditioning, summer and Winter Air conditioning.

UNIT IV AIR CONDITIONING SYSTEMS 9
Cooling load calculation working principles of – Centralized Air conditioning systems, Split, Ductable split, Packaged Air conditioning, VAV & VRV Systems. Duct Design by equal friction method, Indoor Air quality concepts.

UNIT V UNCONVENTIONAL REFRIGERATION CYCLES 9
Vapor Absorption system – Ejector jet, Steam jet refrigeration, thermo electric refrigeration. APPLICATIONS – ice plant – food storage plants – milk – chilling plants.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Manohar Prasad, "Refrigeration and Air Conditioning", Wiley Eastern Ltd., 1983.
2. Arora C.P., "Refrigeration and Air Conditioning", Tata McGraw Hill, New Delhi, 1988.

REFERENCE BOOKS:

1. Roy. J. Dossat, "Principles of Refrigeration", Pearson Education 1997.
2. Jordon and Priester, "Refrigeration and Air Conditioning", Prentice Hall of India Pvt. Ltd., New Delhi, 1985.
3. Stoecker N.F. and Jones, "Refrigeration and Air Conditioning", TMH, New Delhi, 1981.

ME2023 RENEWABLE SOURCES OF ENERGY L T P C
3 0 0 3

AIM:

To instruct the importance of renewable energy and its utilization for the thermal and electrical energy needs and also the environmental aspects of these resources.

OBJECTIVES:

- At the end of the course, the student expected to do Understand and analyze the pattern of renewable energy resources Suggest methodologies / technologies for its utilization
- Economics of the utilization and environmental merits

UNIT I SOLAR ENERGY 9
Solar Radiation – Measurements of solar Radiation and sunshine – Solar Thermal Collectors – Flat Plate and Concentrating Collectors – Solar Applications – fundamentals of photo Voltaic Conversion – solar Cells – PV Systems – PV Applications.

UNIT II WIND ENERGY 9
Wind Data and Energy Estimation – wind Energy Conversion Systems – Wind Energy generators and its performance – Wind Energy Storage – Applications – Hybrid systems.

UNIT III BIO - ENERGY 9
Biomass, Biogas, Source, Composition, Technology for utilization – Biomass direct combustion – Biomass gasifier – Biogas plant – Digesters – Ethanol production – Bio diesel production and economics.

UNIT IV OTEC, TODAL, GEOTHERMAL AND HYDEL ENERGY 9
Tidal energy – Wave energy – Data, Technology options – Open and closed OTEC Cycles – Small hydro, turbines – Geothermal energy sources, power plant and environmental issues.

UNIT V NEW ENERGY SOURCES 9
Hydrogen, generation, storage, transport and utilization, Applications : power generation, transport – Fuel cells – technologies, types – economics and the power generation

TOTAL: 45 PERIODS

TEXT BOOK:

1. G.D. Rai, Non Conventional Energy Sources, Khanna Publishers, New Delhi, 1999.
2. S.P. Sukhatme, Solar Energy, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.

REFERENCES:

1. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K., 1996.
2. Twidell, J.W. & Weir, A., Renewable Energy Sources, EFN Spon Ltd., UK, 1986.
3. G.N. Tiwari, solar Energy – Fundamentals Design, Modelling and applications, Narosa Publishing House, New Delhi, 2002.
4. L.L. Freris, Wind Energy Conversion systems, Prentice Hall, UK, 1990.

**ME2024 INDUSTRIAL TRIBOLOGY L T P C
3 0 0 3**

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 - Hydrodynamic Lubrication – Elasto-hydrodynamic lubrication- Boundary Lubrication - Solid Lubrication- Hydrostatic 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 Sommerfield 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: 45 PERIODS

TEXT BOOK:

1. A.Harnoy “ Bearing Design in Machinery “Marcel Dekker Inc,NewYork,2003

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 EducationalBooks 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.

ME2025	VIBRATION AND NOISE CONTROL	L T P C
	(COMMON TO MECHANICAL AND AUTOMOBILE)	3 0 0 3

OBJECTIVE:

- The student will be able to understand the sources of vibration and noise in automobiles and make design modifications to reduce the vibration and noise and improve the life of the components

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 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, equipment, frequency analysis, tracking analysis, sound quality analysis.

UNIT III AUTOMOTIVE NOISE SOURCES 9
Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.

UNIT IV CONTROL TECHNIQUES 9
Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNIT V SOURCE OF NOISE AND CONTROL 9
Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Singiresu S.Rao - "Mechanical Vibrations" - Pearson Education, ISBN –81-297-0179-0 - 2004.
2. Kewal Pujara "Vibrations and Noise for Engineers, Dhanpat Rai & Sons, 1992.

REFERENCES:

1. Bernard Challen and Rodica Baranescu - "Diesel Engine Reference Book" - Second edition - SAE International - ISBN 0-7680-0403-9 – 1999.
2. Julian Happian-Smith - "An Introduction to Modern Vehicle Design"- Butterworth-Heinemann, ISBN 0750-5044-3 - 2004
3. John Fenton - "Handbook of Automotive body Construction and Design Analysis - Professional Engineering Publishing, ISBN 1-86058-073- 1998.

ME2026 UNCONVENTIONAL MACHINING PROCESSES L T P C
(COMMON TO MECHANICAL AND PRODUCTION) 3 0 0 3

OBJECTIVE:

- To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications

UNIT I INTRODUCTION 5
Unconventional machining Process – Need – classification – Brief overview .

UNIT II MECHANICAL ENERGY BASED PROCESSES 10
Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic Machining. (AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR-Variation in techniques used – Applications.

UNIT III ELECTRICAL ENERGY BASED PROCESSES 8
Electric Discharge Machining (EDM)- working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.

UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES
12

Chemical machining and Electro-Chemical machining (CHM and ECM)-Etchants- maskant-techniques of applying maskants-Process Parameters – Surface finish and MRR-Applications. Principles of ECM-equipments-Surface Roughness and MRR- Electrical circuit-Process Parameters-ECG and ECH - Applications.

UNIT V THERMAL ENERGY BASED PROCESSES **10**

Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.

TEXT BOOK:TOTAL: 45 PERIODS

1. Vijay.K. Jain “Advanced Machining Processes” Allied Publishers Pvt. Ltd., New Delhi, 2007

REFERENCES:

1. Benedict. G.F. “Nontraditional Manufacturing Processes” Marcel Dekker Inc., New York (1987).
2. Pandey P.C. and Shan H.S. “Modern Machining Processes” Tata McGraw-Hill, New Delhi (2007).
3. Mc Geough, “Advanced Methods of Machining” Chapman and Hall, London (1998).
4. Paul De Garmo, J.T.Black, and Ronald.A.Kohser, “Material and Processes in Manufacturing” Prentice Hall of India Pvt. Ltd., New Delhi ,8th Edition, 2001.